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Draft Environmental Impact Statement for the Draft Revised Forest Plan

Helena – Lewis and Clark National Forest

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Draft Environmental Impact Statement for the Revised Forest Plan for the Helena – Lewis and Clark National Forest

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Abstract: This draft environmental impact statement contains analysis of 5 alternatives developed for the programmatic management of approximately 2,846,606 acres administered by the Helena – Lewis and Clark National Forest.

Comments: Comments on this draft environmental impact statement must be received or postmarked within 90 days of the Environmental Protection Agency's publication of the Notice of Availability in the Federal Register. It is important reviewers provide their comments at such times and in such a way that they are useful to the Agency's preparation of the final environmental impact statement. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record. Comments submitted anonymously will be accepted and considered; however anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews.

The decision to approve the revised forest plan for the Helena – Lewis and Clark National Forest will be subject to the objection process identified in 36 CFR 219 Subpart B (219.50 to 219.62). Only those individuals and entities who have submitted substantive comments related to the Helena – Lewis and Clark National Forest plan revision during the opportunities provided for public comment will be eligible to file an objection (36 CFR 219.52(a)).

Electronic comments can be sent to https://cara.ecosystem-management.org/Public/CommentInput?Project=44589. Postal mail comments can be sent to Helena – Lewis and Clark National Forest Supervisor's Office, 2880 Skyway Dr., Helena, MT 59602.

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List of Abbreviations

AUM	animal unit month
BASI	best available scientific information
BMP	best management practice
BE	biological evaluation
BO	biological opinion
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
DEIS	draft environmental impact statement
EIS	environmental impact statement
ESA	Endangered Species Act
FACTS	forest activity tracking system database
FEIS	final environmental impact statement
FIA	forest inventory and analysis
FS	Forest Service
FSH	Forest Service Handbook
FSM	Forest Service Manual
GA	geographic area
GIS	geographic information system
HLC NF	Helena - Lewis and Clark National Forest
HUC	hydrologic unit code
INFISH	Inland Native Fish Strategy
IRA	inventoried roadless area
LAU	lynx analysis unit
LRMP	land and resource management plan
MMBF	million board feet
MTDEQ	Montana Department of Environmental Quality
MTDFWP	Montana Department of Fish, Wildlife, and Parks
MTDNRC	Montana Department of Natural Resources and Conservation
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NFS	National Forest System
NRLMD	Northern Rockies Lynx Management Direction

NRV	natural range of variability
PIBO	PACFISH/INFISH Biological Opinion
PCE	primary constituent elements
PTSQ	projected timber sale quantity
PWSQ	projected wood sale quantity
PVT	potential vegetation type
RFSS	Regional Forester sensitive species
RMZ	riparian management zone
RNA	research natural area
ROD	record of decision
ROS	recreational opportunity spectrum
RWA	recommended wilderness area
SCC	species of conservation concern
SIMPPLLE	SImulating Pattern and Process at Large Landscape ScalES (model)
SIO	scenic integrity objective
SMZ	streamside management zone
TES	threatened, endangered, and sensitive species
TMDL	total maximum daily load
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
VMAP	vegetation map (geospatial database)
WCC	watershed condition class
WUI	wildland urban interface
WMU	wildlife management unit
WSA	wilderness study area
WSR	wild and scenic river

Summary

Purpose and Need for Action

The Forest Service has prepared this draft environmental impact statement (DEIS) to describe and analyze in detail five alternatives for managing the land and resources of the Helena – Lewis and Clark National Forest (HLC NF). The DEIS describes the affected environment and the environmental consequences of the alternatives.

This DEIS is a programmatic document. It discloses the environmental consequences of implementing the Draft Revised Forest Plan on a large scale, at the planning level. This is in contrast to analyses conducted for site-specific projects. The DEIS presents a programmatic, forest level of analysis but does not predict what will happen each time the standards and guidelines are implemented at the project level. Environmental consequences for individual, site-specific projects on the Forest are not described. The environmental effects of individual projects will depend on the implementation of each project.

Best Available Scientific Information

The 2012 Planning Rule requires the responsible official to use the best available scientific information (BASI) to inform the development of the proposed plan, including plan components, the monitoring program, and plan decisions. The foundation from which the plan components were developed for the proposed action was provided by the Assessment of the HLC NF, the BASI, and analyses therein. From this foundation, specialists used a number of resources that included peer-reviewed and technical literature, databases and data management systems, modeling tools and approaches, information obtained via participation and attendance at scientific conferences, local information, workshops and collaborations, and information received during public participation periods for related planning activities. Resource specialists considered what is most accurate, reliable, and relevant in their use of the BASI. The BASI includes the publications listed in the literature cited sections of the Assessment and DEIS.

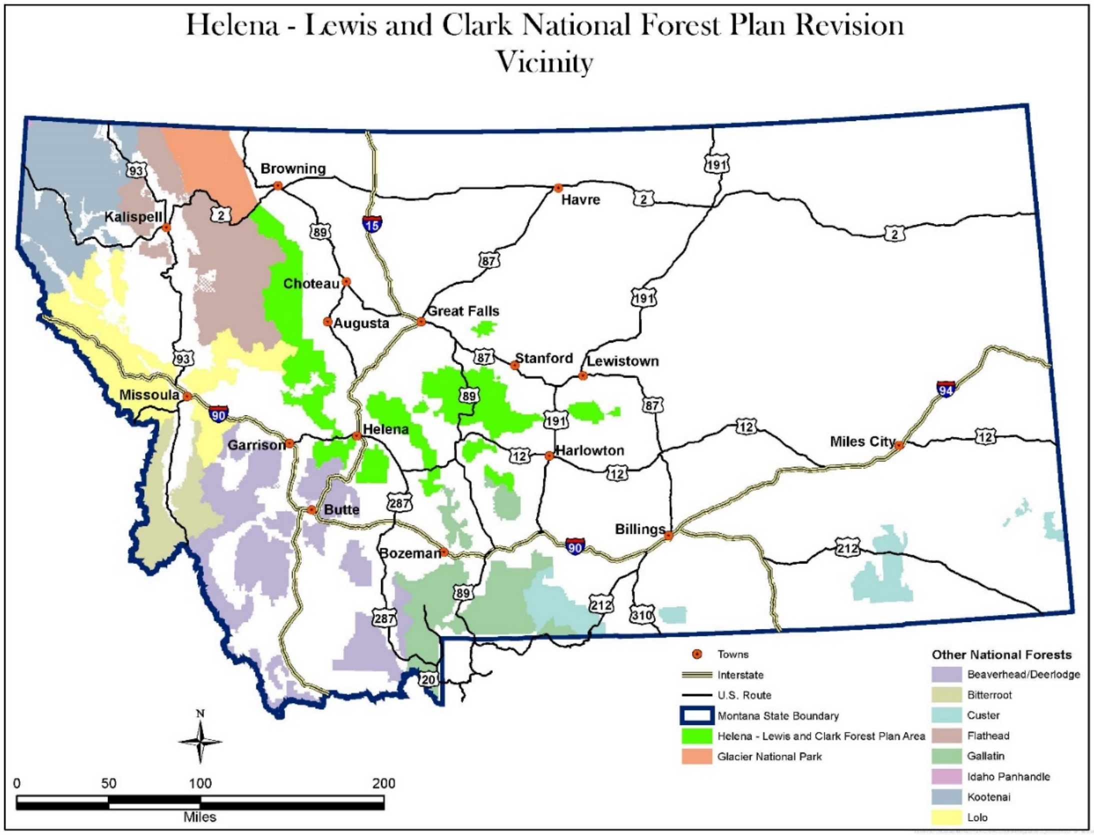
Proposed Action

The Forest Service (FS) proposes to revise the land resource management plan (LRMP - hereinafter referred to as the "draft forest plan") in compliance with the National Forest System (NFS) land management planning rule (36 CFR § 219). The area covered under this revision is shown in Figure 1.

To develop a proposed action that makes changes to a forest plan, the management direction in the current plan and its amendments was reviewed. Effective management direction from the current plan may be retained, or it may be modified or augmented by incorporating relevant new scientific information or direction from other regulatory documents. The 2012 Planning Rule requirements also mandate that new management direction be developed to address sustainability. Consideration of ecologic, economic, and social sustainability is required by the 2012 Planning Rule.

The Planning Area

The planning area is the HLC NF, which is located in central Montana in the Rocky Mountains and includes approximately 2,846,606 acres of public NFS land within its administrative boundaries. In addition, the plan area includes approximately 30,973 acres of NFS land on the Beaverhead-Deerlodge National Forest that is administered by the Helena National Forest and about 2,308 acres of NFS lands that exist as isolated parcels outside of the administrative boundaries. Inholdings of other ownerships occur within the HLC NFs administrative boundaries. These lands are not included in the acreages listed above and are not subject to FS management. The Forest includes portions of 17 counties. The plan area encompasses eight ranger districts: Lincoln, Helena, Townsend, Belt Creek, Judith, Musselshell, Rocky Mountain, and White Sulphur Springs. The Forest Supervisor's offices are located in Helena and Great Falls, Montana. See Summary Figure 1.



Summary Figure 1. Helena – Lewis and Clark National Forest and vicinity

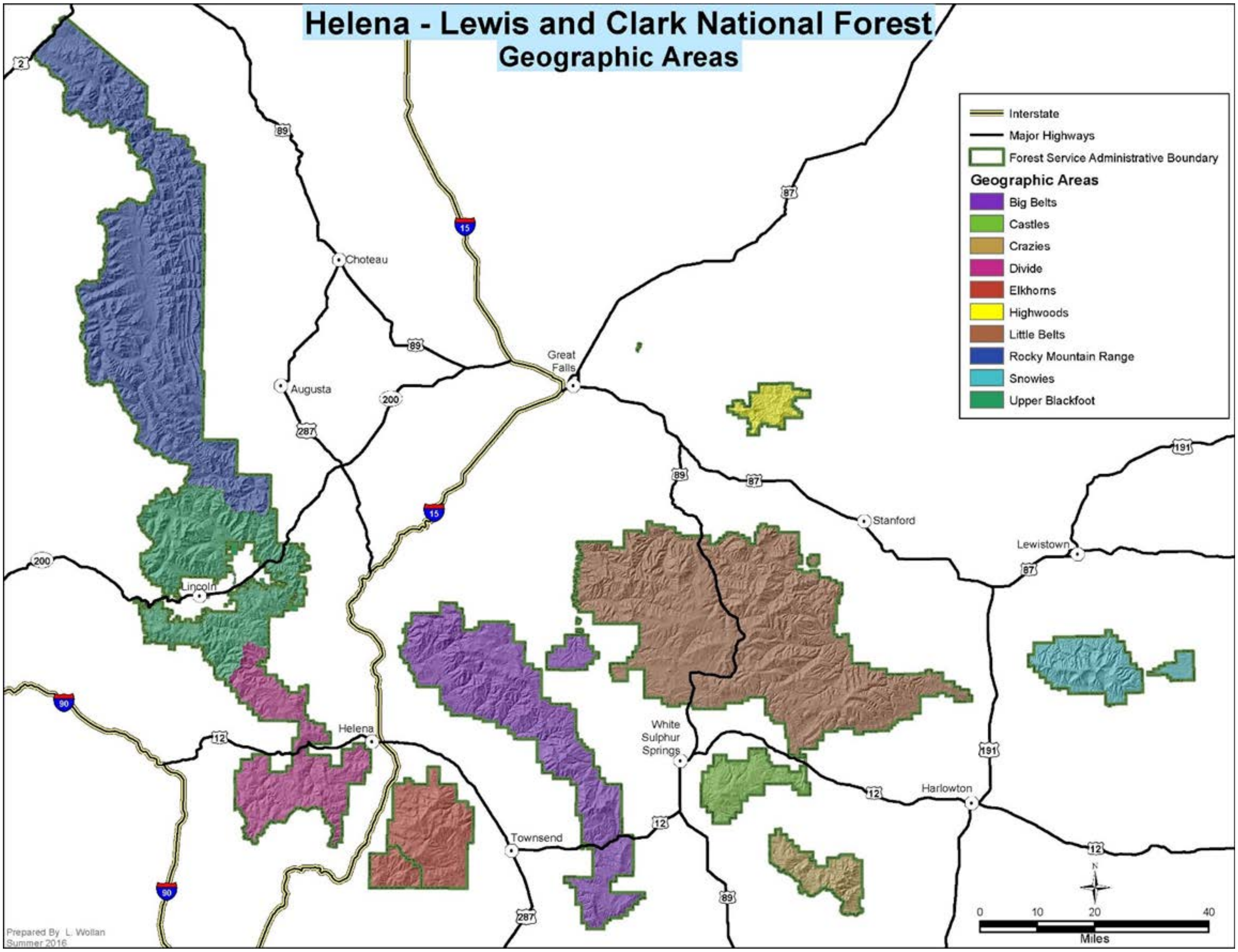
Geographic areas

The HLC NF straddles the Continental Divide and includes several island mountain ranges. Because of its diversity and extent, and because the island mountain ranges each include unique ecological and social context, the plan area is divided into ten geographic areas (GAs). GAs provide a means for describing conditions and trends at a more local scale if appropriate. The GAs identified in the draft revised plan correspond to the island mountain ranges and/or district or watershed boundaries. Summary Table 1 displays the acres of the HLC NFs by GA. Summary Figure 2 displays the GAs.

Summary Table 1. Acres within the ten GAs on the HLC NFs, within the administrative boundary

GA	Total Acres (all ownerships)	NFS acres within the GA	% of GA in NFS lands
Big Belts	452,292	312,983	69
Castles	79,862	69,610	87
Crazies	70,036	57,618	82
Divide	232,890	202,577	87
Elkhorns	175,259	160,599	92
Highwoods	44,495	42,315	95
Little Belts	900,961	802,711	89
Rocky Mountain Range	782,986	777,963	99

GA	Total Acres (all ownerships)	NFS acres within the GA	% of GA in NFS lands
Snowies	121,897	117,989	98
Upper Blackfoot	348,185	333,215	96



Summary Figure 2. GAs of the HLC NF

Purpose and Need for Action

The purpose of the revised HLC NF LRMP is to provide an integrated set of plan direction for social, economic, and ecological sustainability, and multiple uses of the HLC NF lands and resources. The requirements of the 2012 Planning Rule, findings from the assessment, changes in conditions and demands since the 1986 forest plans, and public concerns highlighted several areas where changes are needed to the current plan.

After a series of public meetings, as well as discussions with resource specialists, the Preliminary Need to Change Report identified a variety of subjects for which change was needed. Those included changed social and ecological conditions, economic contributions to local communities, climate change, invasive species, and increasing use by the public and desire for access to NFS lands.

More specifically there is a need to revise the existing forest plans to:

- Create one forest plan to manage the HLC NF that is consistent across two formerly separate NFS.
- Address changes that have occurred in the conditions and demands since the 1986 forest plans.
- Be consistent with the 2012 Planning Rule and associated directives by using adaptive management, public input, and best available science.
- Address changes in economic, social, and ecological conditions, new policies and priorities, and new information based on monitoring and scientific research.

Public Involvement

The HLC NF began public participation activities prior to the development of the Assessment of the HLC NF. The Forest contracted with the Center for Natural Resources and Environmental Policy at the University of Montana to develop an extensive public engagement process. The Center facilitated numerous public and interagency meetings to bring together information for the HLC NF to consider in preparing the assessment, developing the proposed action, and developing alternatives to the proposed action. There were four rounds of public meetings. The first set of meetings introduced the concepts of forest plan revision to the public. The next meetings discussed the Need to Change, the Desired Conditions, and Forest Resource Management (including wilderness and timber suitability). Public input was taken at each meeting as well as throughout the process. The dialogue and recommendations from this public involvement process were used to help develop the draft proposed action.

In addition to postal mail and email, public meeting information was announced via the forest plan revision website (www.fs.usda.gov/goto/hlc/forestplanrevision). The website also included means for the public to comment (using electronic or printed comment forms, a mapping tool, subscribing to the website, and/or submitting comments via an electronic database) and posted meeting results and other information. Updates were posted and mailed periodically.

The notice of intent for the proposed action to prepare an EIS was published in the Federal Register on December 1, 2016. The notice of intent asked for public comment on the proposal for a 120-day period. The agency held nine public meetings to provide opportunities to better understand the proposed action so that meaningful public comments could be provided by the end of the scoping period. Using the comments from the public, other agencies, tribes, and organizations, the Forest's interdisciplinary team developed a list of issues to address through changes to the proposed action, development of alternatives, or in analysis of impacts of the proposed action.

Government Agency Involvement

The 2012 Planning Rule (36 CFR § 219.4(b)) requires the review of the planning and land use policies of other Federal agencies, state and local governments, and Indian tribes. As part of that outreach effort, a number of discussions with representatives from those agencies were initiated, and ongoing dialogue continues. In addition, the Center for Natural Resources and Environmental Policy at the University of Montana organized and facilitated intergovernmental meetings. These meetings enabled the Forest to learn about upcoming plans and projects from other agencies, as well as being able to evaluate whether those planning documents were or were not consistent with the proposed HLC NF plan. These meetings provided agencies an opportunity to exchange updates and information.

The Forest reviewed other agency planning documents that are within or in close proximity to the HLC NF for consistency. Management of public lands adjacent to the HLC NF was considered in the formulation of alternatives and in the analysis of cumulative effects of those alternatives. Land management plans were reviewed for consistency with the forest plan. The draft forest plan is consistent with the majority of these plans. Discrepancies can be found in specific resource sections. For example, county wildfire protections plans emphasize protection of values at risk; while the draft plan integrates these values with other resource objectives. While certain components may not be fully consistent, the HLC NF will continue to work with these entities to address the impacts and benefits from forest management.

Forest Service Planning

Forest Service planning takes place at different organizational levels and geographic scales. Planning occurs at three levels—national strategic planning, NFS unit planning, and project or activity planning. The Chief of the Forest Service is responsible for national planning, such as preparation of the FS strategic plan that established goals, objectives, performance measures, and strategies for management of the NFS. NFS unit planning results in the development, amendment, or revision of a land management plan, such as the HLC NF forest plan. The supervisor of the national forest is the responsible official for the development and approval of a plan, plan amendment, or plan revision for lands under the responsibility of the supervisor. The forest supervisor or district ranger is the responsible official for project and activity planning (§ 219.2).

National strategic planning

The United States Department of Agriculture (USDA) Forest Service Strategic Plan: Fiscal Year 2015-2020 contains four outcome-oriented goals for the FS, each with strategic objectives. The strategic plan can be accessed online (www.fs.fed.us/strategicplan). The first two goals and related objectives are directly related to the current planning effort:

1. Sustain our Nation’s forests and grasslands
    - Foster resilient, adaptive ecosystems to mitigate climate change
    - Mitigate wildfire risk
    - Conserve open space
2. Deliver benefits to the public
    - Provide abundant clean water
    - Strengthen communities
    - Connect people to the outdoors

The FS continues to use the results of the 2010 Resources Planning Act Assessment, a report on the status and projected future trends of the nation's renewable resources on all forests and rangelands, as required by the 1974 Forest and Rangeland Renewable Resources Planning Act. The assessment includes analyses of forests, rangelands, wildlife and fish, biodiversity, water, outdoor recreation, wilderness, urban forests, and the effects of climate change on these resources. The assessment provides a snapshot of current U.S. forest and rangeland conditions (all ownerships), identifies drivers of change for natural resource conditions, and projects the effects of those drivers on resource conditions 50 years into the future. This assessment uses a set of future scenarios that influence the resource projections, allowing the exploration of a range of possible futures for U.S. renewable natural resources. Alternative future scenarios were used to analyze the effects of human and environmental influences on U.S. forests and rangelands, including population growth, domestic and global economic growth, land use change, and climate change.

In addition, the USDA strategic plan for fiscal year 2014-2018 has specific goals that also align with the 2012 Planning Rule, including (1) assist rural communities to create prosperity so they are self-sustaining, repopulating, and economically thriving; and (2) ensure our national forests and private working lands are conserved, restored, and made more resilient to climate change while enhancing our water resources. The USDA strategic plan can be accessed on the USDA's Web site (www.usda.gov).

National Forest System unit planning

The National Forest Management Act (NFMA) of 1976 (Pub. L. 94-588) amended the Forest and Rangeland Renewable Resources Planning Act of 1974. The NFMA requires the preparation of an integrated land management plan by an interdisciplinary team for each unit of the NFS (national forests and grasslands). The public must be involved in preparing and revising forest plans. Forest plans must provide for multiple use and sustained yield of products and services and include coordination of outdoor recreation, range, timber, watershed, wildlife and fish, and wilderness. The forest plan does not authorize site-specific prohibitions or activities; rather, it establishes broad direction, similar to zoning in a community.

The 2012 Planning Rule for land management planning for the NFS sets forth process and content requirements to guide the development, amendment, and revision of land management plans to maintain and restore NFS land and water ecosystems while providing for ecosystem services (the benefits people obtain from the NFS planning area) and multiple uses(USDA, 2012b)(USDA, 2012b). The final planning directives, effective January 30, 2015, are the key set of agency guidance documents that direct implementation of the 2012 Planning Rule.

Project or activity planning

Project and activity consistency with the forest plan (§ 219.15) will be achieved through (1) application to existing authorizations and approved projects or activities, (2) application to projects or activities authorized after the plan decision, (3) resolving inconsistency, (4) determining consistency, and (5) consistency of resource plans within the planning area with the land management plan. Refer to pages 10-11 of the forest plan for additional information about project and activity consistency. Previously approved and ongoing projects and activities are not required to meet the direction of the forest plan and will remain consistent with the direction in the 1986 forest plan, as amended.

The forest plan direction will apply to all projects and or activities that have a decision made on or after the effective date of the final ROD. Projects and activities authorized after approval of the forest plan will be consistent with applicable plan components in the forest plan. A project or activity approval document will describe how the project or activity is consistent with the applicable plan components.

Any resource plans developed by the Forest that apply to the resources or land areas within the planning area will be consistent with the plan components. Resource plans developed prior to the plan decision will be evaluated for consistency with the plan and amended if necessary.

When a proposed project or activity would not be consistent with the applicable plan components, the responsible official shall take one of the following steps, subject to valid existing rights (36 CFR § 219.15(c)):

- modify the proposed project or activity to make it consistent with the applicable plan components,
- reject the proposal or terminate the project or activity,
- amend the plan so that the project or activity will be consistent with the plan, as amended, or
- amend the plan contemporaneously with the approval of the project or activity so that the project or activity will be consistent with the plan, as amended. This amendment may be limited to apply only to the project or activity.

The forest supervisor or district ranger is the responsible official for project and activity planning. In order for prohibitions or activities that take place on the ground, project or activity decisions will need to be made following appropriate procedures (e.g., site-specific analysis in compliance with National Environmental Policy Act (NEPA)).

Issues

Issues serve to highlight effects or unintended consequences that may occur from the proposed action or alternatives, giving opportunities during the analysis to reduce adverse effects and compare trade-offs for the decision maker and public to understand. Issues were identified through scoping. Significant issues were defined as those directly or indirectly caused by implementing the proposed action, involve potentially significant effects, and could be meaningfully and reasonably evaluated and addressed within the programmatic scope of a Forest Plan. Some issues are best resolved at finer scales (subsequent NEPA analysis) where the site-specific details of a specific action and resources it affects can be meaningfully evaluated and weighed. Conversely, some issues have already been considered through broader programmatic NEPA analysis [e.g. the Northern Rockies Lynx Management Direction (NRLMD) Final Environmental Impact Statement (FEIS)]. In these cases, the issues focus on evaluating the effects unique to and commensurate with the decisions being considered here.

Alternatives were developed around those significant issues that involved unresolved conflicts concerning alternative uses of available resources (40 CFR 1500.2(e)). The HLC NF identified the following significant issues during scoping that drove alternative development.

Issues that drove alternatives

Recommended wilderness and undeveloped areas

The allocation of recommended wilderness areas (RWAs) was a primary issue for the majority of the public commenters. The range of public comments regarding RWAs was vast. On one end of the spectrum, commenters asked the Forest to consider all existing inventoried roadless areas (IRAs) for RWAs. At the other end of the spectrum, commenters desired no RWAs. Many commenters recommended the consideration of additions or deletions to specific areas that were identified in the proposed action. Commenters also provided recommendations on areas they wished to remain undeveloped where primitive recreation opportunities are provided.

Motorized and mechanized means of transport in recommended wilderness areas

In addition to the issue of the amount and location of RWAs, whether or not to allow motorized and mechanized recreation uses within RWAs was also a primary concern of many public comments.

Comments included those in favor of prohibiting motorized and mechanized means of transport within RWAs, as well as those that desire to continue these uses unless the RWAs are formally designated by Congress. The motor vehicle use and mountain bike communities were most vocal on this issue. Some motorized users do not want to see further restrictions on motorized access. The mountain bike community was concerned about the potential loss of access to areas that they currently use. To address these public concerns, alternatives were created that analyzed the effects of allowing as well as not allowing motorized and mechanized means of transport on wilderness character within RWAs.

To address additional concerns about wildlife habitat in the core of the Elkhorns wildlife management unit, one alternative analyzed closing the core of the Elkhorns to mechanical means of transport (mountain bikes).

Timber harvest and timber production

Timber harvest and production was raised as an issue by many public commenters. This topic includes the identification of lands suitable for timber production, estimated volume outputs of timber, and timber harvest conducted both for timber production and for other purposes. The comments included requests to increase the amount of lands suitable for timber production, increase timber volume offered from NFS lands, and/or increase the number of acres treated with harvest. Conversely, other commenters requested that few or no lands be suitable for timber production, and/or that less timber harvest occurs on NFS lands.

Alternatives

The range of alternatives developed and presented is based on a preliminary evaluation of the information gathered from public and internal comments and the purpose and need for the project. While all alternatives provide a wide range of ecosystem services and multiple uses, some give slightly greater emphasis to selected resources based on the theme of the alternative and response to revision topics.

A list of significant issues was identified during the public involvement period, and some of these issues drove the development of alternatives. Some additional items, such as the WSRs eligibility study and the wilderness inventory and evaluation, are addressed in the revision because they are required by planning regulations (i.e., 36 CFR § 219.17(3)(b)(1)).

Alternative A is the no-action alternative, which reflects the 1986 forest plans, as amended to date, and accounts for current laws, regulations, and terms and conditions from biological opinions (BOs). Alternative B was released for public review and comment as the proposed action. Development of alternatives C, D, and E was driven by issues identified during scoping. The alternatives span the range of forest management practices and uses of available resources. The general theme and intent of each alternative is summarized below.

The HLC NF has not identified a preferred alternative(s) at this point but plans to identify a preferred alternative in the FEIS after reviewing and considering the analysis presented in this DEIS and comments received by the public on this document.

Given the extensive public engagement and environmental review recently completed for the forests' travel management decisions, all action alternatives would be generally consistent with the current travel plans, which are primarily reflected by motorized versus nonmotorized ROS settings. To respond to the issues, ROS settings would be adjusted by alternative where the shift remains consistent with the travel plans.

Elements common to all alternatives

All alternatives in this document adhere to the principles of multiple use and the sustained yield of goods and services required by the CFR (36 CFR § 219.1 (b)). All the alternatives are designed to:

- meet law, regulation, and policy;
- contribute to ecological, social, and economic sustainability;
- meet the purpose and need for change and address one or more significant issues;
- provide integrated direction as included in the forestwide desired conditions, objectives, standards, guidelines, and sustainability;
- provide sustainable levels of products and services, and
- comply with existing travel plans, except in RWAs and other limited locations.

In addition, the following would be the same for all alternatives:

- Existing developed recreation sites and recreation residence special use permits would be allowed; alternatives do not make decisions to remove or create developed recreation sites.
- Management direction for and location of utility and road rights-of-way, easements, and communication sites would remain constant.
- National Wilderness System lands and plan components would remain constant.
- Oil and gas leasing decisions would not be made.
- Eligible WSRs would remain constant.
- Recent and updated multi-region management direction for Canada lynx; and new management direction for grizzly bear would be incorporated.

Elements common to all action alternatives

All action alternatives are designed to be consistent with the 2012 Planning Rule and associated directives, and emphasize adaptive management and the use of best available science.

Alternative A – no action

Alternative A, the no-action alternative, reflects current management practices under the 1986 forest plans, as amended and implemented, and provides the basis for comparing alternatives to current management and levels of output. Alternative A does not address some of the elements associated with the 2012 Planning Rule, such as timber suitability or riparian management zones (RMZs). The Council on Environmental Quality regulations (40 CFR 1502.14d) requires that a “no action” alternative be analyzed in every EIS. This does not mean that nothing would occur under alternative A. The current conditions as described by each resource in chapter 3 would continue. Under this alternative, current management plans would continue to guide management of the plan area, and ongoing work or work previously planned and approved would occur under that guidance. Laws and regulations that have been adopted since the 1986 plans will be analyzed as part of the no-action alternative (for example, the designation of IRAs). With respect to the identified issues, the alternative is described as follows:

- There would be three RWAs (Big Log, Mount Baldy, and Electric Peak – also known as Blackfoot Meadows).
- Existing mechanized means of transport would be allowed in all areas except designated wilderness.
- Lands suitable for timber production would be based on the 1986 plans as amended and implemented, with current regulation and policy. When consistent with other plan components, harvest for purposes other than timber production could occur on a subset of unsuitable lands.
- Standards for elk security are included in the 1986 plans.

Alternative B

Alternative B, which was scoped as the proposed action, represents a mix of RWAs and lands identified as suitable for timber production. The balance of opportunities available for primitive recreation and nonmotorized recreation experiences versus less primitive and more motorized recreation experiences would be generally consistent with current travel plans, except in the case of RWAs. With respect to the identified issues, the alternative is described as follows:

- There would be nine RWAs (Big Log, Mount Baldy, Blackfoot Meadows, Deep Creek, Big Snowies, Dearborn Silverking, Red Mountain, Arrastra Creek, and Nevada Mountain).
- Motorized and mechanized means of transport would be prohibited in RWAs.
- All lands that were are not withdrawn from timber suitability due to legal or technical factors would be suitable for timber production except for: areas with primitive and semi-primitive nonmotorized ROS; RWAs; and the Elkhorns GA, South Hills Recreation Area, Badger Two Medicine area, Highwoods GA, Snowies GA, and Dry Range. When consistent with other plan components, harvest for purposes other than timber production could occur on other lands not suitable for production.
- Plan components that specifically address management of elk security would be included.

Alternative C

Alternative C is a modified proposed action, which also represents a mix of RWAs and lands identified as suitable for timber production. The balance of opportunities available for primitive recreation and nonmotorized recreation experiences versus less primitive and more motorized recreation experiences would be generally consistent with current travel plans, except in the case of RWAs. In the Divide and Elkhorn GAs some changes to the ROS would be included in this alternative. This is proposed for areas where desired future management would require changes to the travel plans. With respect to the identified issues, the alternative is described as follows:

- There would be nine RWAs; these are the same as listed for alternative B.
- Motorized and mechanized means of transport in RWAs would be allowed.
- Changes to the ROS settings in the Elkhorns and Divide GAs would require minor changes to existing travel plans shifting from motorized to nonmotorized semi-primitive recreation opportunities.
- An area within the Elkhorns “core” would be identified where no mechanized means of transport would be allowed.
- The timber suitability determinations would be the same as described for alternative B.
- Plan components that specifically address management of elk security would not be included

Alternative D

Alternative D was developed to address comments and themes of limiting human influences on the landscape. This alternative would be responsive to commenters who desire more undeveloped recreation areas, and includes the greatest amount of RWAs and least amount of lands suitable for timber production. RWAs and primitive or semi-primitive nonmotorized ROS areas were selected where consistent with current travel plans with emphasis given to areas where decreased human presence would enhance connectivity for wildlife. In this alternative, the core of the Elkhorn Mountains would be identified as an area where mechanized means of transport would not be allowed. With respect to the identified issues, the alternative is described as follows:

- There would be 16 RWAs. These would include the nine areas listed for alternatives B and C in addition to the following 7 areas: Camas Creek; Wapiti Peak; Loco Mountain; Colorado Mountain;

Tenderfoot Creek; Big Horn Thunder; and Middle Fork Judith. RWAs would be identified with consideration given to maintaining or enhancing potential habitat connectivity for large, wide-ranging wildlife species within and among GAs. Includes additions to the original Blackfoot Meadows and Nevada Mountain RWAs.

- Motorized and mechanized means of transport would be prohibited in RWAs.
- Additional primitive ROS areas would be identified in the Elkhorns, Highwoods, and Badger Two Medicine areas of the Rocky Mountain Range to provide additional undeveloped areas.
- In addition to the exclusions from alternative B, lands would not be suitable for timber production within additional RWAs, or where the ROS settings are modified to be primitive or semi-primitive nonmotorized. When consistent with other plan components, harvest for purposes other than timber production could occur on lands not suitable for production.
- Plan components that specifically address management of elk security would not be included.

Alternative E

Alternative E was developed to address comments and themes of increasing timber production from NFS lands and not including any RWAs. All lands that may be suited are included as suitable for timber production, with the exception of the Badger Two Medicine area and the Elkhorns GA. The recreation opportunities spectrum classes that are the most compatible with harvest activities are selected where consistent with current travel plans. No RWAs are included. With respect to the identified issues, the alternative is described as follows:

- There would be no RWAs.
- Mechanized means of transport would not be prohibited anywhere except designated wilderness.
- All lands that were are not withdrawn from timber suitability due to legal or technical factors would be suitable for timber production except for those lands within the Elkhorns GA and the Badger Two Medicine area. When consistent with other plan components, harvest for purposes other than timber production could occur on a subset of unsuitable lands.
- Plan components that specifically address management of elk security would be included.

Comparison of alternatives

Forestwide comparison of alternatives by issue

Summary Table 2 displays the range of alternatives with respect to the issues. Numbers such as acres, miles, and volumes are approximate due to the use of geographic information system (GIS) data and rounding.

Summary Table 2. Comparison of issues (and their measurement indicators) by alternative

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	3	9	9	16	0
2) Acres of RWAs	34,226	213,076	213,076	474,589	0
3) Acres of additional undeveloped areas[1]	0	0	0	183,094	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	206	0	442	0
2) Miles of road no longer open for access	0	12	0	23	0
3) Acres of motorized over-snow use no longer available	0	24,290	0	79,109	0
4) Miles of motorized trail no longer available	0	0.1	0	59	0
Timber harvest					
1) Acres suitable for timber production	430,489	443,057	443,057	435,014	474,640
2) Acres unsuitable for timber production where harvest may occur for other purposes, outside IRAs[2]	418,133	489,392	489,392	444,840	463,414
3) Projected timber sale quantity (PTSQ) Decade 1	4.34 mmcf (19.68 mmbf)	4.25 mmcf (19.18 mmbf)	4.25 mmcf (19.18 mmbf)	4.26 mmcf (19.28 mmbf)	7.41 mmcf (36.06 mmbf)
4) Projected wood sale quantity (PWSQ) Decade 1	6.35 mmcf	6.24 mmcf	6.24 mmcf	6.25 mmcf	9.87 mmcf
5) Projected acres of timber harvest Decade 1	4,108 acres	4,091 acres	4,091 acres	4,075 acres	2,336 acres

1. Additional undeveloped areas that vary by alternative are those designated as a primitive ROS. Other land designations are present on the landscape which reflect a largely undeveloped character, but do not vary by alternative. Such lands include designated wilderness and IRAs.
2. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Recommended wilderness and undeveloped areas

The amount and location of RWAs were several of the primary issues that drove the development of alternatives. Three areas are recommended as wilderness in alternative A, under the existing 1986 forest plans. In alternatives B and C, 9 areas are recommended which represent an area about 6 times greater than the total included in alternative A. Alternative D was designed to respond to public desires for more RWA to the greatest degree, and includes 16 RWAs. In addition, several other areas were designated with a primitive ROS in this alternative, in response to public comments requesting additional undeveloped areas. Alternative E does not recommend any wilderness or additional undeveloped areas, and responds to public comments and desires to decrease the amount of RWAs and other undeveloped lands.

In all alternatives, including alternative E, there are additional lands that have an undeveloped character based on legal designations which do not vary by alternative (such as designated wilderness and IRAs).

Motorized and mechanized means of transport in RWAs

Whether or not continuation of existing motorized and mechanized transport is allowed in RWAs also varies by alternative in response to public comments. In alternatives A and C, these uses are allowed within RWAs. In alternatives B and D, these uses would not be allowed. There is no RWA in alternative E. Therefore, alternatives A, C, and E would represent no net change to the motorized and mechanized uses in these areas.

Timber harvest and timber production

The lands suitable for timber production vary by alternative. Alternative A has the least amount, but is similar to alternatives B/C and D. With these alternatives, about 15% of the HLC NF would be suitable for timber production. Alternative E has the most lands suitable for timber production (about 16% of the HLC NF). The lands suitable for timber production show relatively little variance because the primary factors that drive this determination do not vary by alternative, including vegetation types and land allocations such as designated wilderness and IRAs. PTSQ and the projected wood sale quantity (PWSQ) similar for alternatives A, B/C and D, and greater with alternative E. However, under alternative E the greatest volume would be produced and the fewest acres would be harvested because to maximize timber production, the types and locations of treatment would capitalize on stands with the highest volume available. In addition, because the RWAs identified in the other alternatives are almost exclusively in IRAs, they would not be considered for timber production in any alternative.

Forestwide comparison of alternatives by resource issue

Summary Table 3 describes the range of alternatives with respect to the resource issues which did not drive alternatives. This table is arranged by resource area, with each alternative ranked from 1 to 5, with 1 being the greatest in magnitude or greatest relative contributions to desired conditions to 5 being the lowest contribution. More information about the indicators can be found in chapter 3. Not all of the resource indicators found in chapter 3 are included. In many cases the primary difference is between the no-action and action alternatives.

Summary Table 3. Comparison of alternatives by resource issue - magnitude or relative contribution to desired condition

Resource Area	Indicator	1	2	3	4	5
Watersheds	Water Quality	BCD	E	A		
	Water Quantity	ABCDE				
	Overall movement toward desired conditions	BCD	E	A		
Riparian	Riparian Desired Condition	BCDE	A			
Fisheries and Aquatic Habitat	Aquatic Habitat (includes all above)	BCD	E	A		

Resource Area	Indicator	1	2	3	4	5
Soils	Riparian	BCDE	A			
	Uplands	D	BC	A	E	
Air Quality	Acres per decade of wildfire and prescribed fire	ABCDE				
Fire and Fuels Management	Flexibility for fire management	E	A	C	B	D
	Future vegetation treatments	ABCD	E			
	Future wildfires and fire regimes	ABCDE				
Terrestrial Vegetation	Composition, structure, pattern, snags, old growth, and downed woody debris (movement toward desired conditions)	BCDE	A			
Terrestrial Wildlife Diversity	Overall movement toward desired habitat conditions	BCDE	A			
Terrestrial Wildlife Species at risk	Grizzly bear and Canada lynx (contribution to recovery)	BCDE	A			
	Wolverine (contribution to long-term persistence in the plan area)	ABCDE				
	Species of conservation concern (movement toward desired habitat conditions)	BCDE	A			
Elk	General habitat desired conditions	ABCDE				
	Cover and/or habitat security	ABCDE				
Recreation Settings	Primitive and semi-primitive nonmotorized settings	D	C	B	AE	
	Semi-primitive motorized and roaded natural settings	AE	B	C	D	
Recreation Opportunities	Number and kind of developed recreation facilities and dispersed recreation sites	ABCDE				
Recreation Special Uses	Guidance for management of recreation special sues	BCDE	A			
Recreation Access	Miles of open road	ACE	B	D		
	Miles of motorized trails	ACE	B	D		
	Miles of nonmotorized trail, open for mechanical transport	AE	C	B	D	
	Miles of groomed trail	ABCE	D			
	Acres open to motorized over-snow use	AE	B	C	D	
	Aviation access (airstrips)	ABCDE				
Scenic Character	High and Very High SIOs	D	BE	C	A	
	Moderate, Low, and Very Low SIOs	A	C	BE	D	
Recommended Wilderness	Acres of recommended wilderness	D	BC	A	E	
	Wilderness characteristics	BD	AC	E		
Designated Wilderness	Wilderness characteristics	ABCDE				

Resource Area	Indicator	1	2	3	4	5
Wilderness Study Areas (WSAs)	Wilderness characteristics	D	B	C	AE	
IRAs	Roadless area characteristics	ABCDE				
Eligible WSRs	Free-flowing condition; outstanding & remarkable values	ABCDE				
Continental Divide National Scenic Trail	Visual quality and other desired conditions along the trail	BCDE	A			
Research Natural Areas (RNAs)	Acres established, proposed, candidate	D	ABCE			
Smith River Corridor	Natural and cultural values	BCDE	A			
Missouri River Corridor	Natural, cultural, and historic values	BCDE	A			
Cultural, Historic and Tribal Resources	Cultural and historical values	D	B	C	E	A
Livestock Grazing	Expected Rangeland Condition and trend	BCDE	A			
	Acres suitable rangeland	ABCDE				
	Number of permitted livestock head months	ABCDE				
Timber and other Forest Products	Timber production (volume)	E	ABCD			
	Acres treated with harvest and prescribed fire	ABCD	E			
	Other forest products (commercial opportunities)	E	A	BC	D	
Minerals	Lands open to mineral entry and access	E	A	C	B	D
Carbon	Carbon storage potential and guidance	BCDE	A			
Social and Economic	Direct income and jobs	E	A	BCD		
	Fish and wildlife (including non-use values)	D	BC	E	A	
	Grazing (including non-use values)	C	A	E	B	D
	Infrastructure	BCD	E	A		
	Other income and jobs	ABCDE				
	Public information, interpretation, and education	BCDE	A			
	Ecosystem integrity (including erosion control, flood protection, and non-use values)	BCD	E	A		
	Fire suppression (and mitigation)	BCD	E	A		

Geographic area comparison of alternatives

Summary Tables 4-13 display a comparison of the range of alternatives for each GA, in terms of significant issues as well as other resource indicators that vary by alternative and/or are key to understanding the unique effects to the GA. Issues or indicators that are not applicable to a given GA are omitted from the table (for example, if no RWAs are identified under any alternative, those indicators are not listed for that GA).

Big Belts

Summary Table 4. Comparison of alternatives for the Big Belts GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	2	2	3	0
2) Acres of RWAs	0	21,407	21,407	37,750	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	18.9	0	34.9	0
2) Miles of road no longer open for access	0	0	0	0.3	0
Timber harvest					
1) Acres suitable for timber production	43,538	67,379	67,379	69,283	69,295
2) Acres where harvest may occur for other purposes, outside IRAs[1]	80,404	69,230	69,230	68,982	67,943

1. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Castles

Summary Table 5. Comparison of alternatives for the Castles GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	0	0	1	0
2) Acres of RWAs	0	0	0	30,606	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	0	0	9.5	0
2) Miles of road no longer open for access	0	0	0	6.1	0
3) Acres of motorized over-snow use no longer available	0	0	0	26,332	0
4) Miles of motorized trail no longer available	0	0	0	31.9	0

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Timber harvest					
1) Acres suitable for timber production	17,743	18,450	18,450	17,859	18,450
2) Acres where harvest may occur for other purposes, outside IRAs[1]	18,533	21,876	21,876	20,258	21,876

2. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Crazies

Summary Table 6. Comparison of alternatives for the Crazies GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	0	0	1	0
2) Acres of RWAs	0	0	0	24,977	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	0	0	23.5	0
2) Miles of road no longer open for access	0	0	0	0	0
3) Acres of motorized over-snow use no longer available	0	0	0	4,754	0
4) Miles of motorized trail no longer available	0	0	0	0	0
Timber harvest					
1) Acres suitable for timber production	12,826	7,089	7,089	6,509	7,517
2) Acres where harvest may occur for other purposes, outside IRAs[1]	4,650	13,005	13,005	10,831	12,576

3. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Divide

Summary Table 7. Comparison of alternatives for the Divide GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	2	1	1	2	0
2) Acres of RWAs	16,657	18,296	18,296	41,089	0
Motorized and mechanized means of transport in recommended wilderness					

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
1) Miles of trail no longer available to mechanized means of transport	0	16.3	0	24.2	0
2) Miles of road no longer open for access	0	0	0	0	0
3) Acres of motorized over-snow use no longer available	0	11.1	0	6,348	0
4) Miles of motorized trail no longer available	0	0	0	2.4	0
Timber harvest					
1) Acres suitable for timber production	76,023	62,640	62,640	60,081	71,656
2) Acres where harvest may occur for other purposes, outside IRAs[1]	46,793	73,827	73,827	69,094	66,984
South Hills Special Recreation Area acres	0	50,180	50,180	50,180	0

4. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Elkhorns

Summary Table 8. Comparison of alternatives for the Elkhorns GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
3) Acres of additional undeveloped areas[1]	0	0	0	49,229	0
Timber harvest					
2) Acres where harvest may occur for other purposes, outside IRAs[2]	83,026	86,482	86,482	84,376	86,482
Elkhorns Core Area acres (No Mechanized Use)	0	0	49,229	0	0

5. Additional undeveloped areas that vary by alternative are those designated as a primitive ROS.
6. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Highwoods

Summary Table 9. Comparison of alternatives for the Highwoods GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
3) Acres of additional undeveloped areas[1]	0	0	0	8,598	0
Timber harvest					
1) Acres suitable for timber production	1,170	0	0	0	1,048

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
2) Acres where harvest may occur for other purposes, outside IRAs[2]	1,167	2,677	2,677	2,677	1,628

7. Additional undeveloped areas that vary by alternative are those designated as a primitive ROS.
8. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Little Belts

Summary Table 10. Comparison of alternatives for the Little Belts GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	1	1	4	0
2) Acres of RWAs	0	14,490	14,490	169,920	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	12.9	0	109.8	0
2) Miles of road no longer open for access	0	0	0	15.1	0
3) Acres of motorized over-snow use no longer available	0	0	0	26,320.9	0
4) Miles of motorized trail no longer available	0	0	0	21.7	0
Timber harvest					
1) Acres suitable for timber production	208,975	232,217	232,217	226,716	232,222
2) Acres where harvest may occur for other purposes, outside IRAs[1]	114,212	130,254	130,254	120,832	130,249

9. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Rocky Mountain Range

Summary Table 11. Comparison of alternatives for the Rocky Mountain Range GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
3) Acres of additional undeveloped areas[1]	0	0	0	125,266	0
Timber harvest					
1) Acres suitable for timber production	1,683	0	0	1,458	0
2) Acres where harvest may occur for other purposes, outside IRAs[2]	28,307	32,281	32,281	7,730	32,281

10. Additional undeveloped areas that vary by alternative are those designated as a primitive ROS.

11. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Snowies

Summary Table 12. Comparison of alternatives for the Snowies GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	1	1	1	0
2) Acres of RWAs	0	95,299	95,299	95,299	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	98.3	0	98.3	0
2) Miles of road no longer open for access	0	11.8	0	11.8	0
3) Acres of motorized over-snow use no longer available	0	13,145	0	13,144	0
4) Miles of motorized trail no longer available	0	0.1	0	0.1	0
Timber harvest					
1) Acres suitable for timber production	16,030	0	0	0	17,377
2) Acres where harvest may occur for other purposes, outside IRAs[1]	2,755	19,770	19,770	19,770	2,869

12. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Upper Blackfoot

Summary Table 13. Comparison of alternatives for the Upper Blackfoot GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	4	4	4	0
2) Acres of RWAs	0	69,591	69,591	74,948	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	59.3	0	60	0
2) Miles of road no longer open for access	0	0	0	1.3	0
3) Acres of motorized over-snow use no longer available	0	11,134.4	0	15,355.2	0
4) Miles of motorized trail no longer available	0	0	0	3.4	0
Timber harvest					

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
1) Acres suitable for timber production	52,502	54,825	54,825	54,825	56,618
2) Acres where harvest may occur for other purposes, outside IRAs[1]	38,286	40,292	40,292	40,292	40,527

13. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Monitoring plan

Under all action alternatives, monitoring would occur as listed in appendix A of the draft plan. The monitoring elements are designed to enable the Forest to determine if a change in plan components or other plan management guidance may be needed, forming a basis for continual improvement and adaptive management. The monitoring plan would have the effect of improving the HLC NF’s ability to move toward the desired conditions for each resource area, by providing the information needed to assess change through time and support adaptive management actions.

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Chapter 1. Purpose and Need for Action

1.1 Introduction

The National Forest Management Act (NFMA) of 1976 (Public Law 94-588) requires the preparation of an integrated land management plan by an interdisciplinary team for each unit of the National Forest System (NFS). In May of 2012, the FS began using new planning regulations (2012 Planning Rule) to guide collaborative and science-based revision of land management plans that promote the ecological integrity of national forests (NFs) while contributing to social and economic sustainability. Public involvement must be provided in preparing and revising forest plans. Forest plans must provide for multiple use and sustained yield of products and services, and include coordination of outdoor recreation, range, timber, watershed, wildlife and fish, and wilderness. The forest plan does not authorize site-specific projects or activities; rather, it establishes broad direction, similar to zoning in a community.

The Helena and the Lewis and Clark NFs were consolidated on December 11, 2015. The official name of the combined forest is the Helena – Lewis and Clark NF. For the purposes of this document, it will be referred to as the HLC NF. Prior to the official combination, each forest had its own land and resource management plan (LRMP). Part of implementing the consolidation included a combined forest plan revision effort, which includes the preparation of this draft environmental impact statement (DEIS).

The forest plan revision process began with preparation of an assessment that summarized the current status and management of various resources on the HLC NF. The Assessment of the HLC NF was published in March 2015. This assessment evaluated existing information about relevant ecological, economic, and social conditions, trends, and sustainability, and their relationship to the land management plan within the context of the broader landscape. This information was used to identify any need for change in forest resources or in the management of those resources, and as a basis for preparing the Draft Revised Forest Plan. The Draft Revised Plan was released as a proposed action for public review and comment (scoping) in the winter of 2016. The comments that were received were used to make changes to the Draft Plan and to develop alternatives to the proposed action that are analyzed in this DEIS.

This DEIS is a programmatic document. It discloses the environmental consequences of implementing the Draft Revised Forest Plan on a large scale, at the planning level. This is in contrast to analyses conducted for site-specific projects. The DEIS presents a programmatic, forest level of analysis but does not predict what will happen each time the standards and guidelines are implemented at the project level. Environmental consequences for individual, site-specific projects on the Forest are not described. The environmental effects of individual projects will depend on the implementation of each project.

1.2 Proposed Action

The Forest Service (FS) proposes to revise the LRMP (hereinafter referred to as the “draft forest plan”) in compliance with the NFS land management planning rule (USDA, 2012a) (36 CFR § 219). The area covered under this revision is shown in figure 1.

To develop a proposed action that makes changes to a forest plan, the management direction in the current plan and its amendments was reviewed. Effective management direction from the current plan may be retained, or it may be modified or augmented by incorporating relevant new scientific information or direction from other regulatory documents. The 2012 Planning Rule requirements also mandate that new management direction be developed to address sustainability. Consideration of ecologic, economic, and social sustainability is required by the 2012 Planning Rule.

On December 1, 2016, the HLC NF released the proposed action with a notice of intent to prepare an environmental impact statement (EIS) in the Federal Register. The notice of intent initiated the scoping process, which guides the development of the EIS. The Forest received over 900 public comments on the proposed action during the 120-day comment period that ended March 31, 2017. The HLC NF planning revision team reviewed all the comments, and the responsible official identified the significant issues that were used to frame alternatives for the draft forest plan. The planning team used these issues and public comments to refine the proposed action and build alternatives.

Documentation that describes development of the draft revised plan, including analyses of project area resources, information about public involvement to date, and other documents used in developing alternatives and as background for the resource specialists’ analysis may be found in the planning record located at the HLC NF Supervisor’s Office.

1.3 Document Organization

The document is organized as follows:

Volume 1 includes the summary, chapter 1 (purpose and need, proposed action, and decision framework), chapter 2 (alternatives, public involvement, and issues), chapter 3 (affected environment and environmental consequences), and literature cited.

Volume 2 includes the glossary, preparers, agencies/organizations/persons to whom DEIS sent, and the appendices.

1.4 The Planning Area

The planning area is the HLC NF, which is located in central Montana in the Rocky Mountains and includes approximately 2,846,606 acres of public NFS land within its administrative boundaries. In addition, the plan area includes approximately 30,973 acres of NFS land on the Beaverhead-Deerlodge NF that is guided by the Helena NF plan and about 2,308 acres of NFS lands that exist as isolated parcels outside of the administrative boundaries. Therefore, the NFS lands considered in this planning effort total 2,879,887 acres. Inholdings of other ownerships occur within the HLC NFs administrative boundaries. These lands are not included in the acreages listed above and are not subject to FS management. The Forest includes portions of 17 counties. The plan area encompasses eight ranger districts: Lincoln, Helena, Townsend, Belt Creek, Judith, Musselshell, Rocky Mountain, and White Sulphur Springs. The Forest Supervisor’s offices are located in Helena and Great Falls, Montana. See Figure 1.

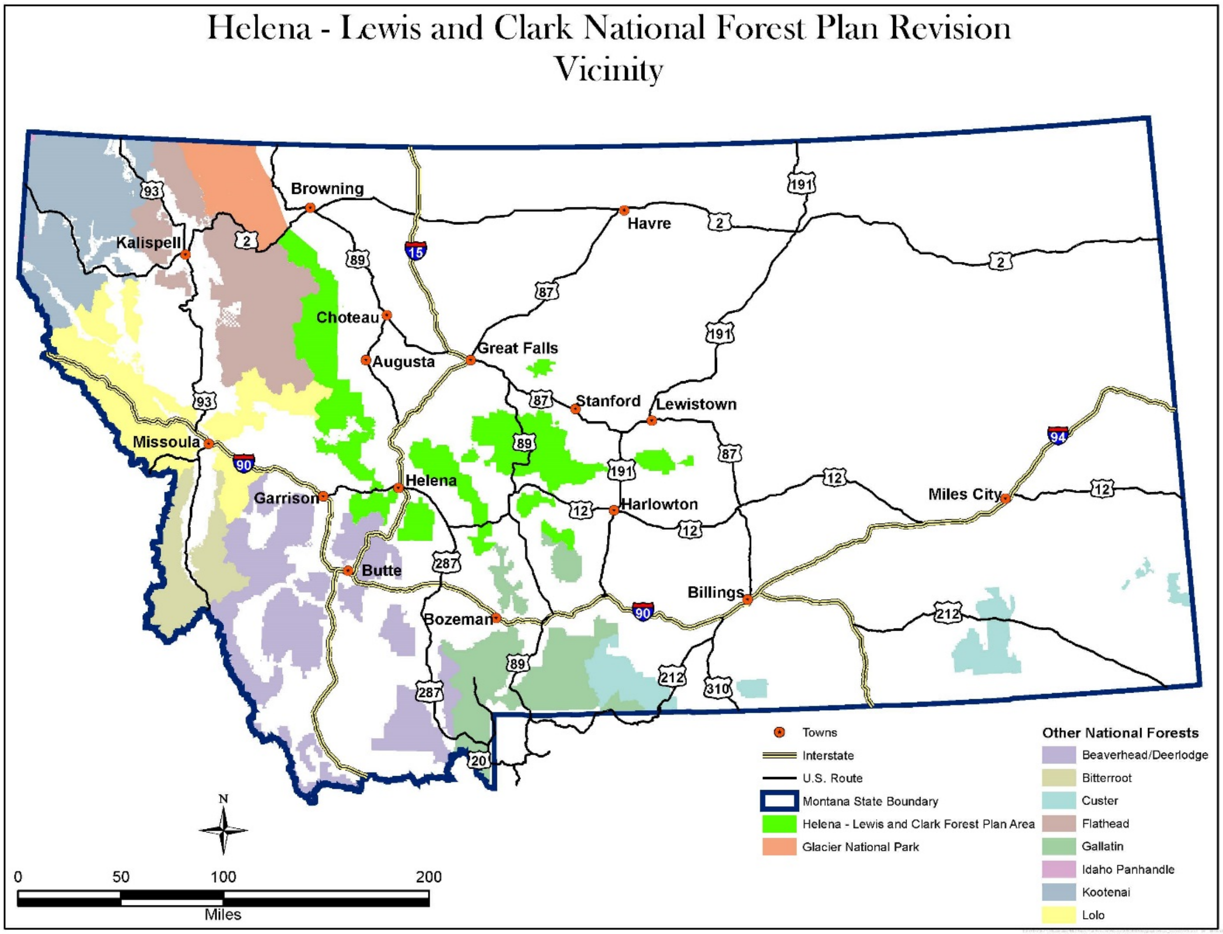

Figure 1. Helena – Lewis and Clark National Forest and vicinity

1.4.1 Geographic areas

The HLC NF straddles the Continental Divide and includes several island mountain ranges. Because of its diversity and extent, and because the island mountain ranges each include unique ecological and social context, the plan area is divided into ten geographic areas (GAs). GAs provide a means for describing conditions and trends at a more local scale if appropriate. The GAs identified in the draft revised plan correspond to the island mountain ranges and/or district or watershed boundaries. Table 1 displays the acres of the HLC NFs by GA, and Figure 2 displays the GAs.

Table 1. Acres within the ten GAs on the HLC NFs, within the administrative boundary

GA	Total Acres (all ownerships)	NFS acres within the GA	% of GA in NFS lands
Big Belts	452,292	312,983	69
Castles	79,862	69,610	87
Crazies	70,036	57,618	82
Divide	232,890	202,577	87
Elkhorns	175,259	160,599	92
Highwoods	44,495	42,315	95
Little Belts	900,961	802,711	89

GA	Total Acres (all ownerships)	NFS acres within the GA	% of GA in NFS lands
Rocky Mountain Range	782,986	777,963	99
Snowies	121,897	117,989	98
Upper Blackfoot	348,185	333,215	96

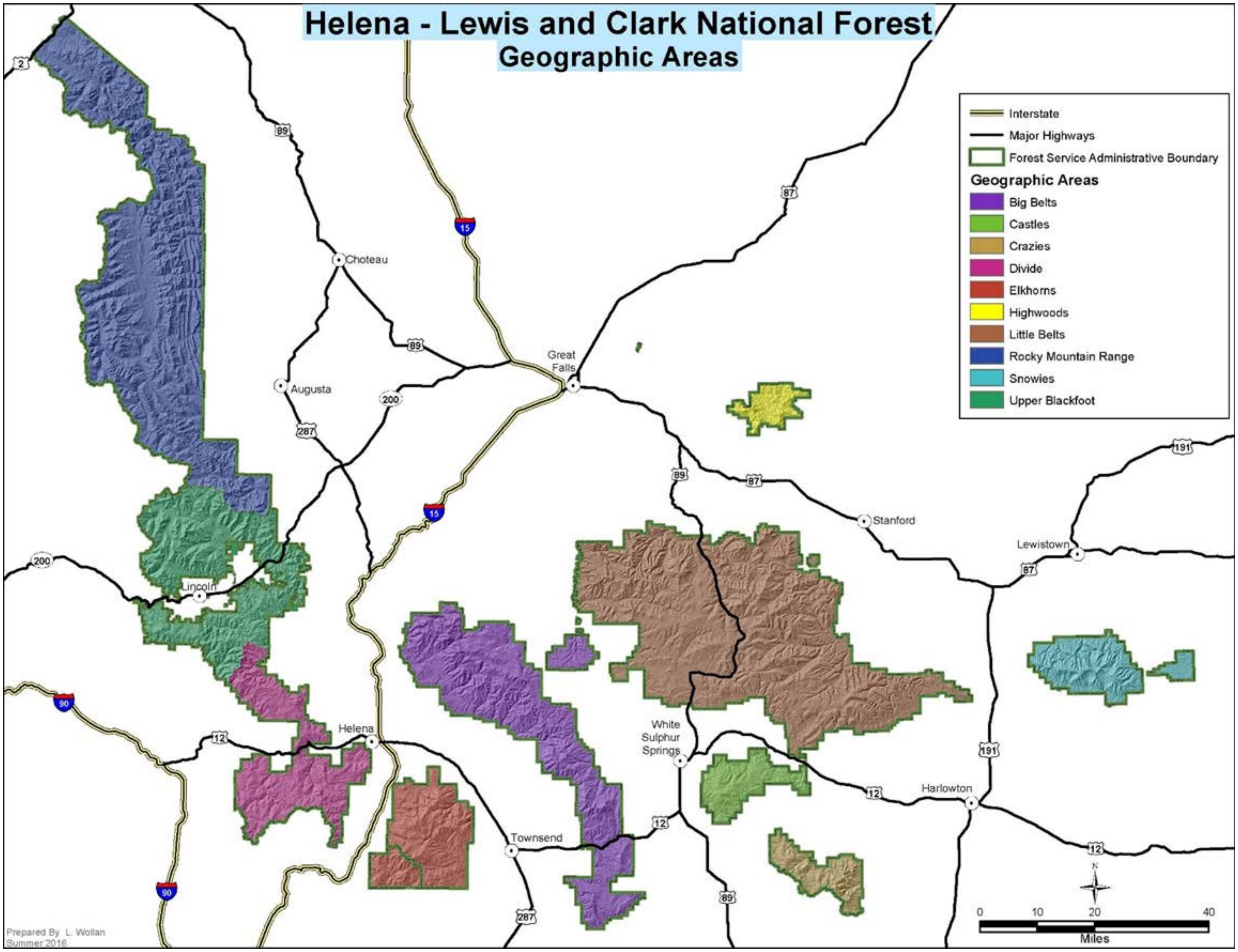

Figure 2. GAs of the HLC NF

1.5 Purpose and Need for Action

The purpose of the revised HLC NF LRMP is to provide an integrated set of plan direction for social, economic, and ecological sustainability, and multiple uses of the HLC NF lands and resources. The requirements of the 2012 Planning Rule, findings from the assessment, changes in conditions and demands since the 1986 forest plans, and public concerns highlighted several areas where changes are needed to the current plan. After a series of public meetings, as well as discussions with resource specialists the Preliminary Need to Change Report identified a variety of subjects for which change was needed. Those included changed social and ecological conditions, economic contributions to local communities, climate change, invasive species, and increasing use by the public and desire for access to NFS lands.

More specifically there is a need to revise the existing forest plans to:

- Create one forest plan to manage the HLC NF that is consistent across two formerly separate NFs.
- Address changes that have occurred in the conditions and demands since the 1986 forest plans.
- Be consistent with the 2012 Planning Rule and associated directives by using adaptive management, public input, and best available scientific information (BASI). Key differences from the former planning rule that are in the new rule and directives include, but are not limited to requirements to:
    a. Identify plant and animal species of conservation concern (SCC) and one or more focal species.
    b. Use a coarse filter approach to provide for ecological sustainability and species diversity that includes the development of desired conditions that are based on the natural range of variation (NRV).
    c. Identify priority watersheds to focus efforts on the integrated restoration of watershed conditions.
    d. Providing contributions to social and economic sustainability by managing for multiple uses and ecosystem services.
    e. Estimate potential timber outputs using concepts described in the 2012 Planning Rule and associated directives.
    f. Provide for a range of recreation opportunities using the recreation opportunity spectrum (ROS) to display the allocations.
    g. Use the scenery management system to identify scenic integrity objectives (SIOs).
    h. Conduct a wilderness inventory and evaluation using procedures described in the 2012 Planning Rule and associated directives.
    i. Study and identify eligible wild and scenic rivers (WSRs) using procedures described in the 2012 Planning Rule and associated directives.
    j. Develop a monitoring plan.
- Address changes in economic, social, and ecological conditions, new policies and priorities, and new information from monitoring and research. Such considerations include but are not limited to:
    a. Emerging information about climate change and carbon stocks.
    b. New science and better understanding regarding the natural role of fire on the landscape as well as the need to manage fuels and protect values at risk.
    c. The listing of whitebark pine as a candidate species under the Endangered Species Act (ESA).
    d. Recent and updated multi-region management direction for Canada lynx
    e. New management direction for grizzly bears in the Northern Continental Divide Ecosystem
    f. Increased recreational use of the forest, and the need for flexible management strategies to address emerging technologies and potential future uses.
    g. An increased focus on

- adaptive management for livestock grazing,
- invasive species management, and
- watershed condition and restoration

1.6 Decision Framework

The 2012 Planning Rule specifies the following eight primary decisions that are to be made in forest plans:

- Forestwide components to provide for integrated social, economic, and ecological sustainability, and ecosystem integrity and diversity, while providing for ecosystem services and multiple uses. Components must be within FS authority and consistent with the inherent capability of the Forest [36 Code of Federal Regulations (CFR) 219.7 and §§219.8–219.10].
- Identification of GAs and/or management area specific components (36 CFR 219.7(d).
- Identification of suitability of areas for the appropriate integration of resource management and uses, including lands suited and not suited for timber production (36 CFR 219.7(c)(2)(vii) and 219.11).
- Identification of the maximum quantity of timber that may be removed from the Forest (36 CFR 219.7(c)(2)(ix) and 219.11 (d)(6)).
- Identification of watersheds that are a priority for maintenance or restoration (36 CFR 219.7(f)(i).
- Recommendations to Congress (if any) for lands suitable for inclusion in the National Wilderness Preservation System and/or rivers eligible for inclusion in the National Wild and Scenic Rivers System (36 CFR 219.7(c)(2)(v) and (vi)).
- Identification or recommendation (if any) of other designated areas (36 CFR 219.7(c)(2)(vii).
- Plan monitoring program (36 CFR 219.7 (c)(2)(x) and 219.12.

The responsible official for the revised forest plan is the forest supervisor. After reviewing the results of the analysis evaluated in the final environmental impact statement (FEIS), the responsible official will issue a draft record of decision (ROD), in accordance with agency decision making procedures (40 CFR § 1505.2) that will:

- disclose the decision (identifying the selected alternative) and reasons for the decision,
- discuss how public comments and issues were considered in the decision, and
- discuss how all alternatives were considered in reaching the decision, specifying which one is the environmentally preferable alternative (defined in 36 CFR § 220.3).

The draft forest plan identifies GAs and includes recommendations for areas that can only be designated by statute, such as wilderness.

Most effects discussed in this document are indirect and cumulative effects. However, there are some direct effects associated with recreation uses in recommended wilderness and in the Elkhorns GA under some alternatives. The analysis of these direct effects would support a site specific decision concurrent with the forest plan decision.

The draft forest plan provides a draft set of integrated plan direction for managing the Forest for the next 10 to 15 years. However, even after approval of the plan, project level environmental analysis will still need to be completed for specific proposals to implement the direction in the forest plan.

Forest plans do not make budget decisions. Should Congress emphasize specific programs by appropriation, a redistribution of priorities would follow, regardless of the alternative implemented.

Chapter 2. Alternatives

2.1 Introduction

This chapter describes and compares the alternatives considered by the responsible official for the draft forest plan. It includes a discussion of how the alternatives were developed, issues raised, descriptions and comparisons of the alternatives, and alternatives that were not considered in detail. Numbers such as acres, miles, and volumes are approximate due to the broad scale of the data used.

Chapter 2 is intended to present the alternatives in comparative form, providing a clear basis for choice among options by the decision maker. The information used to compare alternatives is summarized from Chapter 3, "Affected Environment and Environmental Consequences" contains the detailed scientific basis used to measure the potential environmental consequences of each of the alternatives.

2.2 Alternative Development

As discussed in chapter 1, this forest plan revision effort is based on the requirements of the 2012 Planning Rule, findings of the forest assessment, changes in conditions and demands since the 1986 forest plans, and public concerns. A list of significant issues was identified during the public involvement period, and some of these issues drove the development of alternatives. Some additional items, such as the WSRs eligibility study and the wilderness inventory and evaluation, are addressed in the revision because they are required by planning regulations (i.e., 36 CFR § 219.17(3)(b)(1)).

The Council on Environmental Quality regulations, with respect to the National Environmental Policy Act (NEPA) procedures and specifically the aspect related to alternative development (36 CFR 40 § 1502.14), are fundamental to the process. This section of the CFR reads as follows:

> This section is the heart of the EIS. Based on the information and analysis presented in the sections on the affected environment (§ 1502.15) and the environmental consequences (§ 1502.16), it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public. In this section agencies shall:
>
> a. Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.
>
> b. Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.
>
> c. Include reasonable alternatives not within the jurisdiction of the lead agency.
>
> d. Include the alternative of no action.
>
> e. Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.
>
> f. Include appropriate mitigation measures not already included in the proposed action or alternatives.

All reasonable alternatives to the proposed action must meet the purpose and need for change and address one or more of the significant issues. Not all possible alternatives were carried into detailed study, because the list of options would have been prohibitively large. Instead, the responsible official identified those alternatives that met the criteria and created a reasonable range of outputs, direction, costs, management requirements, and effects from which to choose.

Alternatives represent a range of possible management options. Information presented here and in Chapter 3 provide the basis from which to evaluate the comparative merits of the alternatives. Each alternative emphasizes specific land and resource uses and de-emphasizes other uses in response to the significant issues.

Alternative A is the no-action alternative, which reflects the 1986 forest plans, as amended to date, and accounts for current laws, regulations, and terms and conditions from biological opinions (BOs). Alternative B was released for public review and comment as the proposed action. Development of alternatives C, D, and E was driven by issues identified during scoping.

The HLC NF has not identified a preferred alternative(s) at this point but plans to identify a preferred alternative in the FEIS after reviewing and considering the analysis presented in this DEIS and comments received by the public on this document.

2.3 Public Involvement

The HLC NF began public participation activities prior to the development of the Assessment of the HLC NF. The Forest contracted with the Center for Natural Resources and Environmental Policy at the University of Montana to develop an extensive public engagement process. The Center facilitated numerous public and interagency meetings to bring together information for the HLC NF to consider in preparing the assessment, developing the proposed action, and developing alternatives to the proposed action. There were four rounds of public meetings. The first set of meetings introduced the concepts of forest plan revision to the public. The next meetings discussed the Need to Change, Desired Conditions, and Forest Resource Management (including recommended wilderness and timber suitability). Public input was taken at each meeting and throughout the process. The dialogue and recommendations from this public involvement process were used to help develop the draft proposed action.

In addition to postal mail and email, public meeting information was announced via the forest plan revision website (www.fs.usda.gov/goto/hlc/forestplanrevision). The website also included means for the public to comment (using electronic or printed comment forms, a mapping tool, subscribing to the website, and/or submitting comments via an electronic database) and posted meeting results and other information. Updates were posted and mailed periodically.

The notice of intent for the proposed action to prepare an EIS was published in the Federal Register on December 1, 2016. The notice of intent asked for public comment on the proposal for a 120-day period. The agency held nine public meetings to provide opportunities to better understand the proposed action so that meaningful public comments could be provided by the end of the scoping period. Using the comments from the public, other agencies, tribes, and organizations, the Forest’s interdisciplinary team developed a list of issues to address through changes to the proposed action, development of alternatives, or in analysis of impacts of the proposed action.

2.4 Government Agency Involvement

The 2012 Planning Rule (36 CFR § 219.4(b)) requires the review of the planning and land use policies of other Federal agencies, state and local governments, and Indian tribes. As part of that outreach effort, a number of discussions with representatives from those agencies were initiated, and ongoing dialogue continues. In addition, the Center for Natural Resources and Environmental Policy at the University of Montana organized and facilitated intergovernmental meetings. These meetings enabled the Forest to learn about upcoming plans and projects from other agencies, as well as being able to evaluate whether those planning documents were or were not consistent with the proposed HLC NF plan. These meetings provided agencies an opportunity to exchange updates and information.

The Forest reviewed other agency planning documents that are within or in close proximity to the HLC NF for consistency. Management of public lands adjacent to the HLC NF was considered in the formulation of alternatives and in the analysis of cumulative effects of those alternatives. Land management plans were reviewed for consistency with the forest plan. The draft forest plan is consistent with the majority of these plans. Discrepancies, if any, are described in the cumulative effects sections for specific resources. For example, county wildfire protections plans emphasize protection of values at risk; while the draft plan integrates these values with other resource objectives. While certain components may not be fully consistent, the HLC NF will continue to work with these entities to address the impacts and benefits from forest management.

2.4.1 Federal

Management concerns across boundaries were considered when working with other federal agencies, as well as with adjacent NFs. Land management plans for NFS lands within or in close proximity to the HLC NF that were considered during the analysis include the following:

- Custer Gallatin NF Plan,
- Beaverhead-Deerlodge NF Plan,
- Flathead NF Plan,
- Lolo NF Plan

Other plans considered included: Bureau of Reclamation Canyon Ferry Shoreline Management Plan, Bureau of Reclamation Canyon Ferry Reservoir Resource Management Plan, Bureau of Land Management (BLM) Butte Resource Management Plan, BLM Missoula Resource Management Plan, BLM Lewistown Resource Management Plan, National Park Service Glacier National Park General Management Plan, National Park Service Glacier National Park Bear Management Plan, Natural Resources Conservation Service Montana Soil Health Strategy, Natural Resources Conservation Service Montana Sage Grouse Initiative, and the Montana Army National Guard Integrated Natural Resources Management Plan for the Limestone Hills Training Area.

2.4.2 Tribal

The forest supervisor and members of the planning team met with tribal representatives from the Blackfeet Tribe during development of the draft forest plan. As a result, specific tribal comments were considered in this DEIS and draft forest plan.

Several resource management plans for the Blackfeet were identified but were not yet available for review at the time of the DEIS: Blackfeet Integrated Resource Management Plan, Blackfeet Fire/Forestry Management Plan, and the Blackfeet Bison Restoration and Conservation Plan. These plans are in development, and when available will be considered for the revised forest plan.

2.4.3 State

Several Montana State agencies are affected by, or affect, FS management. The Forest coordinated information formally and informally with state agencies during all phases of the process. These offices provided formal comments during the public comment period and other public involvement stages.

The following plans were considered during the analysis: Montana Statewide Forest Resource Strategy, Montana State Parks and Recreation Strategic Plan, Montana State Parks 2014-2018 Statewide Comprehensive Outdoor Recreation Plan, Montana's Statewide Wildlife Action Plan, and the Montana Fish and Wildlife Conservation and Management Plans.

2.4.4 County/City

Beginning with initiation of the planning process, local government officials from the counties within HLC NF lands were regularly updated. FS representatives attended county meetings to provide updates and answer questions. County plans were considered and evaluated for consistency during the planning process. The HLC NF is committed to working with all local counties to better address the impacts and benefits from management of the HLC NF.

The following plans were considered during the analysis: County Community Wildfire Protection Plans, Broadwater County Growth Policy Plan, Cascade County Growth Policy Update, Choteau County Growth Policy Plan, Jefferson County Growth Policy Plan, Judith Basin County Growth Policy, Lewis and Clark County Growth Policy Plan, Meagher County Growth Policy Plan, Pondera County Growth Policy Plan, Powell County Growth Policy Plan, Teton County Growth Policy Plan, and the City of Helena Montana Parks, Recreation, and Open Space Plan.

2.5 Forest Service Planning

FS planning takes place at different organizational levels and geographic scales. Planning occurs at three levels—national strategic planning, NFS unit planning, and project or activity planning. The Chief of the FS is responsible for national planning, such as preparation of the FS strategic plan that established goals, objectives, performance measures, and strategies for management of the NFS. NFS unit planning results in the development, amendment, or revision of a land management plan, such as the HLC NF forest plan. The supervisor of the NF is the responsible official for the development and approval of a plan, plan amendment, or plan revision for lands under the responsibility of the supervisor. The forest supervisor or district ranger is the responsible official for project and activity planning (§ 219.2).

2.5.1 National strategic planning

The USDA FS Strategic Plan: Fiscal Year 2015-2020 contains four outcome-oriented goals for the FS, each with strategic objectives. The strategic plan can be accessed online (www.fs.fed.us/strategicplan). The first two goals and related objectives are directly related to the current planning effort:

3. Sustain our Nation’s forests and grasslands
    - Foster resilient, adaptive ecosystems to mitigate climate change
    - Mitigate wildfire risk
    - Conserve open space
4. Deliver benefits to the public
    - Provide abundant clean water
    - Strengthen communities
    - Connect people to the outdoors

The FS continues to use the results of the 2010 Resources Planning Act Assessment (USDA, 2012c), a report on the status and projected future trends of the nation’s renewable resources on all forests and rangelands, as required by the 1974 Forest and Rangeland Renewable Resources Planning Act. The assessment includes analyses of forests, rangelands, wildlife and fish, biodiversity, water, outdoor recreation, wilderness, urban forests, and the effects of climate change on these resources. The assessment provides a snapshot of current U.S. forest and rangeland conditions (all ownerships), identifies drivers of change for natural resource conditions, and projects the effects of those drivers on resource conditions 50 years into the future. This assessment uses a set of future scenarios that influence the resource projections, allowing the exploration of a range of possible futures for U.S. renewable natural resources. Alternative future scenarios were used to analyze the effects of human and environmental influences on U.S. forests and rangelands, including population growth, domestic and global economic growth, land use change, and climate change.

In addition, the USDA strategic plan for fiscal year 2014-2018 has specific goals that also align with the 2012 Planning Rule, including (1) assist rural communities to create prosperity so they are self-sustaining, repopulating, and economically thriving; and (2) ensure our NFs and private working lands are conserved, restored, and made more resilient to climate change while enhancing our water resources. The USDA strategic plan can be accessed on the USDA's Web site (www.usda.gov).

2.5.2 National Forest System unit planning

The NFMA of 1976 (Pub. L. 94-588) amended the Forest and Rangeland Renewable Resources Planning Act of 1974. The NFMA requires the preparation of an integrated land management plan by an interdisciplinary team for each unit of the NFS (national forests and grasslands). The public must be involved in preparing and revising forest plans. Forest plans must provide for multiple use and sustained yield of products and services and include coordination of outdoor recreation, range, timber, watershed, wildlife and fish, and wilderness. The forest plan does not authorize site-specific prohibitions or activities; rather, it establishes broad direction, similar to zoning in a community.

The 2012 Planning Rule for land management planning for the NFS sets forth process and content requirements to guide the development, amendment, and revision of land management plans to maintain and restore NFS land and water ecosystems while providing for ecosystem services (the benefits people obtain from the NFS planning area) and multiple uses (USDA, 2012b). The final planning directives, effective January 30, 2015, are the key set of agency guidance documents that direct implementation of the 2012 Planning Rule (USDA, 2015).

2.5.3 Project or activity planning

Project and activity consistency with the forest plan (§ 219.15) will be achieved through (1) application to existing authorizations and approved projects or activities, (2) application to projects or activities authorized after the plan decision, (3) resolving inconsistency, (4) determining consistency, and (5) consistency of resource plans within the planning area with the land management plan. Refer to pages 10-11 of the forest plan for additional information about project and activity consistency. Previously approved and ongoing projects and activities are not required to meet the direction of the forest plan and will remain consistent with the direction in the 1986 forest plan, as amended.

The forest plan direction will apply to all projects and or activities that have a decision made on or after the effective date of the final ROD. Projects and activities authorized after approval of the forest plan will be consistent with applicable plan components in the forest plan. A project or activity approval document will describe how the project or activity is consistent with the applicable plan components.

Any resource plans developed by the Forest that apply to the resources or land areas within the planning area will be consistent with the plan components. Resource plans developed prior to the plan decision will be evaluated for consistency with the plan and amended if necessary.

When a proposed project or activity would not be consistent with the applicable plan components, the responsible official shall take one of the following steps, subject to valid existing rights (36 CFR § 219.15(c)):

- modify the proposed project or activity to make it consistent with the applicable plan components,
- reject the proposal or terminate the project or activity,
- amend the plan so that the project or activity will be consistent with the plan, as amended, or

- amend the plan contemporaneously with the approval of the project or activity so that the project or activity will be consistent with the plan, as amended. This amendment may be limited to apply only to the project or activity.

The forest supervisor or district ranger is the responsible official for project and activity planning. In order for prohibitions or activities that take place on the ground, project or activity decisions will need to be made following appropriate procedures (e.g., site-specific analysis in compliance with National Environmental Policy Act).

2.6 Issues

Issues serve to highlight effects or unintended consequences that may occur from the proposed action or alternatives, giving opportunities during the analysis to reduce adverse effects and compare trade-offs for the decision maker and public to understand. Issues were identified through scoping. Significant issues were defined as those directly or indirectly caused by implementing the proposed action, involve potentially significant effects, and could be meaningfully and reasonably evaluated and addressed within the programmatic scope of a Forest Plan. Some issues are best resolved at finer scales (subsequent NEPA analysis) where the site-specific details of a specific action and resources it affects can be meaningfully evaluated and weighed. Conversely, some issues have already been considered through broader programmatic NEPA analysis [e.g. the Northern Rockies Lynx Management Direction (NRLMD) FEIS]. In these cases, the issues focus on evaluating the effects unique to and commensurate with the decisions being considered here.

Alternatives were developed around those significant issues that involved unresolved conflicts concerning alternative uses of available resources (40 CFR 1500.2(e)). The HLC NF identified the following significant issues during scoping that drove alternative development.

2.6.1 Issues that drove alternatives

Recommended Wilderness and Undeveloped Areas

The allocation of recommended wilderness areas (RWAs) was a primary issue for the majority of the public commenters. The range of public comments regarding RWAs was vast. On one end of the spectrum, commenters asked the Forest to consider all existing inventoried roadless areas (IRAs) for RWAs. At the other end of the spectrum, commenters desired no RWAs. Many commenters recommended the consideration of additions or deletions to specific areas that were identified in the proposed action. Commenters also provided recommendations on areas they wished to remain undeveloped where primitive recreation opportunities are provided.

Measurement indicators: number of RWAs, acres of RWAs, and acres of additional undeveloped areas (represented by primitive recreation opportunities).

Motorized and Mechanized Means of Transport in Recommended Wilderness Areas

In addition to the issue of the amount and location of RWAs, whether or not to allow motorized and mechanized recreation uses within RWAs was also a primary concern of many public comments. Comments included those in favor of prohibiting motorized and mechanized means of transport within RWAs, as well as those that desire to continue these uses unless the RWAs are formally designated by Congress. The motor vehicle use and mountain bike communities were most vocal on this issue. Some motorized users do not want to see further restrictions on motorized access. The mountain bike community was concerned about the potential loss of access to areas that they currently use. To address these public concerns, alternatives were created that analyzed the effects of allowing as well as not allowing motorized and mechanized means of transport on wilderness character within RWAs.

To address additional concerns about wildlife habitat in the core of the Elkhorns wildlife management unit, one alternative analyzed closing the core of the Elkhorns to mechanical means of transport (mountain bikes).

Measurement indicators: miles of trail no longer available to mechanized means of transport, miles of road no longer open for access, acres of motorized over-snow use no longer available, and miles of motorized trail no longer available

Timber Harvest and Timber Production

Timber harvest and production was raised as an issue by many public commenters. This topic includes the identification of lands suitable for timber production, estimated volume outputs of timber, and timber harvest conducted both for timber production and for other purposes. The comments included requests to increase the amount of lands suitable for timber production, increase timber volume offered from NFS lands, and/or increase the number of acres treated with harvest. Conversely, other commenters requested that few or no lands be suitable for timber production, and/or that less timber harvest occurs on NFS lands.

Measurement indicators: acres suitable for timber production, acres unsuitable for timber production where harvest may occur for other purposes, volume for projected timber sale quantity (PTSQ) and projected wood sale quantity (PWSQ), acres of projected harvest.

2.6.2 Issues that did not drive alternatives

Other issues were raised both internally and externally. While they did not drive the development of alternatives, they are important elements of the analysis in the DEIS. Some issues include forest plan components that vary by alternative, to allow the analysis to display the effects of different approaches.

These issues include but are not limited to:

- Water supply and quality
- Riparian area conditions
- Spread and control of invasive plants (weeds)
- Impacts of livestock grazing on various resources, including its importance to local communities
- Air quality
- Role and effects of large fires on the landscape
- Role of fire management, including fire suppression, the identification of high value resources, fire suppression, and wildland urban interface (WUI) considerations
- Climate change and carbon storage
- Natural range of variation (NRV) of vegetation conditions
- Role of vegetation management actions (timber harvest, fuel reduction, restoration, re-vegetation, salvage)
- Specific vegetation components (old growth, snags, coarse woody debris, large trees)
- Condition of specific plant species or types (whitebark pine, aspen, sagebrush, non-forested plant communities, spruce/fir)
- At-risk (threatened, endangered, and species of conservation concern) plant and animal species
- Wildlife species diversity and viability of species, including specific wildlife species
- Distribution of certain wildlife species and availability for hunting, trapping, viewing and other human uses
- Recreation Opportunities
- Recreation Special Uses

- Recreation Access
- Aviation recreation access in primitive and semi-primitive non-motorized ROS settings
- Scenic Integrity Objectives
- Designated Areas and Designated Uses
- Management of the Badger Two Medicine area
- Habitat Connectivity
- Elk Security
- Economic contributions of agriculture

2.7 Alternatives

The range of alternatives developed and presented is based on a preliminary evaluation of the information gathered from public and internal comments and the purpose and need for the project. While all alternatives provide a wide range of ecosystem services and multiple uses, some give slightly greater emphasis to selected resources based on the theme of the alternative and response to revision topics.

The action alternatives were developed based on the Forest’s assessment (2015), the need for change, desired conditions, implementation and monitoring of the current forest plan, public meetings, and comments received during the public involvement period, interagency meetings, and meetings with tribal partners. The alternatives represent a range of possible management options from which to choose. Each alternative emphasizes specific land and resource uses and de-emphasizes other uses in response to the revision topics. Some components may vary between alternatives to address the issues identified during scoping; see the description of the alternatives for specific details. Plan direction for desired conditions, standards, and guidelines remains constant for all action alternatives, with the exceptions noted.

In addition to the no-action alternative (A) and the proposed action that was scoped (B), three additional alternatives (C, D, and E) were developed based on the identified issues. The alternatives span the range of forest management practices and uses of available resources. The general theme and intent of each alternative is summarized below. A limited number of plan components vary by alternative.

Given the extensive public engagement and environmental review recently completed for the forests’ travel management decisions, all action alternatives would be generally consistent with the current travel plans, which are primarily reflected by motorized versus nonmotorized ROS settings. To respond to the issues, ROS settings would be adjusted by alternative where the shift remains consistent with the travel plans.

2.7.1 Elements common to all alternatives

All alternatives in this document adhere to the principles of multiple use and the sustained yield of goods and services required by the CFR (36 CFR § 219.1 (b)). All the alternatives are designed to:

- meet law, regulation, and policy;
- contribute to ecological, social, and economic sustainability;
- meet the purpose and need for change and address one or more significant issues;
- provide integrated direction as included in the forestwide desired conditions, objectives, standards, guidelines, and sustainability;
- provide sustainable levels of products and services; and
- comply with existing travel plans, except in RWAs and other limited locations.

In addition, the following would be the same for all alternatives:

- Existing developed recreation sites and recreation residence special use permits would be allowed; alternatives do not make decisions to remove or create developed recreation sites.

- Management direction for and location of utility and road rights-of-way, easements, and communication sites would remain constant.
- National Wilderness System lands and plan components would remain constant.
- Oil and gas leasing decisions would not be made.
- Eligible WSRs would remain constant.
- Recent and updated multi-region management direction for Canada lynx; and new management direction for grizzly bear would be incorporated.

2.7.2 Elements common to all action alternatives

All action alternatives are designed to be consistent with the 2012 Planning Rule and associated directives, and emphasize adaptive management and the use of best available science.

2.7.3 Alternative A – no action

Alternative A, the no-action alternative, reflects current management practices under the 1986 forest plans, as amended and implemented, and provides the basis for comparing alternatives to current management and levels of output. Alternative A does not address some of the elements associated with the 2012 Planning Rule, such as timber suitability or riparian management zones (RMZs). The Council on Environmental Quality regulations (40 CFR 1502.14d) requires that a “no action” alternative be analyzed in every EIS. This does not mean that nothing would occur under alternative A. The current conditions as described by each resource in chapter 3 would continue. Under this alternative, current management plans would continue to guide management of the plan area, and ongoing work or work previously planned and approved would occur under that guidance. Laws and regulations that have been adopted since the 1986 plans will be analyzed as part of the no-action alternative (for example, the designation of IRAs). With respect to the identified issues, the alternative is described as follows:

- There would be three RWAs (Big Log, Mount Baldy, and Electric Peak – also known as Blackfoot Meadows).
- Existing mechanized means of transport would be allowed in all areas except designated wilderness.
- Lands suitable for timber production would be based on the 1986 plans as amended and implemented, with current regulation and policy. When consistent with other plan components, harvest for purposes other than timber production could occur on a subset of unsuitable lands.
- Standards for elk security are included in the 1986 plans.

2.7.4 Alternative B

Alternative B, which was scoped as the proposed action, represents a mix of RWAs and lands identified as suitable for timber production. The balance of opportunities available for primitive recreation and nonmotorized recreation experiences versus less primitive and more motorized recreation experiences would be generally consistent with current travel plans, except in the case of RWAs. With respect to the identified issues, the alternative is described as follows:

- There would be nine RWAs (Big Log, Mount Baldy, Blackfoot Meadows, Deep Creek, Big Snowies, Dearborn Silverking, Red Mountain, Arrastra Creek, and Nevada Mountain).
- Motorized and mechanized means of transport would be prohibited in RWAs.
- All lands that were are not withdrawn from timber suitability due to legal or technical factors would be suitable for timber production except for: areas with primitive and semi-primitive nonmotorized ROS; RWAs; and the Elkhorns GA, South Hills Recreation Area, Badger Two Medicine area, Highwoods GA, Snowies GA, and Dry Range. When consistent with other plan

components, harvest for purposes other than timber production could occur on other lands not suitable for production.

- Plan components that specifically address management of elk security would be included.

2.7.5 Alternative C

Alternative C is a modified proposed action, which also represents a mix of RWAs and lands identified as suitable for timber production. The balance of opportunities available for primitive recreation and nonmotorized recreation experiences versus less primitive and more motorized recreation experiences would be generally consistent with current travel plans, except in the case of RWAs. In the Divide and Elkhorn GAs some changes to the ROS would be included in this alternative. This is proposed for areas where desired future management would require changes to the travel plans. With respect to the identified issues, the alternative is described as follows:

- There would be nine RWAs; these are the same as listed for alternative B.
- Motorized and mechanized means of transport in RWAs would be allowed.
- Changes to the ROS settings in the Elkhorns and Divide GAs would require minor changes to existing travel plans shifting from motorized to nonmotorized semi-primitive recreation opportunities.
- An area within the Elkhorns “core” would be identified where no mechanized means of transport would be allowed.
- The timber suitability determinations would be the same as described for alternative B.
- Plan components that specifically address management of elk security would not be included.

2.7.6 Alternative D

Alternative D was developed to address comments and themes of limiting human influences on the landscape. This alternative would be responsive to commenters who desire more undeveloped recreation areas, and includes the greatest amount of RWAs and least amount of lands suitable for timber production. RWAs and primitive or semi-primitive nonmotorized ROS areas were selected where consistent with current travel plans with emphasis given to areas where decreased human presence would enhance connectivity for wildlife. In this alternative, the core of the Elkhorn Mountains would be identified as an area where mechanized means of transport would not be allowed. With respect to the identified issues, the alternative is described as follows:

- There would be 16 RWAs. These would include the nine areas listed for alternatives B and C in addition to the following 7 areas: Camas Creek; Wapiti Peak; Loco Mountain; Colorado Mountain; Tenderfoot Creek; Big Horn Thunder; and Middle Fork Judith. RWAs would be identified with consideration given to maintaining or enhancing potential habitat connectivity for large, wide-ranging wildlife species within and among GAs. Includes additions to the original Blackfoot Meadows and Nevada Mountain RWAs.
- Motorized and mechanized means of transport would be prohibited in RWAs.
- Additional primitive ROS areas would be identified in the Elkhorns, Highwoods, and Badger Two Medicine areas of the Rocky Mountain Range to provide additional undeveloped areas.
- In addition to the exclusions from alternative B, lands would not be suitable for timber production within additional RWAs, or where the ROS settings are modified to be primitive or semi-primitive nonmotorized. When consistent with other plan components, harvest for purposes other than timber production could occur on lands not suitable for production.

- Plan components that specifically address management of elk security would not be included.

2.7.7 Alternative E

Alternative E was developed to address comments and themes of increasing timber production from NFS lands and not including any RWAs. All lands that may be suited are included as suitable for timber production, with the exception of the Badger Two Medicine area and the Elkhorns GA. The recreation opportunities spectrum classes that are the most compatible with harvest activities are selected where consistent with current travel plans. No RWAs are included. With respect to the identified issues, the alternative is described as follows:

- There would be no RWAs.
- Mechanized means of transport would not be prohibited anywhere except designated wilderness.
- All lands that were are not withdrawn from timber suitability due to legal or technical factors would be suitable for timber production except for those lands within the Elkhorns GA and the Badger Two Medicine area. When consistent with other plan components, harvest for purposes other than timber production could occur on a subset of unsuitable lands.
- Plan components that specifically address management of elk security would be included.

2.7.8 Alternatives considered, but not given detailed study

The Council on Environmental Quality requires federal agencies to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14 (a). Public comments received during scoping provided suggestions for alternative methods for achieving the purpose and need for action. Some of these alternatives were outside the scope of the purpose and need for action, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary harm. The alternatives provided by the public (in bold) and the subsequent agency rationale as to why they were not given further detailed study are described below.

Old growth and snag guidelines should not apply in lands suitable for timber production. The reason that snags and old growth have guidelines in the Draft Plan is to ensure that there is an appropriate abundance and distribution of these features across the landscape because they are rare and/or of particular importance for wildlife habitat and other ecosystem functions. However, there was interest to analyze an alternative with no old growth or snag guidelines applying in lands suitable for timber production. The rationale for this suggestion was that the lands suitable for timber production represent a small proportion of the landscape, and of that harvest occurs on only a portion; therefore adequate old growth and snags should be available in unmanaged areas. Excluding these components would be responsive to desires to maximize timber production. For snags, there are also safety concerns related to requiring retention of snags in areas where people are conducting management activities.

A brief analysis was done to evaluate the potential for an alternative that did not include guidelines for snags and old growth in lands suitable for timber production. Although lands suitable for timber production make up only 15-16% of the HLC NF depending on alternative, approximately one-third of the old growth and one-quarter of the large and very large snags that exist on the HLC NF are estimated to occur on those lands. This is not a static condition, but demonstrates that lands suitable for timber production provide a substantial proportion of the old growth and large snag resources on the HLC NF, by virtue of the successional processes that occur in productive forests.

It can be theoretically assumed that without guidelines, any old growth treated with harvest in lands suitable for timber production would no longer be old growth, and most if not all large/very large snags would be cut. This potential loss would be ameliorated by two factors: first, not all lands suitable for would actually be harvested. Based on modeled projections, harvest activities would impact 19 to 23 percent of the lands suitable for timber production over a 50-year horizon, which equates to 3 to 4 percent of all lands on the HLC NF, depending on alternative. Second, not all areas harvested would be old growth or have snags. Therefore the actual loss of these resources would be something less than the total harvested amounts. The level of this loss would vary by GA based on the amount and distribution of lands suitable for timber production. It is impossible to project the precise outcomes from harvest on lands suitable for timber production to old growth and snags.

Although it seems likely that the effects would occur on a small proportion of the HLC NF, the alternative to exclude old growth and snag guidelines in lands suitable for timber production was not analyzed in further detail for the following reasons:

- To some degree, there would be less old growth and fewer large snags in lands suitable for timber production in an alternative without guidelines for these features. This would indicate a movement away from the NRV, and possibly result in slower movement toward desired conditions.
- Not all vegetation types are represented equally in areas that are unsuitable for timber production, and therefore limiting old growth and snags to those areas may result in underrepresenting those features in some vegetation types.
- Stochastic disturbances like fire can also limit the abundance and distribution of old growth and snags. An alternative that relies on providing these habitat features in lands unsuitable for timber production would be flawed if that happens to be where catastrophic fire occurs.
- The spatial distribution of snags and old growth is a key factor in assessing habitat to support wildlife viability and diversity. The potential impacts to wildlife from a reduction of old growth and/or snags in lands suitable for timber production would depend on the distribution of lands suitable for timber production in a given landscape, actual locations of harvest treatments, the current distribution of snags and old growth, and the habitat needs of each species. Without guidelines to ensure retention of these features across the landscape, the likelihood that habitat in the plan area would support the natural diversity of native wildlife species is less certain.

All IRAs, and/or all areas in the wilderness inventory, should be recommended wilderness. Not all of these areas contain the wilderness characteristics required of RWAs. Detailed rationale is documented in appendix F of the draft plan and appendix E of the DEIS.

Fire, both planned and unplanned, should be eliminated or very limited on the landscape. All fires should be suppressed and prescribed fire should not occur, especially in the Rocky Mountain Range GA. It is not FS policy nor best available science to eliminate all planned and unplanned fire from the landscape. The effects of potential fire on the landscape will be analyzed in the DEIS. Within wilderness areas, the FS is mandated to allow natural processes to occur. This alternative would be contrary to the wilderness act.

The management emphasis of the Elkhorns should be modified (to no longer be a Wildlife Management Unit; to be suitable for timber production; and/or the Elkhorns Core should be recommended wilderness). The Elkhorns was a wilderness study area identified in 1976 by the Montana Wilderness Study Act. The Final Report on the Elkhorn Wilderness Study Area (USDA 1981) recommended that the area not be recommended as wilderness, but rather be managed to emphasize high wildlife values. This recommendation was accepted by the Chief of the FS, and as a result, the Agriculture Secretary at the time directed the FS to establish the Elkhorns as a special wildlife management unit (WMU) in the forest plan. President Reagan issued a Message to Congress concuring with this direction in 1982. As a result, the Helena Forest Plan in 1986 established the Elkhorns as a WMU and incorporated the recommendations for management found in the Final Report on the Elkhorn Wilderness Study Area (USDA 1981). The Elkhorns GA has been managed under this specific guidance since that time.

The Elkhorns core area was reviewed in the wilderness inventory and evaluation process and was found to have wilderness characteristics that would make it valuable as a RWA. The forested lands within it were also included in the consideration for lands that may be suitable for timber production. However, public scoping for the proposed action revealed that most people did not want to see the special emphasis on the Elkhorns change. There was a general sense that the FS should retain and not change the current direction for this area. Further, the rationale for the original recommendations from the Final Report on the Elkhorn Wilderness Study Area, as well as the direction from the Chief of the FS, Agriculture Secretary, and President in 1982 were determined to still be relevant today.

Because of this, the FS has chosen to carry the Elkhorns WMU designation forward in all alternatives with management similar to that specified in the 1986 forest plan. The primary management purpose for the area is to maintain habitat for viable populations of native species, particularly for species requiring seclusion. As such, RWA designation within the Elkhorns was not considered under any alternative. Further, although timber harvest may be compatible with management for wildlife habitat and may in fact be used to maintain or enhance some habitats, management for production of timber as either a primary or secondary purpose is not compatible with an emphasis on managing habitat for species that require seclusion from human disturbance.

Maximum timber production with no budget or resource constraints; include all lands that may be suited for timber production. The DEIS analysis includes potential timber outputs without budget constraints for analysis purposes; however, per the 2012 Planning Rule, the Draft Plan and alternatives must be based on the fiscal capability of the unit. Further, it would not be possible to remove all resource constraints and still meet applicable laws. The alternatives address a range of lands suitable for timber production, but lands within several key areas are not suitable for timber production in any alternative. Lands in the Elkhorns Wildlife Management Unit are excluded because to maintain the goals and objectives for that designation, timber production would not be a primary or secondary land use, although timber harvest could be used for other purposes. Lands within the Badger Two Medicine area are also excluded to be consistent with its designation as a Traditional Cultural District.

Consider an ecological/biocentric forest plan. Some elements of this public comment are included in the range of alternatives. However, as a whole, not all of the suggested elements would meet the laws, regulation, and policies that guide the multiple use management of NFS lands.

2.7.9 Comparison of alternatives

Forestwide comparison of alternatives by issue

Table 2 displays the range of alternatives with respect to the issues that drove development of alternatives.

Table 2. Comparison of issues (and their measurement indicators) by alternative

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	3	9	9	16	0
2) Acres of RWAs	34,226	213,076	213,076	474,589	0
3) Acres of additional undeveloped areas[1]	0	0	0	183,094	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	206	0	442	0
2) Miles of road no longer open for access	0	12	0	23	0
3) Acres of motorized over-snow use no longer available	0	24,290	0	79,109	0
4) Miles of motorized trail no longer available	0	0.1	0	59	0
Timber harvest					
1) Acres suitable for timber production	430,489	443,057	443,057	435,014	474,640
2) Acres unsuitable for timber production where harvest may occur for other purposes, outside IRAs[2]	418,133	489,392	489,392	444,840	463,414
3) Projected timber sale quantity (PTSQ) Decade 1	4.34 mmcf (19.68 mmbf)	4.25 mmcf (19.18 mmbf)	4.25 mmcf (19.18 mmbf)	4.26 mmcf (19.28 mmbf)	7.41 mmcf (36.06 mmbf)
4) Projected wood sale quantity (PWSQ) Decade 1	6.35 mmcf	6.24 mmcf	6.24 mmcf	6.25 mmcf	9.87 mmcf
5) Projected acres of timber harvest Decade 1	4,108 acres	4,091 acres	4,091 acres	4,075 acres	2,336 acres

14. Additional undeveloped areas that vary by alternative are those designated as a primitive ROS. Other land designations are present on the landscape which reflect a largely undeveloped character, but do not vary by alternative. Such lands include designated wilderness and IRAs.
15. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Recommended wilderness and undeveloped areas

The amount and location of RWAs were several of the primary issues that drove the development of alternatives. Three areas are recommended as wilderness in alternative A, under the existing 1986 forest plans. In alternatives B and C, 9 areas are recommended which represent an area about 6 times greater than the total included in alternative A. Alternative D was designed to respond to public desires for more RWA to the greatest degree, and includes 16 RWAs. In addition, several other areas were designated with a primitive ROS in this alternative, in response to public comments requesting additional undeveloped areas. Alternative E does not recommend any wilderness or additional undeveloped areas, and responds to public comments and desires to decrease the amount of RWAs and other undeveloped lands.

In all alternatives, including alternative E, there are additional lands that have an undeveloped character based on legal designations which do not vary by alternative (such as designated wilderness and IRAs).

Motorized and mechanized means of transport in RWAs

Whether or not continuation of existing motorized and mechanized transport is allowed in RWAs also varies by alternative in response to public comments. In alternatives A and C, these uses are allowed within RWAs. In alternatives B and D, these uses would not be allowed. There is no RWA in alternative E. Therefore, alternatives A, C, and E would represent no net change to the motorized and mechanized uses in these areas.

Timber harvest and timber production

The lands suitable for timber production vary by alternative. Alternative A has the least amount, but is similar to alternatives B/C and D. With these alternatives, about 15% of the HLC NF would be suitable for timber production. Alternative E has the most lands suitable for timber production (about 16% of the HLC NF). The lands suitable for timber production show relatively little variance because the primary factors that drive this determination do not vary by alternative, including vegetation types and land allocations such as designated wilderness and IRAs. PTSQ and the projected wood sale quantity (PWSQ) similar for alternatives A, B/C and D, and greater with alternative E. However, under alternative E the greatest volume would be produced and the fewest acres would be harvested because to maximize timber production, the types and locations of treatment would capitalize on stands with the highest volume available. In addition, because the RWAs identified in the other alternatives are almost exclusively in IRAs, they would not be considered for timber production in any alternative.

Forestwide comparison of alternatives by resource issue

Table 3 describes the range of alternatives with respect to the resource issues which did not drive alternatives. This table is arranged by resource area, with each alternative ranked from 1 to 5, with 1 being the greatest in magnitude or greatest relative contributions to desired conditions to 5 being the lowest contribution. More information about the indicators can be found in chapter 3. Not all of the resource indicators found in chapter 3 are included. In many cases the primary difference is between the no-action and action alternatives.

Table 3. Comparison of alternatives by resource issue - magnitude or relative contribution to desired condition

Resource Area	Indicator	1	2	3	4	5
Watersheds	Water Quality	BCD	E	A		
	Water Quantity	ABCDE				
	Overall movement toward desired conditions	BCD	E	A		
Riparian	Riparian Desired Condition	BCDE	A			
Fisheries and Aquatic Habitat	Aquatic Habitat (includes all above)	BCD	E	A		

Resource Area	Indicator	1	2	3	4	5
Soils	Riparian	BCDE	A			
	Uplands	D	BC	A	E	
Air Quality	Acres per decade of wildfire and prescribed fire	ABCDE				
Fire and Fuels Management	Flexibility for fire management	E	A	C	B	D
	Future vegetation treatments	ABCD	E			
	Future wildfires and fire regimes	ABCDE				
Terrestrial Vegetation	Composition, structure, pattern, snags, old growth, and downed woody debris (movement toward desired conditions)	BCDE	A			
Terrestrial Wildlife Diversity	Overall movement toward desired habitat conditions	BCDE	A			
Terrestrial Wildlife Species at risk	Grizzly bear and Canada lynx (contribution to recovery)	BCDE	A			
	Wolverine (contribution to long-term persistence in the plan area)	ABCDE				
	Species of conservation concern (movement toward desired habitat conditions)	BCDE	A			
Elk	General habitat desired conditions	ABCDE				
	Cover and/or habitat security	ABCDE				
Recreation Settings	Primitive and semi-primitive nonmotorized settings	D	C	B	AE	
	Semi-primitive motorized and roaded natural settings	AE	B	C	D	
Recreation Opportunities	Number and kind of developed recreation facilities and dispersed recreation sites	ABCDE				
Recreation Special Uses	Guidance for management of recreation special sues	BCDE	A			
Recreation Access	Miles of open road	ACE	B	D		
	Miles of motorized trails	ACE	B	D		
	Miles of nonmotorized trail, open for mechanical transport	AE	C	B	D	
	Miles of groomed trail	ABCE	D			
	Acres open to motorized over-snow use	AE	B	C	D	
	Aviation access (airstrips)	ABCDE				
Scenic Character	High and Very High SIOs	D	BE	C	A	
	Moderate, Low, and Very Low SIOs	A	C	BE	D	
Recommended Wilderness	Acres of recommended wilderness	D	BC	A	E	
	Wilderness characteristics	BD	AC	E		
Designated Wilderness	Wilderness characteristics	ABCDE				

Resource Area	Indicator	1	2	3	4	5
Wilderness Study Areas (WSAs)	Wilderness characteristics	D	B	C	AE	
IRAs	Roadless area characteristics	ABCDE				
Eligible WSRs	Free-flowing condition; outstanding & remarkable values	ABCDE				
Continental Divide National Scenic Trail	Visual quality and other desired conditions along the trail	BCDE	A			
Research Natural Areas (RNAs)	Acres established, proposed, candidate	D	ABCE			
Smith River Corridor	Natural and cultural values	BCDE	A			
Missouri River Corridor	Natural, cultural, and historic values	BCDE	A			
Cultural, Historic and Tribal Resources	Cultural and historical values	D	B	C	E	A
Livestock Grazing	Expected Rangeland Condition and trend	BCDE	A			
	Acres suitable rangeland	ABCDE				
	Number of permitted livestock head months	ABCDE				
Timber and other Forest Products	Timber production (volume)	E	ABCD			
	Acres treated with harvest and prescribed fire	ABCD	E			
	Other forest products (commercial opportunities)	E	A	BC	D	
Minerals	Lands open to mineral entry and access	E	A	C	B	D
Carbon	Carbon storage potential and guidance	BCDE	A			
Social and Economic	Direct income and jobs	E	A	BCD		
	Fish and wildlife (including non-use values)	D	BC	E	A	
	Grazing (including non-use values)	C	A	E	B	D
	Infrastructure	BCD	E	A		
	Other income and jobs	ABCDE				
	Public information, interpretation, and education	BCDE	A			
	Ecosystem integrity (including erosion control, flood protection, and non-use values)	BCD	E	A		
	Fire suppression (and mitigation)	BCD	E	A		

Geographic area comparison of alternatives

Tables 4-13 display a comparison of the range of alternatives for each GA, in terms of significant issues as well as other resource indicators that vary by alternative and/or are key to understanding the unique effects to the GA. Issues or indicators that are not applicable to a given GA are omitted from the table (for example, if no RWAs are identified under any alternative, those indicators are not listed for that GA).

Big Belts

Table 4. Comparison of alternatives for the Big Belts GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	2	2	3	0
2) Acres of RWAs	0	21,407	21,407	37,750	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	18.9	0	34.9	0
2) Miles of road no longer open for access	0	0	0	0.3	0
Timber harvest					
1) Acres suitable for timber production	43,538	67,379	67,379	69,283	69,295
2) Acres where harvest may occur for other purposes, outside IRAs[1]	80,404	69,230	69,230	68,982	67,943

16. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Castles

Table 5. Comparison of alternatives for the Castles GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	0	0	1	0
2) Acres of RWAs	0	0	0	30,606	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	0	0	9.5	0
2) Miles of road no longer open for access	0	0	0	6.1	0
3) Acres of motorized over-snow use no longer available	0	0	0	26,332	0

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
4) Miles of motorized trail no longer available	0	0	0	31.9	0
Timber harvest					
1) Acres suitable for timber production	17,743	18,450	18,450	17,859	18,450
2) Acres where harvest may occur for other purposes, outside IRAs[1]	18,533	21,876	21,876	20,258	21,876

1. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Crazies

Table 6. Comparison of alternatives for the Crazies GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	0	0	1	0
2) Acres of RWAs	0	0	0	24,977	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	0	0	23.5	0
2) Miles of road no longer open for access	0	0	0	0	0
3) Acres of motorized over-snow use no longer available	0	0	0	4,754	0
4) Miles of motorized trail no longer available	0	0	0	0	0
Timber harvest					
1) Acres suitable for timber production	12,826	7,089	7,089	6,509	7,517
2) Acres where harvest may occur for other purposes, outside IRAs[1]	4,650	13,005	13,005	10,831	12,576

1. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Divide

Table 7. Comparison of alternatives for the Divide GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	2	1	1	2	0

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
2) Acres of RWAs	16,657	18,296	18,296	41,089	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	16.3	0	24.2	0
2) Miles of road no longer open for access	0	0	0	0	0
3) Acres of motorized over-snow use no longer available	0	11.1	0	6,348	0
4) Miles of motorized trail no longer available	0	0	0	2.4	0
Timber harvest					
1) Acres suitable for timber production	76,023	62,640	62,640	60,081	71,656
2) Acres where harvest may occur for other purposes, outside IRAs[1]	46,793	73,827	73,827	69,094	66,984
South Hills Special Recreation Area acres	0	50,180	50,180	50,180	0

1. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Elkhorns

Table 8. Comparison of alternatives for the Elkhorns GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
3) Acres of additional undeveloped areas[1]	0	0	0	49,229	0
Timber harvest					
2) Acres where harvest may occur for other purposes, outside IRAs[2]	83,026	86,482	86,482	84,376	86,482
Elkhorns Core Area acres (No Mechanized Use)	0	0	49,229	0	0

1. Additional undeveloped areas that vary by alternative are those designated as a primitive ROS.
2. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Highwoods

Table 9. Comparison of alternatives for the Highwoods GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
3) Acres of additional undeveloped areas[1]	0	0	0	8,598	0
Timber harvest					
1) Acres suitable for timber production	1,170	0	0	0	1,048
2) Acres where harvest may occur for other purposes, outside IRAs[2]	1,167	2,677	2,677	2,677	1,628

1. Additional undeveloped areas that vary by alternative are those designated as a primitive ROS.
2. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Little Belts

Table 10. Comparison of alternatives for the Little Belts GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	1	1	4	0
2) Acres of RWAs	0	14,490	14,490	169,920	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	12.9	0	109.8	0
2) Miles of road no longer open for access	0	0	0	15.1	0
3) Acres of motorized over-snow use no longer available	0	0	0	26,320.9	0
4) Miles of motorized trail no longer available	0	0	0	21.7	0
Timber harvest					
1) Acres suitable for timber production	208,975	232,217	232,217	226,716	232,222
2) Acres where harvest may occur for other purposes, outside IRAs[1]	114,212	130,254	130,254	120,832	130,249

1. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Rocky Mountain Range

Table 11. Comparison of alternatives for the Rocky Mountain Range GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
3) Acres of additional undeveloped areas[1]	0	0	0	125,266	0
Timber harvest					
1) Acres suitable for timber production	1,683	0	0	1,458	0
2) Acres where harvest may occur for other purposes, outside IRAs[2]	28,307	32,281	32,281	7,730	32,281

1. Additional undeveloped areas that vary by alternative are those designated as a primitive ROS.
2. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Snowies

Table 12. Comparison of alternatives for the Snowies GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					
1) Number of RWAs	0	1	1	1	0
2) Acres of RWAs	0	95,299	95,299	95,299	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	98.3	0	98.3	0
2) Miles of road no longer open for access	0	11.8	0	11.8	0
3) Acres of motorized over-snow use no longer available	0	13,145	0	13,144	0
4) Miles of motorized trail no longer available	0	0.1	0	0.1	0
Timber harvest					
1) Acres suitable for timber production	16,030	0	0	0	17,377
2) Acres where harvest may occur for other purposes, outside IRAs[1]	2,755	19,770	19,770	19,770	2,869

1. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

Upper Blackfoot

Table 13. Comparison of alternatives for the Upper Blackfoot GA

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness and undeveloped areas					

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
1) Number of RWAs	0	4	4	4	0
2) Acres of RWAs	0	69,591	69,591	74,948	0
Motorized and mechanized means of transport in recommended wilderness					
1) Miles of trail no longer available to mechanized means of transport	0	59.3	0	60	0
2) Miles of road no longer open for access	0	0	0	1.3	0
3) Acres of motorized over-snow use no longer available	0	11,134.4	0	15,355.2	0
4) Miles of motorized trail no longer available	0	0	0	3.4	0
Timber harvest					
1) Acres suitable for timber production	52,502	54,825	54,825	54,825	56,618
2) Acres where harvest may occur for other purposes, outside IRAs[1]	38,286	40,292	40,292	40,292	40,527

1. Harvest may also occur in IRAs, but is constrained by the 2001 Roadless Area Conservation Rule. See the Timber section.

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Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter presents the existing environment of the HLC NF plan revision area and the potential consequences to that environment that may be caused by implementing the alternatives described in chapter 2. Within each resource section, the boundaries of the area used for the resource analysis are disclosed. The discussions of resources and potential effects use existing information included in the Assessment, other planning documents, resource reports and related information, and other sources as indicated. Where things have changed since the assessment was published, updates have been included.

Numbers such as acres, miles, and volumes are approximate due to the use of geographic information system (GIS) data and rounding.

This DEIS is a programmatic document, disclosing affected environments and environmental consequences at a planning level scale, not at the site-specific project-level scale. Therefore, this DEIS does not predict what would happen each time the proposed plan components are implemented. Land management plans do not have direct effects. They do not authorize or mandate any site-specific projects or activities (including ground-disturbing actions). However, there may be implications, or longer term environmental consequences, of managing the NFs under this programmatic framework. As a result, all effects discussed in this section are considered indirect effects, unless otherwise noted. The environmental effects of those site-specific projects depend on the environmental conditions of each project site, the plan components applied, and implementation.

The affected environment is based in large part upon the assessment, but includes updates and new information that have become available since its printing. The environmental consequences discussions in this chapter allow a reasonable prediction of consequences on the Forest. However, this document does not describe every environmental process nor condition.

3.2 Best Available Scientific Information

The 2012 Planning Rule requires the responsible official to use the best available scientific information (BASI) to inform the development of the proposed plan, including plan components, the monitoring program, and plan decisions. The foundation from which the plan components were developed for the proposed action was provided by the Assessment of the HLC NF, the BASI, and analyses therein. From this foundation, specialists used a number of resources that included peer-reviewed and technical literature, databases and data management systems, modeling tools and approaches, information obtained via participation and attendance at scientific conferences, local information, workshops and collaborations, and information received during public participation periods for related planning activities. Resource specialists considered what is most accurate, reliable, and relevant in their use of the BASI. The BASI includes the publications listed in the literature cited sections of the Assessment and DEIS.

3.3 Regulatory Framework

The Forest will follow all laws, regulations, and policies that relate to managing NFS land. Several important laws and policies form the regulatory framework applicable to managing the HLC NF. The forest plan is designed to supplement, not replace, direction from these sources. Other FS direction, including laws, regulations, policies, executive orders, and FS directives (manual and handbook), are not repeated in the forest plan. The regulatory framework applicable to each resource is included by section, with some of the overarching framework listed below.

3.3.1 Federal law

1895 Agreement with the Indians of the Blackfeet Indian Reservation in Montana: The Blackfeet Tribe retained reserved rights in an area that includes the Badger-Two Medicine Area, in the northern portion of the Rocky Mountain Range GA. These include the right to hunt and fish, subject to the applicable laws of the State of Montana. The federal government has trust responsibilities to Native Americans under a government to government relationship to ensure that the reserved rights are protected.

2012 Planning Rule (36 CFR § 219): Sets out the planning requirements for developing, amending, and revising land management plans for units of the NFS, as required by the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the NFMA of 1976 (16 U.S.C. 1600 et seq). This subpart also sets out the requirements for plan components and other content in land management plans. This part is applicable to all units of the NFS as defined by 16 U.S.C. 1609 or subsequent statute. The planning rule contains detailed requirements that guide the development of the revised forest plan for all resources, and provided the framework for all of the analyses presented in the DEIS. The planning rule can be found at https://www.fs.usda.gov/planningrule.

Antiquities Act of 1906 (16 USC 431) states "That any person who shall appropriate, excavate, injure, or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall, upon conviction, be fined in a sum of not more than five hundred dollars or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court." This act also defines the need for a permit for the examination of ruins; excavation of sites and/or the gathering of objects of antiquity on public lands is only to be done by scientific or educational institutions and for the purpose of knowledge, public viewing and permanent preservation.

Bald and Golden Eagle Protection Act prohibits unauthorized take of bald and golden eagles, as defined through subsequent regulations.

Endangered Species Act (ESA) of 1973, as amended: This act provides requirements for federal agencies with regard to species listed under the act. Section 2 requires all federal agencies to "seek to conserve endangered species and threatened species", and Section 7 requires federal agencies to support biotic sustainability by requiring that they utilize their authorities to carry out programs for the conservation of endangered and threatened species; and to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitats.

Federal Cave Resources Protection Act of 1988: The purpose of this act is to protect and preserve significant caves and cave resources (including animal and plant life occurring naturally in caves) on federal lands and to foster cooperation and exchange of information between governmental authorities and those who use caves for a variety of purposes. A list of significant caves is to be maintained, and those caves are to be "considered in the preparation or implementation of any land management plan".

Federal Clean Air Act of 1955 (as amended in 1967, 1970, 1977, and 1990): This act requires federal agencies to ensure that actions they undertake in nonattainment and maintenance areas are consistent with federally enforceable air quality management plans for those areas. It provides for the protection and improvement of the nation's air resources and applies to the effects of prescribed fire and can help inform wildfire response. The act is a legal mandate designed to protect public health and welfare from air pollution. Although this policy creates the foundation for air quality regulation, states and counties are often responsible for implementation of the air quality standards. The task of identifying National

Ambient Air Quality Standards is assigned by the Clean Air Act to the Environmental Protection Agency. The Environmental Protection Agency evaluates and updates these standards every 5 years.

Federal Land Policy and Management Act of 1976 (Public Law 94-579, as amended) provides authority to control weeds on rangelands as part of a rangeland improvement program. This act declares (per Sec. 102) that "…the public lands be managed in a manner that…will provide for outdoor recreation and human occupancy and use." Title V authorizes the Secretary of Agriculture to issue permits, leases, or easements to occupy, use, or traverse NFS lands. It directs the United States to receive fair market value unless otherwise provided for by statute and provides for reimbursement of administrative costs in addition to the collection of land use fees (43 U.S.C. 1764(g)). This act is also establishes policy for exchange of lands under uniform procedures and that the lands exchanged be consistent with the prescribed mission of the Agency. This act also defines procedures for the withdrawal of lands from mineral entry. It reserves to the United States the rights to prospect for, mine, and remove the minerals in lands conveyed to others and requires the recordation of claims with the BLM.

Federal Water Pollution Control Act (Clean Water Act), 33 U.S.C. 1321(c)(2), 1948, as amended. This law was revised by amendments in 1972 that gave the act its current form and spelled out programs for water quality improvements. Direction is intended to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Sections 303, 319, and 404 apply to forest management. Section 208 of the 1972 amendments mandates identification and control of non-point source pollution resulting from silvicultural activities. There are five required elements: 1) Compliance with state and other federal pollution control rules; 2) No degradation of instream water quality needed to support designated uses; 3) Control of non-point source water pollution using conservation or "best management practices."; 4) Federal agency leadership in controlling non-point sources pollution from managed lands; and 5) Rigorous criteria for controlling discharge of pollutants into the nation's waters. 1987 amendments added Section 319 to the act, under which States are required to develop and implement programs to control nonpoint sources of pollution, or rainfall runoff from farm and urban areas, as well as construction, forestry, and mining sites; and Section 303(d), which requires states to identify pollutant-impaired water segments and develop "total maximum daily loads" that set the maximum amount of pollution that a water body can receive without violating water quality standards, a water quality classification of streams and lakes to show support of beneficial uses, and anti-degradation policies that protect water quality and stream conditions in systems where existing conditions exceed standards.

Forest and Rangelands Renewable Resources Planning Act (1974) provides for the maintenance of land productivity and the need to protect and improve soil and water resources. This act declares (per Sec. 10) that "…the installation of a proper system of transportation to service the NFS ….shall be carried forward in time to meet anticipated needs on an economical and environmentally sound basis…"

Granger-Thye Act of 1950 provides for issuance of grazing permits for a term of up to 10 years. It also provides for the use of grazing receipts for range improvement work. Section 7 authorizes special-use permits not to exceed 30 years duration for the use of structures or improvements under the administrative control of the FS and for the use of land in connection therewith, without acreage limitation.

Migratory Bird Treaty Act of 1918 and Executive Order 13186: This act provides for conservation of migratory birds, through prohibition of unauthorized take as defined through subsequent regulations. In a 2008 MOU (USDA-USFWS, 2008) with the USFWS, the FS agreed to "address the conservation of migratory bird habitat and populations when developing, amending, or revising management plans for NFs and grasslands, consistent with the NFMA, ESA, and other authorities."

Multiple-Use Sustained-Yield Act of 1960: This act confirms the FS' authority to manage the NFs and grasslands "for outdoor recreation, range, timber, watershed, and wildlife and fish purposes" (16 U.S.C. § 528) and does so without limiting the FS' broad discretion in determining the appropriate resource emphasis or levels of use of the lands of each NF and grassland. The Act states that renewable surface resources (such as forests) shall be administered for multiple use and sustained yield to best meet the needs of the American people without impairment of the productivity of the land.

National Environmental Policy Act of 1969: This act requires that all environmental analyses consider a full range of reasonable alternatives to a proposed action. Reasonable alternatives are those that address the significant issues and meet the purpose and need for the proposed action. Requires analysis of projects to ensure the anticipated effects upon all resources within the project area are considered prior to project implementation (40 CFR § 1502.16). This act declares that it is a federal policy to "preserve important historic, cultural, and natural aspects of our national heritage”. It requires federal agencies to use a systematic and interdisciplinary approach that incorporates the natural and social sciences in any planning and decision making that may impact our environment.

National Forest Management Act (NFMA) of 1976: Requires NFs and grasslands to create land management plans. The Act directs the FS to manage for a diversity of habitats to support viable populations. This act directs consultation and coordination of NFS planning with Indian tribes. This act states that the Secretary of Agriculture shall “promulgate regulations” under the principles of the Multiple-Use Sustained-Yield Act of 1960, to “provide for the diversity of plan and animal communities based on the suitability and capability of the specific land area”, and to maintain tree species diversity within the context of multiple-use objectives. It directs that NFS lands shall be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yields.

National Forest Roads and Trails Act of 1964 (16 U.S.C. 532-38): This act authorizes road and trail systems for the NFs. This act declared that an adequate system of roads and trails be constructed and maintained to meet the increasing demand for recreation and other uses. This act authorizes the Secretary of Agriculture to grant temporary or permanent easements to landowners who join the FS in providing a permanent road system that serves lands administered by the FS and lands or resources of the landowner. It also authorizes the grant of easements to public road agencies for public roads that are not a part of the federal-aid system. It authorizes imposition of requirements on road users for maintaining and reconstructing roads, including cooperative deposits for that work.

National Trails System Act of 1968 (P.L. 90-543, 82 Stat.919, as amended): This act establishes the National Trails System and authorizes planning, right-of-way acquisition, and construction of trails established by Congress or the Secretary of Agriculture. The purpose was "to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation." This act authorized three types of trails: 1) National Scenic Trails, 2) National Recreation Trails, and 3) connecting-and-side trails. In 1978 National Historic Trails were also added to the national trail system. National Scenic Trails and National Historic Trails may only be designated by Congress. National Recreation Trails may be designated by the Secretary of Interior or the Secretary of Agriculture. Through designation, these trails are recognized as part of America’s National Trail System.

- **National Parks and Recreation Act of 1978** (Public Law 95-625)**:** This law amended the National Trails System Act of 1968 (Public Law 90-543) to include National Historic Trails.
- **Continental Divide National Scenic Trail Act (S.2660 — 95th Congress (1977-1978)): A**mends the National Trails System Act to establish the Continental Divide National Scenic Trail within Federal lands located in Montana, Idaho, Wyoming, Colorado, and New Mexico. Directs the Secretary of Agriculture to consult with relevant State and Federal officials in the administration of the lands designated under this act.

Organic Administration Act of 1897 (16 U.S.C. 477-482, 551)**:** Provides the main statutory basis for the management of forest reserves. States that the intention of the forest reserves (which later were called national forests) was to “improve and protect the forest” and to secure “favorable conditions of water flows" and provide a "continuous supply of timber for the use and necessities of citizens of the United States." This act also authorizes the Secretary of Agriculture to designate experimental forests and ranges. This act is the basic authority for authorizing use of NFS lands for other than rights-of-way.

Secure Rural Schools and Community Self-Determination Act of October 30, 2000 (P. L. 106-393, 114 Stat. 1607; 16 U.S.C.500 note): This act provides provisions to make additional investments in, and create additional employment opportunities through, projects that improve the maintenance of existing infrastructure, implement stewardship objectives that enhance forest ecosystems, and restore and improve land health and water quality. This act was designed to stabilize annual payments to state and counties containing NFS lands and public domain lands managed by the BLM. Funds distributed under the provisions of this act are for the benefit of public schools, roads, and related purposes.

Sikes Act of 1960 provides for carrying out wildlife and fish conservation programs on Federal lands including authority for cooperative State-Federal plans and authority to enter into agreements with States to collect fees to fund the programs identified in those plans. The act states that FS policies recognize the fact that state agencies and Indian tribes are responsible for management of animals, whereas NFs manage wildlife habitats in cooperation with those entities.

Wilderness Act (1964) (16 U.S.C. 1131-1136): This act provides the statutory definition of wilderness and management requirements for these congressionally designated areas. This act established a National Wilderness Preservation System to be administered in such a manner as to leave these areas unimpaired for future use and enjoyment as wilderness. Both the Bob Marshall and the Gates of the Mountains Wilderness Areas were established by this law. The act identified management goals related to airsheds in wilderness. It also provides that livestock grazing, and the activities and facilities needed to support grazing, are allowed to continue when such grazing was established before the wilderness was designated. Subject to valid rights existing prior to January 1, 1984, wilderness areas are withdrawn from all forms of appropriation and disposition under the mining and mineral leasing laws. The act provides for reasonable access to valid mining claims and other valid occupancies inside wilderness. It establishes requirements for special use authorizations in designated wilderness areas for temporary structures, commercial public services and access to valid mining claims and non-federal lands.

3.3.2 Regulation and policy

All resources have numerous applicable FS manuals and handbooks that are part of the regulatory framework for analysis. These manuals and handbooks provide resource management direction that would be followed under any alternative. Additional details for manuals and handbooks that were specifically referenced in the resource analyses are provided in the regulatory framework sections of the specialist reports, but are not included in the body of the DEIS or the literature cited appendix. Where language from manuals and handbooks are cited within the resource sections below, they are noted as FSM (Forest Service manual) or FSH (Forest Service Handbook).

The final Directives for the planning rule, 2015 (FSH 1909.12) applies to all resources and was used to develop the draft revised plan. The analysis for all resources draws upon the guidance provided in this document. The directives can be found at: https://www.fs.usda.gov/planningrule.

All FS manuals can be obtained at https://www.fs.fed.us/im/directives/dughtml/fsm.html.

All FS handbooks can be obtained at https://www.fs.fed.us/im/directives/dughtml/fsh_1.html.

3.4 Monitoring plan

Under all action alternatives, monitoring would occur as listed in appendix A of the Draft Plan. The monitoring elements are designed to enable the Forest to determine if a change in plan components or other plan management guidance may be needed, forming a basis for continual improvement and adaptive management. The monitoring plan would have the effect of improving the HLC NF's ability to move toward the desired conditions for each resource area, by providing the information needed to assess change through time and support adaptive management actions.

The 1986 plans (alternative A) also included detailed monitoring plans. These 1986 monitoring plans are different than what is included in the action alternatives of this DEIS, although some elements are similar. In general, the monitoring plan under the action alternatives would better provide the information needed to inform adaptive management and ecosystem integrity than the no-action alternative.

The monitoring plan included in the action alternatives would impact each resource area as follows:

- Aquatic ecosystems monitoring would reduce uncertainty related to the impacts of forest management on instream physical habitat, wetlands, riparian management zones, and soil productivity; and reduce uncertainty in the expected effects of climate and disturbance regimes.
- Air quality-monitoring would demonstrate whether air quality is maintained per law and policy.
- Fire and fuels monitoring would improve our understanding of the role fire plays on the landscape; reduce uncertainty surrounding the expected effects of climate on fire processes; and demonstrate the efficacy of hazardous fuel reduction treatments to help improve fuel management strategies.
- Terrestrial vegetation monitoring would demonstrate whether vegetation conditions trend toward the desired conditions; improve our understanding of whether vegetation conditions and habitat can support the natural diversity of plant and animal species ("coarse filter"); reduce uncertainty surrounding the expected effects of climate and disturbances on terrestrial vegetation; demonstrate the efficacy of treatments to improve vegetation resilience; and improve our understanding of the health and condition of specific vegetation communities.
- Old growth, snags, and downed wood monitoring would demonstrate whether these attributes are maintained at desired levels, and reduce uncertainty related to the impacts of forest management, climate, and disturbances on these key habitat elements.
- Plant species at risk monitoring would determine if habitat conditions support the recovery and persistence of at-risk plant species, determine which species require at-risk plant status, and reduce the uncertainty associated with the location and status of rare plant species. Whitebark pine monitoring would demonstrate the ability of the forest to contribute to the recovery of this candidate species.
- Pollinator monitoring would reduce the uncertainty surrounding the abundance and condition of habitat available to support pollinators.
- Invasive plant monitoring would improve our understanding of the extent of nonnative plant species on the forest and reduce uncertainty in the efficacy of invasive plant treatments as well as the impacts of invasive plant treatments on plant species at risk.
- Monitoring related to wildlife habitat would improve our understanding of the trend in and impacts of forest management on habitat for at-risk species; demonstrate the efficacy of specific management actions to reduce human-wildlife conflicts and to maintain specific habitat conditions of interest; improve our understanding of the impacts of forest management on habitat connectivity at some scales; and improve our understanding of how habitat conditions on NFS lands may influence opportunities to hunt some big game species.
- Recreation setting monitoring would demonstrate the progress on moving toward desired recreation opportunity spectrum settings.
- Recreation opportunity monitoring would improve our understanding of the concept of sustainable recreation; reduce uncertainty of the future condition and status of recreation sites and facilities; and improve our understanding of the social and economic contributions of recreation opportunities.

- Recreation special use monitoring would demonstrate the status of recreation special use permits over time.
- Scenic character monitoring would demonstrate the progress on moving toward desired scenic integrity objectives.
- Designated area monitoring would reduce uncertainty regarding whether wilderness character is maintained in designated wilderness and RWAs over time; whether the outstanding remarkable values of eligible wild and scenic rivers are maintained over time; and if nationally designated trails including the Continental Divide National Scenic trail meet the desired conditions for access and maintenance.
- Cultural, historical, and tribal areas of importance monitoring would demonstrate whether progress is made toward the preservation and conservation of significant cultural resources.
- Lands monitoring would demonstrate the degree to which road and trail easements are established.
- Infrastructure monitoring would improve our understanding of the status and condition of the transportation system.
- Public information, interpretation, and education monitoring would demonstrate the extent to which the Forest provides opportunities for the public to connect with the natural resources on the Forest.
- Livestock grazing monitoring would reduce the uncertainty regarding the efficacy of livestock grazing management actions to move rangelands and riparian areas toward desired conditions.
- Timber and other forest products monitoring would demonstrate the degree to which the Forest contributes timber and other forest products to the local community; improve our understanding of the influences of natural disturbances on lands suitable for timber production; and demonstrate the degree to which timber harvest contributes to desirable patch sizes on the landscape.
- Fish and wildlife monitoring would demonstrate the degree to which habitat conditions and management actions on the forest support wildlife and fish related activities; and improve our understanding of the public demand for those opportunities.

3.4.1 Focal species

Two focal species have been selected for monitoring under all action alternatives, which would help improve the Forest's understanding of the integrity of several key ecosystems. The monitoring questions, indicators, and measures are specified in appendix A of the draft plan.

Limber pine

Limber pine (*Pinus flexilis*) has been selected as a focal species to help assess the ecological integrity of xeric ecotone plant communities, which encompass the transition between low elevation grass/shrublands and dry conifer forests. Limber pine is unique in that it spans the elevational gradient across the HLC NF and is also present in some alpine ecotones as an associate with whitebark pine. Ecotone plant communities are of interest due to their vulnerability to climate change, sensitivity to disturbance regime shifts, importance to wildlife, and because they support at-risk plants. Threats to these ecosystems include climate change, fire suppression, mountain pine beetle, and white pine blister rust. Monitoring limber pine with the action alternatives would help decrease the uncertainty regarding expected trends of ecotone communities over time, and inform potential needs for adaptive management.

Westslope cutthroat trout

Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) has been selected as a focal species for monitoring to help assess the habitat integrity of cold water native fisheries. These fisheries provide important habitat for aquatic species, and key habitat elements include connectivity, shade and woody structure. Threats to these habitats include wildfire, climate change, sedimentation, nonnative aquatic species, and livestock grazing. The HLC NF is actively working to restore genetically pure native cutthroat trout populations east of the Continental Divide. Monitoring for this species under the action alternatives would not only help evaluate and inform restoration efforts, but would improve our understanding of the integrity of cold water fisheries in general in light of the uncertain impacts of climate change and other stressors.

3.5 Aquatic Ecosystems

3.5.1 Introduction

This section considers numerous physical and biological resources such as: water quality, native and non-native desirable species, and aquatic habitats. Managing for high quality soil, water and hydrologic function are fundamental in maintaining and restoring watershed health. Soil is the primary medium for regulating the movement and storage of energy and water and for regulating cycles and availability of plant nutrients (ICBEMP, 1997). The physical, chemical, and biological properties of soils determine biological productivity, hydrologic response, site stability, and ecosystem resiliency.

Analysis Area

The analysis area for the watershed, soils and aquatic species include all the lands within the boundary of the HLC NF and connected waterways. The connected river systems are included because migratory bull trout and westslope cutthroat trout that emerge from forest streams move downstream to reach sexual maturity and then return to their natal streams to complete the spawning cycle and depend on connectivity for their survival.

The Forest Plan area is located within two hydrologic unit code (HUC) regions:

- The Missouri Region (HUC = 10) is on the eastern side of the Continental Divide. Within this region, the plan area is located in 3 subregions: Missouri Headwaters (HUC=1002), Missouri-Marias (HUC=1003), and Missouri-Musselshell (HUC=1004). Within these subregions, the plan area is located in 14 fourth level watersheds. Within these fourth level watersheds the plan area is located within 88 fifth level watersheds which are further broken down into 301 sixth level watersheds.
- The Pacific Northwest Region (HUC = 17) drains to the west. Within this region, the plan area is located in one subregion, the Kootenai-Pend Oreille- Spokane (HUC=1701). Within this subregion, the plan area is located in two fourth level watersheds: Upper Clark Fork and Blackfoot River. Within these fourth level watersheds, the plan area is within 16 fifth level watersheds which are further broken down into 72 sixth level subwatersheds.

The analysis scale varies by resource and uses the fourth, fifth and sixth level watershed scales to assess current conditions across the HLC NF.

The FS commonly evaluates how proposed management activities meet the requirements of the Clean Water Act from a holistic perspective that considers land management activities occurring throughout the watershed and their effects on water quality and aquatic habitat integrity. The goal of the Clean Water Act is “to restore and maintain the chemical, physical, and biological integrity of the nation’s water”. Listings of waterbodies and development of Total Maximum Daily Loads (TMDLs) under Section 303(d) of the Act are symptomatic of the effects from historical and some ongoing management activities. Maintaining healthy watersheds and restoration of degraded watersheds would contribute towards the de-listing of impaired waterbodies and to the survival and recovery of aquatic species.

Productivity of soil and vegetation, proximity to water, and the general attractiveness of riparian and aquatic systems continue to make these areas ideal for many land uses managed by the FS. Conflicts between some human uses and the resources dependent on resilient riparian conditions may continue unless management provides for sufficient land use limitations and resource protection that maintain the disturbance processes and pathways associated with resilient riparian conditions (Lake, 2000; Lee et al., 1997; Poff, Koestner, Neary, & Henderson, 2011; Reeves, Benda, Burnett, Bisson, & Sedell, 1995). The revision of these forest plans is designed to provide direction that addresses, if not resolves, these conflicts.

The variety of landscapes and associated aquatic ecosystems on the Forest support an array of different aquatic, terrestrial, and botanical species. Population sizes and distribution of some species, such as bull trout, have declined in most locations across its range in recent decades, with special protection granted under the ESA. Across the range of bull trout, reasons for the decline of some populations are many (Allendorf, Leary, Spruell, & K., 2001; Lee et al., 1997; Martinez et al., 2009). Aquatic species viability is dependent upon maintaining an array of desirable, well-connected habitat conditions. Past activities throughout the planning area, federal and private lands have contributed to fragmentation and degradation of habitat for fish and other riparian-dependent species. Humans have caused changes in habitat conditions through such activities as timber management, livestock grazing practices, road and facility construction, recreation uses, and introduction of non-native species. Future management activities have the potential to impact or restore habitat for species associated with aquatic and riparian ecosystems. For aquatic species, this analysis looks at how the management alternatives proposed in the forest plan either contribute to or mitigate common threats to aquatics within FS authority and capability of lands to sustain native species.

The diverse lithology, structure, and climate over time have resulted in a spatially complex pattern of landforms and soils across the forest that responds differently to management activities. Most management activities and natural processes, such as recent wildfires, affect soil resources to varied extents. Impacts or indicators of stress include: surface erosion, compaction, and nutrient loss through removal of coarse woody debris, high severity burns, flooding or landslides. These effects may be in the uplands or within streams. Soil effects or stresses are not always detrimental or long lasting. In order to maintain and where necessary restore the long term quality and productivity of the soil, detrimental impacts to the soil resource must be managed within tolerable limits.

Measurement Indicators

The primary effects to aquatic ecosystems to be analyzed would result from the implementation of the revised plan (alternatives B-E) compared to alternative A. Comparison is made between alternatives based on their relative ability to move the resources toward desired conditions for:

- Watershed resources
- Water quality
- Riparian areas
- Stream Function
- Aquatic Habitat
- Soils

3.5.2 Regulatory framework

Federal Law

Safe Drinking Water Act of 1977 and amendments (1996) - In 1996, the Safe Drinking Water Act was amended with requirements to identify "*Source water protection areas*" and to assess their susceptibility of contamination. This provides states with more resources and authority to enact the Safe Drinking Water Act. This amendment directs the state to identify source water protection areas for public water supplies that serve at least 25 people or 15 connections at least 60 days a year. In terms of relative size and scope, while an individual NF unit may have 4 designated municipal watersheds, there may be over 100 source water protection areas that intersect with that NFS lands managed by that unit.

Source water protection areas have been established to protect public water systems from contamination. Public water systems are defined as entities that provide "water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year” and the term "public" in "public water system" refers to the people drinking the water, not to the ownership of the system (www.epa.gov/sourcewaterprotection). These systems can be dependent on any type of water source, including streams, lakes, reservoirs, springs, wells, or infiltration galleries, and includes systems used either year-round or only seasonally.

State governments were given the option to accept primacy or responsibility for delineating and developing assessments for these source water protection areas. The State of Montana has accepted this responsibility and should be contacted for the most up-to-date information regarding the source water protection delineations, assessments, and management requirements or goals.

Regulation and Policy

Municipal Watersheds – 36 CFR 251.9 authorizes the Chief of the FS to enter into agreements with municipalities to restrict the use of NFS lands from which water is derived to protect the municipal water supplies (FS Manual 2542).

Executive Orders

Executive Order 11988: Directs federal agencies take action on federal lands to avoid, to the extent possible, the long-and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are required to avoid the direct or indirect support of development on floodplains whenever there are reasonable alternatives and evaluate the potential effects of any proposed action on floodplains.

Executive Order 11990, as amended: Requires federal agencies exercising statutory authority and leadership over federal lands to avoid to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Where practicable, direct or indirect support of new construction in wetlands must be avoided. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands.

Executive Order 12962 (June 7, 1995): Acknowledges the recreational value of aquatic biota by stating the objectives "to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities by: “(h) evaluating the effects of federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries and document those effects relative to the purpose of this order”.

Executive Order 13112 - Directs federal agencies whose actions may affect the status of invasive species to (1) prevent the introduction of invasive species, (2) detect and respond rapidly to and control populations of such species in a cost effective and environmentally sound manner, as appropriations allow.

State of Montana

Montana ARM 16.20.603 - This states that BMPs are the foundation of water quality standards for the State of Montana. The FS has agreed to follow BMPs in a Memorandum of Understanding with the state. Many BMPs are applied directly as mitigation at the project level. Implementing and effectiveness monitoring for BMPs are routinely conducted by contract administrators and during other implementation and annual monitoring events.

Montana State's Nondegradation policy MCA 75-5-303 and ARM 17.30.701 states that existing and anticipated uses and the water quality necessary to protect those uses must be maintained and protected. Many land management activities on NFS lands are considered nonsignificant activities under state law as long as reasonable land, soil, and water conservation practices are applied to protect existing and anticipated beneficial uses. State-defined non-significant activities are found in Montana Code Annotated (MCA) 75-5-317.

Stream Protection Act (SPA 124) – This is the State of Montana's stream permitting system to protect and preserve fish and wildlife resources, and to maintain streams and rivers in their natural or existing state. It applies to any agency or subdivision of state, county, or city government proposing a project that may affect the bed or banks of any stream or its tributaries in Montana. It is a required process for any project including the construction of new facilities or the modification, operation, and maintenance of an existing facility that may affect the natural existing shape and form of any stream or its banks or tributaries. The FS and the State of Montana have entered into a Memorandum of Understanding that commits the Forest to comply with the Stream Protection Act for all road planning and construction and water or hydraulic projects.

3.5.3 Assumptions

Legacy effects from past livestock grazing, timber harvest, mining, and other human-caused disturbances continue to effect watershed health and the aquatic ecosystem. Generally, under the direction of the 1986 Helena and the Lewis and Clark Forest Plans the intensity and the risks associated with new and ongoing developments and human-induced disturbances has been, and would be reduced as compared to the last several decades. However, effects from these activities are likely to continue to occur but are expected to be less than prior to the 1986 plan. The 1986 Forest Plan directions for the east side of the Continental Divide, as well as the 1996 amendment by the Inland Native Fish Strategy (INFISH) on the west side (U.S. Department of Agriculture, Forest Service, Intermountain, Northern, and Pacific Northwest Regions, 1995; USDA, 1995a), reduces the risk to watersheds and aquatic biota from new and ongoing activities. For some resources on the west side of the divide, the INFISH contain additional general direction for repairing past damage from land management associated with roads, grazing, and recreation activities.

There would continue to be localized improvements to watershed, soil, riparian and aquatic habitat conditions as projects are implemented, but watershed-scale improvements may occur slowly given current and anticipated funding levels. With the direction and emphasis in the Forest Plan, watershed restoration may tend to be prioritized and directed by more commodity-based resource decisions, such as restoration associated with timber harvest activities and integrated vegetation restoration projects.

Since the 1980s, improvements in soil productivity should be reflected through an increase in protections resulting in a reduction in adverse impacts and continued restoration efforts. Additional guidelines have provided further direction for soil nutrient management, protection of watershed health improvement in soil quality, and maintenance of soil productivity. This is the rationale that justifies understanding of the expected effects from other resources that influences anticipated effects.

3.5.4 Best available scientific information used

The most important change between the current 1986 plan directions for the HLC NF and the proposed new 2012 planning rule(36 CFR 219.8) is the requirement to establish RMZ widths. The 2012 Planning Rule directed that during plan revision efforts, riparian management areas shall be established in all NFS lands. The 2012 Planning Rules states that the:

> (ii) Plans must establish width(s) for RMZs around all lakes, perennial and intermittent streams, and open water wetlands, within which the plan components required by paragraph (a)(3)(i) of

this section will apply, giving special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams and lakes.

(A) RMZ width(s) may vary based on ecological or geomorphic factors or type of water body; and will apply unless replaced by a site-specific delineation of the riparian area.

(B) Plan components must ensure that no management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment that seriously and adversely affect water conditions or fish habitat shall be permitted within the RMZs or the site-specific delineated riparian areas.

Best available science was used to determine effects of implementing the revised forest plan across aquatic ecosystems. A full report of the aquatic ecosystems BASI is located in appendix C.

3.5.5 Affected environment

Watershed condition

Watersheds are described across the planning area and the Watershed Condition Framework is used to describe conditions in GAs. Water quality, source water protection areas and groundwater resources are also discussed. Aquatic ecosystems are described by GA, focusing on habitat for bull trout west of the Continental Divide, and habitat for westslope cutthroat trout west and east of the divide. Management effects are described by GA, and system drivers and stressors of water resources and aquatic ecosystems are detailed together. The soil resources section details information and considerations for soils in the planning process.

Watershed condition

The primary hydrologic unit upon which watershed condition has been assessed is the sixth-level hydrologic unit, or subwatershed, which is a watershed of about 10,000-40,000 acres. To evaluate baseline watershed conditions across the analysis area, a watershed condition rating was determined for each subwatershed. This characterization estimated the existing condition based on physical characteristics (e.g., hydrologic, geomorphic, landscape, topographic, vegetative cover, and aquatic habitat) and human-caused disturbances (e.g., road construction and vegetative treatments).

Watershed condition classification ultimately ranks watersheds in one of three discrete categories (or classes) that reflect the level of watershed health or integrity. Watershed health and integrity are considered conceptually the same (Regier, 1993). Watersheds with high integrity are in an unimpaired condition in which ecosystems show little or no influence from human actions (Lackey, 2001).

Within this context, the three watershed condition classifications are directly related to the degree or level of watershed functionality or integrity:

- Class 1 – Functioning Properly
- Class 2 – Functioning at Risk
- Class 3 – Impaired Function

The watershed condition framework (USDA, 2011b) characterizes a watershed in good condition as one that is functioning in a manner similar to natural wildland conditions (Karr & Chu, 1999; Lackey, 2001). A watershed is considered to be functioning properly if the physical attributes are adequate to maintain or improve biological integrity. This consideration implies that a class 1 watershed that is functioning properly has minimal undesirable human impact on its natural, physical, or biological processes, and it is resilient and able to recover to the desired condition when disturbed by large natural disturbances or land management activities (Yount & Niemi, 1990). By contrast, a class 3 watershed has impaired function because some physical, hydrological, or biological threshold has been exceeded. Substantial changes to the factors that caused the degraded state are commonly needed to return the watershed to a properly functioning condition.

Watershed conditions vary across the plan area with conditions ranging from those unaffected by direct human disturbance to those exhibiting various degrees of modification and impairment. The Forest completed the first round of watershed condition classification in the summer of 2011 (USDA, 2011b). In summary, 103 watersheds were rated as functioning properly, 159 were rated as functioning at risk, and 34 were rated as impaired. The most significant drivers of the ratings in the plan area were roads, grazing, and mining. These conditions would be re-assessed in the future to assess change.

Mineral extractions and ancillary mining-related activities have left a history of impacts to watersheds and water quality in a number of watersheds across the planning area. Historic mining of minerals including gold, silver, lead and zinc has occurred in many of the GAs; notably the Little Belt, Big Belts, Elk Horn and Divide GAs. Water quality is impacted from acid mine drainage and heavy metals contaminated runoff from mined materials. Streambanks and riparian habitats have been degraded through large and small placer operations. Many of these watershed and water quality impacts have been, or are currently being addressed through response actions conducted by federal agencies in accordance with delegated authorities under the Comprehensive Environmental Response Compensation and Liability Act, as amended. FS actions taken under this act to date across the planning area have been largely individual mine site focused or area specific, while the Environmental Protection Agency’s actions under the National "Superfund" Program have sought to address impacts by defining "Sites" at the watershed scale. The forest is also addressing mining impacts through restoration of streambanks and riparian areas. Watersheds that support bull and westslope cutthroat trout are an emphasis for restoration using the priority watershed designation under watershed condition framework as well as when designated under conservation watershed network. Bull trout are a listed species and a goal under the Bull Trout Conservation Strategy. The Recovery Unit Implementation Plan goal is to improve habitat conditions of the five-Class 2 watersheds found in the Divide and Upper Blackfoot GAs.

Geographic areas

Watershed conditions vary across the plan area by GA range from those unaffected by direct human disturbance to those exhibiting various degrees of modification and impairment. According to the model, 40 percent of watersheds within the plan area are in watershed condition class 1 and “exhibit high geomorphic, hydrologic and biotic integrity relative to their natural potential condition” ” (Potyondy & Geier, 2011). The summary by GAs of the results are displayed in Table 14 and in appendix A, Watershed Condition Class Framework. In summary, 103 watersheds were rated as functioning properly, 159 were rated as functioning at risk, and 34 were rated as impaired. The most significant drivers of the ratings in the plan area were roads, livestock grazing, and mining. These conditions would be re-assessed in the future to assess change.

Table 14. Summary of sixth level watersheds by GA rated in each category under the WCC

GA	Class 1 Functioning Properly	Class 2 Functioning at Risk	Class 3 Impaired Function	Grand Total
Big Belts	3	35	7	45
Castles	2	9	1	12
Crazies	5	5		10
Divide	1	13	14	28
Elkhorns	1	18	2	21
Highwoods	3	4		7

GA	Class 1 Functioning Properly	Class 2 Functioning at Risk	Class 3 Impaired Function	Grand Total
Little Belts	21	39	4	64
Rocky Mountain Range	40	13	1	54
Snowies	15	3		18
Upper Blackfoot	12	20	5	37
Total	103	159	34	296[1]

1. 8 watersheds are within 2 GAs, making the total 296 rather than 288.

Across the plan area, watersheds were most commonly rated as impaired for the indicators: aquatic biota, roads and trails, and water quality. Of the 24 attributes, watersheds were most commonly rated impaired for rangeland vegetation, aquatic invasive species, road proximity to water, soil contamination and insects and disease.

Stream Channels

Streams carry water, sediment, dissolved minerals, and organic material derived from hillsides and their vegetation cover. The shape and character of stream channels constantly and sensitively adjust to the flow of this material by adopting distinctive patterns such as pools-and-riffles, meanders, and step-pools. The vast array of physical channel characteristics combined with energy and material flow, provide diverse habitats for a wide array of aquatic organisms.

Varied topography coupled with the irregular occurrences of channel-affecting processes and disturbance events such as fire, debris flows, landslides, drought, and floods, result in a mosaic of river and stream conditions that are dynamic in space and time under natural conditions. The primary consequence of most disturbances is to directly or indirectly provide large pulses of sediment and wood into stream systems. As a result, most streams and rivers undergo cycles of channel change on timescales ranging from years to hundreds-of-years in response to episodic inputs of wood and sediment. The types of disturbance, that affect the morphology of a particular channel depends on watershed characteristics, size, and position of the stream within the watershed. Many aquatic and riparian plant and animal species have evolved in concert with stream channels. They develop traits, life-history adaptations, and propagation strategies that allow persistence and success within dynamic landscapes.

Human uses have altered some stream channels in the last century. Stream channels have changed as a result of channelization, livestock grazing, placer and hard rock mining, road building, logging, splash dams, the extirpation of beaver and their habitat, and indirectly by altering the natural incidence, frequency, and magnitude of disturbance events such as wildfire. Some characteristics of channels commonly measured to help identify changes caused by management include frequency and depth of large pools, the width-depth ratio of stream channels, and the percent of fine sediment contained in substrate (Al-Chokhachy, 2010). Low gradient (less than 2%) stream channels show the most response to land management activities. Lower pool frequencies and higher fine sediment concentrations are most obvious in watersheds with higher road densities such as the Little Belts, Big Belt and Divide GAs. Placer and hard rock mining have altered stream morphologies in streams throughout most of the planning area notably in the Big Belts, Upper Blackfoot, Elkhorn, Little Belts, Castles and Divide GAs. Placer mining reshapes and straightens as well as removes fine sediment from stream channels. Hard rock mining changes the morphology of the streams by adding mine waste to stream channels and altering groundwater flows regimes. These findings are consistent with observations that indicate past road construction/maintenance, grazing, mining, and timber harvest practices altered sediment delivery and routing, and potentially other habitat components, which in turn has led to fewer pools, higher fine sediment resulting in stream aggradation, as well as the lack of fines as resulting from placer mining.

Consequently, watersheds, stream channels, and aquatic habitats in many locations on the forest are now subject to continued compounding effects of watershed disturbance. This contrasts with a more pulse-like pattern of disturbance under which most streams and associated species evolved. Consequently, many stream channels are less than optimal for aquatic and riparian-dependent species, which evolved in environments that had more high-quality habitat areas spread across the landscape. These degraded conditions are prevalent on much of the GAs throughout the HLC NF.

Water Quality

Impaired and threatened water bodies

Water quality is regulated under the authority of the Clean Water Act, and Montana assess the waters within their jurisdiction and identifies stream segments and other water bodies whose water quality is “impaired” or generally not meeting water quality standards for beneficial uses. Individual stream segments, lakes, and other water bodies have been listed as "Water Quality Limited Segments" (i.e., "impaired") by the state of Montana (MTDEQ, 2014) and are described in subsection 303(d) of the Clean Water Act as waters that do not meet state standards; a broad term that includes water quality criteria, designated uses, and anti-degradation policies. The 2016 state’s list of impaired waterbodies indicated the planning area includes 313 miles of streams on the forest that were listed as impaired due to sedimentation/siltation; 107 miles of stream segments listed for nutrients and 277 miles listed for metals.

According to the 2016 draft State 303(d) list, 110 stream segments or 617 miles within the plan area are not meeting water quality standards (MTDEQ, 2016), Montana State 303(d) Listed Water Quality Impaired Streams). 31 segments or 150 miles of these are listed for mining related impacts, and the remaining 79 or 467 miles are listed for agricultural practices, grazing impacts, forest roads or habitat quality issues.

The Montana Department of Environmental Quality (MTDEQ) develops TMDLs, which is the maximum amount of a pollutant a waterbody can receive and still meet water quality standards. They are submitted the U.S. Environmental Protection Agency for approval. The Montana Water Quality Act requires its Department of Environmental Quality to develop TMDLs for streams and lakes that do not meet, or are not expected to meet, Montana water quality standards. TMDLs provide an approach to improve water quality so that streams and lakes can support and maintain their state-designated beneficial uses.

TMDL assessments have been prepared and are being implemented for several sub-basins in the plan area, including those in the Little Belts, Castles, Crazies, Divide, Elkhorns, and Upper Blackfoot GAs. The streams with mining related issues are also discussed in the minerals and geology section of this DEIS.

To understand the current conditions of water quality within the planning area, the amount of currently listed waterbodies needs to be put into context. Many streams within the Forest’s administrative boundary have not yet been assessed. There are approximately 10,290 miles of streams within the Forest’s administrative boundary, and the MTDEQ has assessed about 6 percent or 617 miles of those streams (MTDEQ, 2016). All waterbodies are assigned to a category, which defines the status of the waterbody.

The breakdown of the categories of the assessed streams in the planning area are:

- Category 1: 13 percent of the waterbody’s assessed were found to be fully supportive of all beneficial uses.
- Category 2: 3 percent of the waterbody’s assessed had information that showed some, but not all, of the beneficial uses are supported.
- Category 3: 4 percent insufficient data prevents assessing the use support of any beneficial use for the waterbody.

- Category 4A: 26 percent of the waterbody's assessed were required to have TMDLs, which have subsequently been prepared and approved by the U.S. Environmental Protection Agency.
- Category 4C: 3 percent of the waterbody's assessed are impaired in pollution categories such as dewatering or habitat modifications, and thus a TMDL is not required.
- Category 5: 43 percent of the waterbody has at least one impaired or threatened use, but a required TMDL or other control program is not in place.
- Category 5N: 8 percent of the waterbody's has at least one standard that is not met, and available data/information indicates that the cause could not be a natural condition (i.e.no human-cause source have been identified).

Habitat quality monitoring methodologies, such as Proper Functioning Condition (PFC) (Dickard et al., 2015) assessments and channel stability index (Pfankuch, 1975) have been conducted across the forest. The current trends in stream conditions and aquatic habitat have been documented to be stable or no meeting desired conditions in a timely manner.

The results are not indicative of actual water quality, as the MTDEQ focuses its assessment on impaired water. Most of the healthy stream miles have not been assessed and entered into Montana's Waterbody System (MTDEQ, 1998).

On the Forest, the MTDEQ determined that sediment continues to impair aquatic life. The MTDEQ provided sediment TMDLs for those waterbody segments. Therefore, TMDLs have been developed for all streams on the Forest where required.

For the streams with sediment TMDL, excess sediment may be limiting their ability to support aquatic life. Water quality restoration goals for sediment were established on the basis of fine sediment levels in trout spawning areas and aquatic insect habitat, stream morphology and available in-stream habitat as it related to the effects of sediment, and the stability of streambanks. The MTDEQ believes that once these water quality goals are met, all water uses currently affected by sediment will be restored. The MTDEQ's water quality assessment methods for sediment impairment are designed to evaluate the most sensitive use, thus ensuring protection of all designated uses. For streams in western Montana, the most sensitive use assessed for sediment is aquatic life.

Groundwater

Ground water-dependent ecosystems are communities of plants, animals, and other organisms whose extent and life processes depend on ground water (USDA Forest Service 2007). The following are examples of some ecosystems that may depend on ground water:

- Wetlands in areas of ground water discharge or shallow water table
- Terrestrial vegetation and fauna, in areas with a shallow water table or in riparian zones
- Aquatic ecosystems in ground water-fed streams and lakes
- Caves and Karst systems
- Aquifer systems, and
- Springs and seeps

Groundwater is an important resource in Montana, and it will likely become more important in the future as the State's population and industries grow. More than half of Montanans depend on groundwater for their primary water supply. Water generated in the mountains of the Forest is an important source of recharge for valley aquifers and is therefore an important Forest product.

Because of limited supply and lack of development opportunities, beneficial use of Forest groundwater is generally low. Consumption is limited to special-use permits and FS campgrounds or administrative sites with domestic wells. Off-Forest, groundwater is used extensively for pump irrigation and drinking water wells in the prairies/mountain valleys. There are very few natural sources of groundwater contamination. Most threats to groundwater quality are linked directly or indirectly to a variety of human activities. Groundwater contamination on forest has occurred in areas of past mining activities. Large areas of acid mine drainage are present in the Little Belt, Divide, Upper Blackfoot, and Castles GAs. Particular threats to groundwater in the plan area include facility and road development, grazing impacts, contamination from roads, and clearing of vegetation.

Bull trout are present in streams on the west side of the Continental Divide in the Upper Blackfoot and the west side of the Divide GAs. Bull trout are highly dependent on groundwater areas that influence spawning and winter habitat conditions.

Aquatic habitat condition

The most comprehensive and consistent data set on stream channel conditions is provided by the Pacfish/Infish Biological Opinion (PIBO) monitoring program, which is a highly organized monitoring effort that collects data systematically across NFS and BLM lands across the Interior Columbia River Basin and Upper Missouri River basin. PIBO monitoring was developed to determine if components in PACFISH/INFISH were effective at preventing further habitat degradation at the scale of the entire Columbia River Basin, This monitoring program collects reach-level stream habitat, temperature, macroinvertebrate, sediment, and riparian data to evaluate if key biological and physical components of aquatic and riparian communities are being degraded, maintained or restored. With over a decade of consistently collected data and improvements in data analysis, comparisons between managed and reference watersheds can now be scaled down to conditions on an individual NF. Currently, PIBO monitoring provides rigorously collected local data that can be statistically compared to reference conditions in the same geophysical province.

Monitoring began on the NFs west of the Continental Divide in 2001. The program was expanded to the east side of the Continental Divide to the Upper Missouri River Basin in 2006. Over a 5 year period, 1,300 sub-watersheds are sampled in the Columbian River basin and 250 sub-watersheds in the Missouri River basin, which equates to about a third of the sub-watersheds managed by the BLM and the FS within the study area. Once three sampling rotations have been completed, this program allows for the evaluation of status and trends comparison of the reference and managed conditions. An analysis of stream habitat conditions using the PIBO data can be found in the project files. As of 2017 all of the west side sites have been sampled at least three times and the third rotation of sampling has been initiated on the east side.

Two types of data comparison are made with PIBO data, “status”, and “trend”. Status compares conditions between a group of managed stream reaches against a group of unmanaged stream reaches (unmanaged reaches have little or no road development, mining, timber harvest, grazing, recreation development, etc.) Because of a century plus of management in what is now the HLC NF, it has been difficult to find reference reaches on the HLC NF, so comparisons are made at the larger ecoregion scale (Ecoregions are defined to be areas of relative homogeneity in ecological systems). Trend comparisons look at conditions for a group of reaches measured at least 3 time intervals, usually about 5 years apart. Looking at how conditions change for a group (either managed or reference) and how a group of managed sites compares to reference sites over that time allows managers to judge the trend in conditions in managed sites and whether or not managed site conditions are moving towards the desired conditions described in the Forest Plan.

In addition to a forest-scale analysis, PIBO data was grouped into drainages and/or individual units for the HLC NF portions of the combined forest to provide trend information for more discrete areas. Regardless of how the HLC NF PIBO sites are broken down, trend data show fewer trends in the desired direction for habitat attributes for managed sites or reaches when compared to all PIBO managed reaches monitored in Region 1. The overall index score of integrator sites (located at the lowermost, low gradient reach occurring on federal land, which are influenced by the watershed area upstream, and considered the most sensitive area to sediment and flow regimes) is also lower for all areas on the HLC NF for managed areas when compared to Region 1 as a whole. Additionally, the overall index score for integrator sites located on the HLC NF west of the Continental Divide are higher than for the Lewis and Clark portion of the forest (all east of the Continental Divide) or that portion of the Helena unit east of the Continental Divide. When compared to the overall index scores for reference sub-watersheds from the within the appropriate ecoregion, the managed areas scores were statistically lower. Ecoregions are defined to be regions of relative homogeneity in ecological systems or in relationships between organisms and their environments. The comparison between reference and managed reaches are not meant to be used as goals to be attained in managed reaches, but rather an indication of management-induced disturbance. Although this suggests that measures implemented west of the Continental Divide have improved habitat conditions somewhat more than east of the Continental Divide, managed areas on both sides would still need to be improved to meet desired conditions.

PIBO data show streams in managed sub-watershed across the planning area have lower median values or habitat conditions for many of the measured indexes (Archer & Ojala, 2016) (Archer & Ojala, 2017). The PIBO data methodology selects managed sites based on a rigorous and repeatable methodology that attempts to find sites that are representative of managed conditions in that portion of the forest. Managed sites in grazed sub-watersheds are considered representative of grazing impacts typical for low gradient habitat in that pasture. When we have qualitatively compared PIBO data sets to forest collected data, many areas have shown that livestock impacts to streams and riparian areas continue to occur.

Benefits to People

Watersheds across the planning area provide many benefits to people that include clean water for drinking, high quality habitat for fish and sport fishing, wildlife, livestock, and agricultural irrigation. FS-managed lands include the headwater tributaries for a large percentage of source (drinking) water protection areas in the U.S. High quality water and habitats provides high elevation refugia for fish across the planning area in a warming environment. Watersheds provide many agricultural benefits for local rural communities in the form of grazing forage for livestock, and agricultural irrigation water on and downstream of the forest.

Drinking water

Water draining off NFS lands is often used for drinking water supplies. A lot of confusion exists around current agency policies to protect drinking water supplies and their importance during Forest Plan revision efforts. The following discussion will provide an overview of Municipal Supply Watersheds and Source Water Protection Areas, which are two separate constructs for drinking water protection that are applicable to NFS land management.

Municipal Supply Watersheds

The 1986 forest plans currently recognize 4 municipal supply watersheds diverting surface water from streams within or just downstream of the HLC NF and are recognized in accordance with 36 CFR 251.9. Big Spring Creek watershed provides drinking water for the City of Lewistown and is proposed as a new municipal watershed under the draft forest plan revision. Together, these 5 municipal supply watersheds serve approximately 36,690 people, including some travelers, i.e. transients.

- The town of Neihart, population of 50, uses O’Brien Creek and Shorty Creek. Both of these are within Belt Creek-Carpenter Creek sixth level watershed in the Little Belts GA. Neihart has had some issues with turbidity in O’Brien Creek not meeting EPA Safe Drinking Water Standards, so it installed an infiltration gallery in Shorty Creek to use during those times when waters do not meet the standard. The City received a State Treasure State Endowment Program planning grant in 2015 and has applied for a project grant to improve their overall system.
- The City of Helena uses Tenmile Creek in the Divide GA (Management Areas H1 and H2 in the existing Helena Forest Plan) and its tributaries as its primary source of drinking water for a

population of around 28,190. Streams in the lower portion of the Tenmile watershed do not meet drinking water quality standards, but above the diversions, water quality does generally meet standards. Diversions are located on Tenmile Creek above Rimini and near the mouths of Beaver Creek, Minnehaha Creek, Moose Creek, and Walker Creek. Water from all diversions is carried to the Tenmile Water Treatment Plant in a common buried pipeline. In addition, the City of Helena stores water from several tributaries in Scott and Chessman Reservoirs (in the upper part of the watershed) when streamflow is high. The Red Mountain Flume carries water from some of these tributaries to Chessman reservoir. Vegetation treatment efforts are occurring in the watershed under the Red Mountain Flume Chessman Reservoir Project. This project treats the areas around the flume and reservoir. Further treatments in the rest of the watershed are in the planning process for the Tenmile South Helena Project. The primary objective of this project is to reduce the risk for a high intensity wildfire and associated adverse post-fire watershed effects in the watershed.

- The city of White Sulphur Springs, population of 984, uses Willow Creek (part of the Smith River-Trout Creek sixth level watershed). The Willow Creek municipal watershed is located in the Castles GA. The Castle Mountains landscape assessment of 2012 described conditions within the municipal watershed as good. Specifically, the watershed is fenced out and with the exception of few trespass cows, livestock access is nonexistent. It has a healthy riparian area with a great diversity of plants including cottonwood, aspen, dogwood, alder, and willow. Mixed conifers adjacent to the channel provide an excellent source of large woody debris which forms numerous log jams along the profile. A boulder dominated channel bed, less-prone to degradation when compared to other project area channels within the GA, dissipates the 500 year flood energy efficiently and shows no detrimental effects from the natural event. The overall condition of the watershed is excellent but hillslopes surrounding the creek have high fuel loading (dead lodgepole pine) which could potentially trigger a wildfire. Treatments have been proposed for the watershed, which include thinning and prescribed burning.
- Also included in the 1986 Helena NF Plan, is the municipal watershed for the City of East Helena, population of 1,642. The city uses McClellan Creek, located in the Elkhorn GA for one source of municipal water. This source is an infiltration gallery located approximately five miles south of East Helena, in the McClellan Creek drainage, downstream of the forest boundary. The infiltration gallery draws water into two collection systems installed into alluvium near the creek. Recharge to McClellan Creek occurs in the Elkhorn Mountains on the Forest.
- Not included in the Lewis and Clark NF 1986 plan is the city of Lewistown’s source water protection area. This municipality receives its water from Big Spring Creek. The recharge area for Big Spring Creek extends into the Madison limestone within the Snowies GA to the south. This includes the Middle and East Fork Big Spring Creek watersheds above the forest boundary.

Source Water Protection Areas

Source water protection areas protect public water systems from contamination in accordance with the 1996 amendments to the Safe Drinking Water Act. Public water system intakes on surface water sources, i.e. streams, are the most susceptible to contamination from land management activities within the HLC NF. The City of Helena is the only public water system diverting surface water from streams within the HLC NF, specifically from Beaver Creek, Minnehaha Creek, and Moose Creek in the Tenmile Creek watershed. The source water protection areas of these surface water intakes includes a “Spill Response” area that is buffered along each source stream measuring a maximum of 10 miles in length, 1/2 mile from both streambanks, and 1/2 mile downstream from the surface water intake and is confined to the extent within the contributing watershed. These spill response regions are to be managed to prevent releases of contaminants where they can be drawn directly into a water intake with little lag time. In addition to the City of Helena’s surface water intakes, 2 other communities have Spill Response areas that overlap the HLC NF, specifically the Town of Neihart’s surface water intake on O’Brien and Shorty Creeks and the City of White Sulphur Springs intake on Willow Creek.

In addition to the spill response region, the rest of the contributing watershed upstream of each surface water intake is the “watershed region” part of the source water protection area, in which management is to maintain and improve the long-term quality of surface water used by the public water system. In addition to the 3 spill response regions that overlap the HLC NF, 12 public water systems located downstream of the forest have watershed regions that extend up into the forest. All 15 of these surface public water systems collectively serve approximately 100,000 people.

Groundwater sources also supply drinking water in and around the HLC NF. There are 9 public water systems withdrawing groundwater at 12 locations within HLC NFS lands, coming from 9 wells and direct from 3 springs. Montana’s Source Water Protection Program states that areas located within 100 feet of these ground water sources is the “control zone” for each intake, and this area is to be managed to protect sources from damage and to prevent direct introduction of contaminants into sources or the immediate surrounding areas. These 9 public water systems withdrawing groundwater at 12 locations on NFS lands are the only control zones that intersect the HLC NF.

Beyond the 100 foot control zones, the areas within 1 mile of each ground water public water system source are typically designated as “inventory regions” by MTDEQ that will be managed to minimize susceptibility to contamination. The delineation of these inventory regions can also be defined using other methodologies than a simple 1-mile buffer depending on the information available and circumstances, and these areas are delineated by MTDEQ. Management in these inventory regions will be focused on pollution prevention activities where water is likely to flow to a public water system well intake within a specified time-period. These inventory regions have various degrees of delineation on the Forest and management in these inventory regions will be considered at the site-specific project level. BMPs can be implemented to control non-point sources of contamination in these areas (Montana Department of Natural Resources and Conservation, 1999).

Riparian areas

Riparian areas

The vegetation composition and structure, and the pattern of the riparian and wetlands across the planning area are highly diverse. Plant communities may be dominated by grasses with few shrubs and trees, or they may be heavily forested. Riparian vegetation on the west side of the divide may be dominated by broadleaved trees, particularly black cottonwood, or by coniferous species. Spruce and subalpine fir are most common, with other species such as Douglas-fir and a rare occurrence of larch in the Blackfoot GA, are also present in many riparian areas. Forbs and grass-like plants that occupy these sites are quite diverse. East of the Continental Divide, riparian species may consist of broadleaved trees including black, narrow-leaved cottonwood or aspen. Spruce and subalpine fir are most common in high elevations and Douglas-fir on cooler slopes and in many riparian areas. Shrubs include alder, rocky mountain maple, willow species, red-osier dogwood, elderberry, buckthorn, thimbleberry, twinberry honeysuckle, common chokecherry and hawthorn. The vegetative structure may include many decayed and dead trees, and multiple layers of vegetation that include submerged vegetation along open water margins, as well as plants that grow in conditions with variable amounts of soil saturation. Patterns of riparian and wetland ecosystems vary from relatively narrow strips of land along perennial and intermittent streams in deeply incised, steep mountain valleys, to marshes and adjacent wetlands within the wide valleys of the major river bottoms. They may be interconnected in a linear fashion down hillsides and in valleys, they may occur in clusters, or they may occur as isolated microsites in other ecosystems. Riparian areas are widely distributed across the planning area and occur at all elevations. Refer also to the Terrestrial Vegetation section for additional information regarding riparian and wetland vegetation.

The effects of livestock effects can be seen across the planning area, particularly in riparian areas where they concentrate. Historical grazing and agricultural activities such as irrigation has led to riparian vegetation changes. Various allotments have seen improvements through BMPs and updated allotment management plans, however riparian and aquatic habitat improvements within grazing allotments continue to be a challenge across the plan area. Most allotments managed under a season long grazing strategy continue to have impacts to RMZs.

Across the forest, road encroachment into riparian areas and wet meadows are found in all GAs. Runoff from roads in the proximity of riparian areas deliver sediment. Dispersed camping across the forest has also resulted in compacted soils and removed riparian vegetation.

Natural disturbance processes

In the ecosystems of the HLC NF, primary natural disturbances that affect riparian areas include flooding, fire, insects, disease, and weather events (i.e., windstorms). These disturbances are an integral part of the creation, maintenance and renewal of forests.

Periodic flooding in wide, low-gradient drainages maintains a diverse mosaic composed of vegetation patches of varying compositions and structures, interspersed with sloughs and wetlands. Flooding is much less of a factor in moderate or steep gradient streams or for wetlands farther removed from rivers and streams. Fire and other disturbances play a larger role.

Fire has shaped the vegetation conditions across the planning area for millennia, influencing forest ages, structure, plant species composition, productivity, carbon storage, water yield, nutrient retention, and wildlife habitat across all areas of the forest, including riparian areas.

In more normal or wet climatic periods, fires still occurred across the planning area but tended to be smaller and more mixed severity. The more moist vegetation types that are characteristic of riparian areas tended to either not burn or burn at low to moderate severity during these years. More forest in the riparian areas would remain intact across the landscape, with individual or small patches of burned trees, and occasional large, more extensive burned areas within riparian.

Other natural disturbances that historically influenced the forests within riparian areas are insects, disease and weather events, such as windstorms and blowdown. These effects cause varying amounts and extent of tree mortality, from nearly all trees killed (such as in a mountain pine beetle epidemic in a lodgepole pine dominated stand), to only scattered trees killed. As with fire, forest structure is affected, including changes/decreases in forest density and canopy closure and increased amounts of dead wood. Reduced canopy closure may stimulate growth of understory grasses, forbs and shrubs, as well as improve growth on remaining live trees. Tree species compositions may change.

Wetlands

Wetlands and other ground water-dependent ecosystems are communities of plants, animals, and other organisms whose extent and life processes depend on ground water (USDA Forest Service 2007). The following are examples of some ecosystems that may depend on ground water:

- Wetlands in areas of ground water discharge or shallow water table
- Terrestrial vegetation and fauna, in areas with a shallow water table or in riparian zones
- Aquatic ecosystems in ground water-fed streams and lakes
- Caves and Karst systems
- Aquifer systems, and
- Springs and seeps

These areas contain ecological resources that potentially are highly susceptible to permanent or long-term environmental damage from contaminated or depleted ground water. Ground water extraction by humans modifies the pre-existing hydrologic cycle. It can lower ground water levels and alter the natural variability of these levels. The result can alter the timing, availability, and volume of ground water flow to dependent ecosystems. Ground water-dependent ecosystems vary in how extensively they depend on ground water, from being wholly dependent to having occasional dependence. Unique ecosystems that depend on ground water, such as fens or bogs for example, can be entirely dependent on ground water, which makes them very susceptible to local changes in ground water conditions (USDA Forest Service 2007). Particular threats in the plan area include facility and road development, grazing impacts, contamination from roads, and clearing of vegetation.

Riparian and wetland vegetation types are mapped on over 70,000 acres of the HLC NFs administrative area, less than 3% of the total planning area. Forests adjacent to wetlands have historically been influenced by the natural disturbance processes characteristic of this ecosystem. These include fires, insects, disease, and weather events (e.g., windstorms). These disturbances caused various amounts of tree mortality, altering forest structures, species and densities. Mixed or stand replacement fire regimes, where greater than 75 percent mortality of trees occurs across portions or all of a burn area, are the most common natural fire regimes on the planning area, encompassing 90% of the area (see assessment). Forested lands adjacent to wetlands burned as well. Periodic high severity fires would revert older forests to early successional stages where grass, forbs, shrubs, tree seedlings and snags dominated. Mixed severity fires would have some areas burned at high severity, some burned at moderate severity, and some areas at low severity or unburned. All these fire severities may occur in the forested lands immediately adjacent to wetlands, depending upon forest conditions, moisture levels, weather, and luck.

Fisheries, aquatics and conservation watershed networks

Watershed condition is the state of the physical and biological characteristics and processes within a watershed that affect the soil and hydrologic functions supporting aquatic ecosystems. Broadly speaking, watershed condition can range from natural pristine (functioning properly) to degraded (impaired). The FS Manual (FSM 2500) defines watershed condition in terms of 'geomorphic, hydrologic, and biotic integrity' relative to 'potential natural condition.' In this context, integrity relates directly to functionality.

Within the planning area, the trends for the viability of individual populations of species of concern are mixed. Several populations of westslope cutthroat trout are at imminent risk of hybridization and/or extirpation through predation or replacement by nonnative species (L. Nelson et al., 2011). With recovery efforts, the number of known westslope cutthroat trout populations has remained constant at best; populations added through recovery projects have roughly equaled those lost in areas where greater protection wasn't feasible or invasion by non-native species was not expected. Populations are mostly small isolates while the meta-population sized objectives outlined in the restoration goals (MFWP 2007) have yet to be achieved. Efforts underway in the Dry Fork of Belt Creek in the Little Belt Mountains would create over 20 miles of connected habitat and move towards partial achievement of meta-population objectives. Other proposed projects west of the divide, such as removal of hybridized fish in the headwaters of the North Fork Blackfoot River, would also provide meta-populations that have greater probabilities for long-term persistence. This opportunity exists because several somewhat rare basin characteristics combine to allow for a probability of success that isn't readily available in most other locations.

Bull trout express two life histories within this plan area, resident and migratory. Resident populations in tributaries are mostly known to be displaying stable trends based on monitoring survey efforts. There are long-term concerns with smaller, isolated populations, since habitat patch-size is known to be a determining factor in viability even under natural disturbance regimes influenced by conditions such as wildfire and climatic change (Eby, Helmy, Holsinger, & Young, 2014; Rieman et al., 2007). Bull trout also express a fluvial life history in the Blackfoot River and historically in the Little Blackfoot River drainages.

The USFWS now considers the fluvial life-form to be extirpated from the Little Blackfoot River. Surveys conducted by MTFWP personnel have been negative for occurrence in the Little Blackfoot. Personnel from the Forest located a few fluvial-sized bull trout in tributaries to the Little Blackfoot River about ten years ago and observed one angler catch more recently. The most recent genetic test of remnant fluvial-sized fish documented hybridization (Harper 2014). Even though bull trout are considered extirpated in the Little Blackfoot, recent sampling utilizing the environmental DNA technique verified that bull trout persist in the drainage (Young et al. 2017).

The viability of the fluvial life-history form of bull trout in the upper Blackfoot River basin, which correlates well with the boundaries of the NF, is believed to be at low risk under current and forecasted climatic change conditions (Isaak et al 2017). The same survey and assessment efforts put the viability of fluvial populations at high risk lower in the Blackfoot River drainage. Tributaries on the Forest are known to contribute fluvial fish to lower portions of the Blackfoot River.

The plan components of this plan revision were developed to protect the strict habitat requirements of westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and bull trout (*Salvelinus confluentus*) that require colder and cleaner water. The coarse scale components are designed to protect riparian habitat. If these measures are found to be insufficient, fine scale components are developed to protect these habitat requirements. Therefore, habitat conditions for these species will be used to assess the indirect effects of this plan revision. The plan components developed for aquatic habitat and dependent species will provide stream habitat conditions suitable for not only bull trout and westslope cutthroat, but also for numerous other aquatic organisms including sculpins, mountain whitefish and amphibians. Native species west of the Continental Divide whose range includes the Blackfoot and Little Blackfoot River drainages include mountain whitefish (*Prosopium williamsoni*), largescale sucker (*Catostomus macrocheilus),* longnose sucker *(Catostomus catostomus),* longnose dace *(Rhyinichthys cataractae)* and sculpin (*Cottus sp.*). Native species found in lakes include, Northern pikeminnow (*Ptychocheilus oregonensis),* Peamouth chub *(Mylocheilus caurinus),* and Redside shiner *(Richardsonius balteatus).* Many of these species are found at lower elevations in the drainages or in lake systems off forest.

East of the divide mountain sucker *(Catostomus platrhynchus),* longnose sucker *(Catostomus catostomus),* white sucker *(Catostomus commersoni)* burbot *(Lota lota),* stonecat (*Noturus flavus*), longnose dace *(Rhyinichthys cataractae*and), and sculpin (*Cottus sp.*) are also native species in the plan area. Arctic grayling *(Thymallus arcticus*) were also a native salmonid in the Missouri River drainage above the Great Falls and now largely absent from the plan area except in some mountain lakes.

Amphibians whose range overlaps with the plan area include tailed frogs (*Ascaphus montanus*), boreal chorus frog (*Pseudcris maculata*), northern leopard frog (*Lithobates pipiens),* Columbia spotted frog (*Rana luteiventris*), western toad (*Anaxyrus or Bufo boreas*), plains spadefoot (*Spea bombifrons),* long-toed salamander (*Ambystoma macrodactylum*), and western tiger salamander (*Ambystoma mavortium)*.

Non-native brook trout (*S. fontinalis*), rainbow trout (*O.mykiss*), and brown *trout (Salmo trutta)* are also present within the planning area, as is the non-native cyprinid, the common carp *(Cyprinus carpio).* Warmwater sport fish species including northern pike (*Esox lucius*), perch (*Perca flavescens*), and walleye (*Sander vitreus*) can be found in some lakes, rivers and reservoirs primarily in the Missouri River Reservoir complex or at lower elevations off forest. These non-native sport fish are desired by some anglers and provide recreational angling opportunities, however no plan components are being specifically developed for these species since the plan components for trout will provide stream habitat conditions suitable for all coldwater and trout species.

Conservation watershed networks

Conservation Watershed Networks are intended to identify important areas needed for conservation and/or restoration, maintain multi-scale connectivity for at-risk fish and aquatic species, and to ensure ecosystem components needed to sustain long-term high-quality water and persistence of species. The proposed Conservation Watershed Network in the revised forest plan is designed to provide that long-term conservation strategy to conserve native fish in watersheds that are expected to be long-term cold water refugia in the face of climate change (Isaak, Young, Nagel, Horan, & Groce, 2015).

Aquatic at risk species

The 2012 Planning Rule states that, where plan components designed to provide for ecosystem integrity do not sustain the ecological conditions required by an at-risk species, species-specific plan components may be needed. For some at-risk species, specific components have been included in the Draft Plan in order to sustain the ecological conditions (including but not limited to specific amount or distribution of habitat features, protection from human disturbance, etc.) required by that species. Federally listed and proposed species will be analyzed in a Biological Assessment for consultation with the USFWS after a preferred alternative is chosen and concurrent with preparation of a FEIS. At the time this report was prepared, there are three at-risk aquatic species found on the HLC NF. Those species are as follows:

- Federally listed, proposed, or candidate species:
    - Bull Trout – Threatened
- Species of Conservation Concern:
    - Western Pearlshell Mussel
    - Westslope Cutthroat Trout

Bull trout (threatened species)

In November 1999, the USFWS listed all populations of bull trout within the coterminous U.S. as a threatened species pursuant to the ESA of 1973, as amended (Act) (USFWS, 1999). The 1999 listing applied to one distinct population segment (DPS) of bull trout within the coterminous U.S. The Forest is in the Columbia Headwaters recovery unit. Two core areas of the Columbia Headwaters recovery unit are within HLC NF Lands; they are the Blackfoot River Core Area (Number 31) and that portion of the Clark Fork River (Section1) Core Area (Number 34) in the upper Little Blackfoot River drainage. Recovery actions for bull trout (USFWS, 2015b), developed in cooperation with Federal, State, tribal, local, and other partners, fall generally into four categories:

- Protect, restore, and maintain suitable habitat conditions for bull trout.
- Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity.
- Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
- Work with partners to conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks, and considering the effects of climate change.

The Northern Region of USDA FS also developed a Bull Trout Conservation Strategy for Forests in western Montana, including that portion of the HLC NF in 2013. In addition to the recovery plan, the USFWS also released the Columbia Headwaters Recovery Unit Implementation Plan (USFWS, 2015a) in 2015.

Two basic life history forms of bull trout are known to occur: resident and migratory. Resident bull trout spend their entire lives in their natal streams, while migratory bull trout travel downstream as juveniles to rear in larger rivers (fluvial types) or lakes (adfluvial types). The populations in the Blackfoot River drainage include both residents and fluvial life history form, where juveniles remain in their natal stream or move downstream to rearing streams, and then returning around age 6 to spawn.

Extensive sampling from 2008-2010 suggests that bull trout are nearly extinct in the Little Blackfoot drainage (USFS, 2013). It is hypothesized that up to 1,000 bull trout redds may have been historically present in the Blackfoot River Core Area. As with most bull trout populations, overall numbers were likely highly variable from year to year, based on natural climatic and disturbance patterns. Bull trout populations in the Blackfoot River were likely first exposed to mining-caused impacts in the late 1800's in the form of small scale mining. The mining method was often an instream "placer" type operation that directly disrupted fish habitat and stream functions. Once disturbed in this fashion after being moved and straightened, streams rarely have the ability or the power to naturally recover to their pre-disturbance condition.

Western Pearlshell Mussel (SCC)

Western pearlshell (*Margaritifera falcate*) is a state species of special concern in Montana (S2) and is a species previously identified as sensitive on the Region 1 Sensitive Species (RFSS) list (USDA, 2011a). Montana's populations of *M. falcata* have significantly declined over the last century in Montana and have become less viable with stream-decreased flows, warming, and degradation. Previously reported mussel beds in the larger rivers (Smith, Blackfoot, Big Hole, Bitterroot, Clark Fork,) have been extirpated or decreased to such low densities that long-term viability is unlikely.

Westslope cutthroat trout (SCC, Focal Species)

The USFWS was petitioned by interested parties to include the westslope cutthroat trout under the protection of the ESA. In 2003, the USFWS determined that the listing was not warranted due to wide species distribution, available habitat on public lands, and conservation efforts underway by state and federal agencies. The planning area headwater streams are considered a stronghold for westslope cutthroat trout throughout its range (Shepard, May, & Urie, 2005).

The primary reasons for this species' decline are similar to those discussed above for the bull trout. Habitat loss is considered a widespread problem. Cutthroat trout have declined across their range due to poor grazing practices, historic logging practices, mining, agriculture, residential development, and the lingering impact of forest roads. Locally on forest, logging and associated road building have had the greatest impact upon populations. Fish have been unable to use spawning habitat due to barriers created by dams and road culverts. Genetic introgression with rainbow trout threatens long-term persistence of westslope cutthroat trout, and is most likely the greatest threat (Hitt, Frissell, Muhlfeld, & Allendorf, 2003). Climate change may likely exacerbate the rate of introgression (Muhlfeld et al., 2014). Efforts of a wild trout restoration and conservation initiative have been underway since 1988 in the Blackfoot River drainage and is an iterative tributary-based priority-driven process whereby the scope and scale of restoration expands as information and stakeholder cooperation is generated (Pierce & Podner, 2006). Restoration methods include enhancing flows in rearing areas, preventing adult and juvenile fish loss to irrigation in migration corridors, reconstructing damaged streams, fencing livestock from spawning areas, and expanding similar actions in adjacent tributaries to address human-induced limiting factors when opportunities allow. The primary geographic focus of stream improvement activities had been bull trout "core area" streams and tributaries downstream from the North Fork Blackfoot until early in this decade However, restoration and conservation measures have now expanded to streams in the Lincoln valley and headwater areas on the HLC NF. Conservation actions in the headwaters of the Blackfoot River are especially important because this large GA harbors genetically pure native westslope cutthroat trout and may hold the highest potential for native cutthroat trout conservation based at the sub-basin scale. Electrofishing and genetic status monitoring of westslope cutthroat trout is also expected to continue in cooperation with MFWP and other signators of the westslope cutthroat trout Conservation Agreement Memorandum of Understanding (MFWP 2007).

Non-native fish

The Columbia Headwaters Recovery Unit Implementation Plan for Bull Trout Recovery Plan (USFWS, 2015a) identified action items that included suppression of nonnative fish invaders to protect the intact native species assemblages as in the Copper Creek/Landers Fork drainage on the HLC NF. Brown trout may be simply replacing bull trout in areas where habitat quality has declined or they may be actively displacing bull trout. However, additional study is required before definitive conclusions can be made regarding their interactions and their level of threat to bull trout.

Hybridization of westslope cutthroat trout with non-native rainbow trout is increasing in the Blackfoot River drainage (Hahn and Landres 2016). Hybridization reduces reproductive success of westslope cutthroat trout and can lead to a loss of the species and genetic material (Muhlfeld et al. 2009a). Efforts are ongoing to reduce hybridization. Habitat enhancement in streams with native fish assemblages continues to be a priority. In the upper Missouri Subbasin, only 3.3% of the historic distribution is known to be occupied by genetically unaltered westslope cutthroat (Nelson et al., 2011). Conservation populations, those less than 10% genetically introgressed, that reflect the Lewis and Clark portion of the planning unit in northcentral Montana only occupy approximately 10% of the historic range (MFWP 2014). Temperature may play a key role in reducing hybridization between the two species with westslope cutthroats favoring colder water, thus climate change is a concern in the long term.

Soils

Originally adopted in 1986, the Helena and the Lewis and Clark Land Resource Management Plans are the primary documents that establish management standards and guidelines governing activities on NFS lands within the boundaries of the HLC NF. The forest plans do not provide a variety of management direction related to the soil resource. Since 1999, physical soil disturbance has been the focus of soil management on NFS lands. FSM Chapter 2550 Region 1 Soil Management Supplement provides a benchmark that indicates when changes in soil properties and conditions may result in a notable change or impairment of soil quality. Not all soil disturbance results in substantial or permanent impairment of productivity. The R1 FSM defines levels of soil disturbance (compaction, displacement, rutting, severe burning, surface erosion, loss of surface organic matter, and soil mass movement) that are considered detrimental (of a great enough magnitude to potentially cause substantial impairment). No more than 15% of an activity area may have detrimental soil disturbance. This low level of detrimental soil disturbance allows recovery to occur between management activities. The NFMA states that management activities on NFS lands will not produce substantial and permanent impairment of productivity. The agency assures that productivity is maintained by establishing soil quality standards.

In 2010, FSM Chapter 2550 Soil Management was revised at the national level. The emphasis of soil management was changed to include long-term soil quality and ecological function. The FSM defines six soil functions: soil biology, soil hydrology, nutrient cycling, carbon storage, soil stability and support, and filtering and buffering. The objectives of the national direction on NFS lands are 1) to maintain or restore soil quality, and 2) to manage resource uses and soil resources to sustain ecological processes and function so that desired ecosystem services are provided in perpetuity.

The 2012 planning rule broadened soil management direction, requiring plans to maintain or restore terrestrial ecosystems, put more succinctly in terms of ecosystem services. The FS manual outlines these services as soil biology, soil hydrology, nutrient cycling, carbon storage, soil stability and support, and filtering and buffering.

Land use practices, such as grazing, logging, and mining, have been occurring on the HLC NF since their inception. Activity impacts are evident on the landscape today. Dynamic soil characteristics may be indicators of impaired productivity. Compaction may restrict plant rooting, may lower water-holding capacity, and may decrease infiltration. Loss of surface soil through displacement and mixing may decrease soil productivity. Displacement occurs during temporary road construction, excavation of skid trails and landings, and displacement of soils during ground-based harvest. Areas with ground disturbance may become more favorable for weed invasion, which can reduce overall soil productivity and quality.

Since soil function is difficult to measure in the field, associated factors that can be readily observed and measured. These factors include disturbance to surface organic matter and disturbance to topsoil. Most management activities affect surface organic matter that can rebound relatively quickly as surface leaf litter and roots in the soil rebuild organic matter stocks. In contrast, the mineral topsoil could be considered a summation of a site's potential to support growth based on bedrock, terrain, climate, and rate of soil development. When management activities displace or remove portions of the topsoil, this impact involves a longer term recovery than disturbance. These consequences can vary depending on the soil depth and the place in the landscape. Topsoil disturbance on drought prone sites could proportionally affect the soil's ability to provide water to trees more than on wet sites where seasonal moisture stress is less.

Management can also use soil function to inform prescriptions (Craigg et al. 2015). Managers often refer to historic range of variability as an analogue to manage for tree species composition and structure. Soils provide a historic record of vegetation distribution with grassland types and deciduous trees creating darker top soils than sites dominated by forests and shrubs. Soil characteristics of depth, texture and even the accumulation of ash laden loess can indicate areas most able to provide water through the summer. These characteristics inform managers of where best to plant species requiring high summer water and where trees have the best growing conditions.

Existing condition

The Forest has a wide diversity of soil types from the minimally-developed, nutrient poor soil and rock complexes of the steep mountain slopes and ridges to the deep, fertile soils of the lower valleys. Steep terrain prone to intermittent surface movement combined with recent ablation of glaciers have limited soil development. Soil provides ecosystem services through thermoregulation, nutrient cycling, and water purification and storage. It also contributes to provisioning ecosystem services by providing wildlife habitat, plant-growth media, and fill (construction).

The diverse and productive soils of the HLC NFs are described, characterized, and classified in the Soil Survey of Helena NF Area, and Soil Survey of Lewis and Clark NF Area respectively.

Hydric soils

Hydric soils are defined by the National Technical Committee for Hydric Soils as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile (USDA-SCS, 1994). These soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophilic flora. Hydric soils occur across the landscape in areas along stream channels, on floodplains, and in isolated springs and seeps. Hydric soils are a primary indicator of wetlands and are used in the assessment of FS compliance with Executive Orders 11988 and 11990, directives relative to the management and disposition of floodplains and wetlands.

Sensitive soils

Certain attributes associated with soils on the forest make them sensitive or susceptible to impairment of soil quality and productivity caused by management activity.

Soil organic matter is fundamentally important to sustaining long-term soil productivity and quality, and is influenced by fire, harvest activities, decomposition, and accumulation rates. The organic component of soil is a large reserve of nutrients and carbon and is the primary site for microbial activity. Forest soil organic matter influences many critical ecosystem processes, including the formation of soil structure. Soil organic matter is also the primary location for nutrient recycling and humus formation, which enhances nutrients, water storage, and overall fertility. Soil organic matter depends on inputs of biomass (e.g., vegetative litter, fine woody debris) to build and maintain the surface soil horizons, support soil biota, enhance water-holding capacity, and prevent surface erosion. A review of the soil data and interpretations from the Natural Resource Conservation Service Web Soil Survey shows that a majority of the plan area has soils easily eroded if the organic layer is removed.

Soils formed from granitic rocks comprise another group of sensitive soils on the forests (especially in the Divide, Castles and Elkhorn GAs.). These soils are typically non-cohesive, coarse textured and are susceptible to erosion and mass wasting. These soils are droughty with low water and nutrient holding capacities; therefore, keeping the thin surface organic layer intact is extremely important.

Soils with an ash cap are another group of sensitive soils on the NF which are spread across the Upper Blackfoot, Divide, Elkhorn, and the central section of the Big Belts GAs of the Helena NF). These soils are characterized by a low bulk density, high water holding capacity, and high cation exchange capacity that can lead to a concentration of nutrients. Ash caps are extremely susceptible to compaction, erosion, and soil mixing. Ashy soils do not recover from compaction as quickly as other soil types. Since volcanic ash is not replaced, the effects of losing the ash cap would be permanent.

Mollic soils are another group of sensitive soils that occur on the forest. These are soils with a large amount of organic matter (excluding wetlands). They are very productive and support primary grazing. These soils do not generally develop under forested vegetation, but can develop under aspen stands. Areas with these soil types will be overlaid on a map with vegetation, and anything that shows as transitory grazing will become priority lands to be restored to primary grazing. These soils will also be used as an indicator in areas that have conifer encroachment, but that should be restored to meadow or rangeland. This is thought to be occurring over 10s of thousands of acres across the plan area. This analysis will be undertaken when the soil maps are completed.

The final group of sensitive soils are the fine-textured, shallow soils (defined as soils less than 20 inches deep) that occur on the forest. These soils are sensitive because they are susceptible to erosion and detrimental effects from management actions. They are generally weakly developed, have relatively little organic matter, and therefore have low nutrient levels. Any soil displacement or loss can greatly affect their productivity because there is little nutrient-rich soil left when even a small amount is removed. Further, when soil is shallow, runoff can infiltrate to the bedrock layer and run along that layer, carrying the overlying shallow soil with it.

3.5.6 Environmental consequences

Watershed condition

Effects common to all action alternatives

There is a need to update what was intended to be interim INFISH Plan components in place west of the Continental Divide and to improve aquatic habitats are management elsewhere in the Draft Plan and DEIS to remain consistent with strategies in place across public lands in the western United States. Comments received since the proposed action was published have been used where appropriate to improve the proposed action and have helped inform this DEIS. In the Draft Plan and action alternatives, additional management direction has been included to address aquatic and riparian ecosystem integrity and connectivity. Components have been added to the proposed action that increase attention for watersheds identified for conservation (see appendix E.) The HLC NF Plan Revision is also being completed under the 2012 Planning Rule so text and style of original INFISH component standards and guidelines have been adjusted to be compliant with the current Planning rule.

The Draft Plan proposes to maintain the use of PIBO monitoring data collected at a subset of sites on the forest every year in combination with improved desired conditions. While the Draft Plan does not contain numerical Riparian Management Objectives like INFISH did, descriptive desired conditions contained in the Draft Plan would be used to guide project location, development, and actions. Because of the lag time between projects and effects, as well as the tremendous variability that can result from localized weather events, PIBO data analyzed at the Forest Scale is actually a more rigorous method to ascertain whether or not plan components designed to protect and restore the aquatic environment are effective. All of this information will enable the Forest to adapt its management strategies and adjust decisions in the future, if needed, based upon what has been learned.

Another change is the inclusion of a multi-scale analysis strategy in appendix C of the draft plan. Multi-scale analysis, a refinement of watershed analysis, has been a widely applied methodology that was first required for use by the USFS in the Pacific Northwest Region (Henjum et al., 1994). It was also described and recommended for use in the interior Columbia Basin key and priority watersheds by PACFISH and INFISH Strategies (1995), and is recommended for inclusion in plan revisions by the Interior Columbia Basin Ecosystem Management Project (2014) strategy. The multi-scale analysis strategy included in appendix C has been simplified and clarified to sharpen focus on necessary integration.

Watershed condition in geographic areas

The largest change of the revised forest plan to GAs would be the implementation of plan directions for RMZs. All action alternatives would adopt RMZs required plan directions across all GAs (FW-RMZ-STD-01). All plan direction would be implemented across the planning area. Also the Draft Plan direction would result in additional protection for riparian areas with the adoption of RMZs forestwide. The inner and outer riparian zone plan directions would also provide increased aquatic habitat and water quality protection which would maintain or move riparian resources towards desired conditions. These effects would be most dramatic on the east side of the Continental Divide. In the planning areas west side of the Continental Divide (15 percent of the planning area), the RMZs would largely not lead to different outcomes from current INFISH directions in alternative A.

All previous 1986 plan components for municipal watershed were brought forward into the Draft Plan. The addition of the Lewistown municipal watershed in the Snowies GA will affect management actions with those watersheds. Forest plan directions will be more restrictive to maintain high quality drinking water for the city. See discussion on individual municipal watershed in their respective GAs.

General watershed condition

Many land management activities carried out on the forest have the potential to adversely affect watershed and water quality resources to some degree, particularly those activities that disturb the ground in close proximity to water resources. Table 15 provides a summary of draft forest plan components for aquatic ecosystems.

Current and proposed forestwide standard FW-WTR-STD-03 requires the use of project specific BMPs to be incorporated in all land use and project planning as the principle mechanism for controlling nonpoint source pollution to meet watershed desired conditions. Implementation and effectiveness monitoring of BMPs are performed primarily through three administrative processes: the biennial Montana State Forestry Practices BMP review, forest plan monitoring, and the FS’s National BMPs (USDA, 2012d) annual reviews. During the 2014 Montana BMP review, forest BMPs applied on federal lands, including NFS and BLM lands, were found to be over 96% effective at preventing impacts to water quality (Ziesak, 2015). Implementation and effectiveness monitoring of watershed conservation practices, and forest plan standards and guidelines can be carried out by a variety of personnel including timber sale administrators, contract officer representatives, resource specialists, and line officers. Systematic monitoring and adjustment of land management activities, where necessary, would ensure the highest possible level of BMP implementation and effectiveness.

All streams with assigned TMDLs receive special emphasis to improve water quality conditions under all alternatives due to the FS’s legal obligation to meet requirements under the Clean Water Act. For the action alternatives, this obligation has been emphasized with a forestwide guideline to comply with the TMDL implementation plans (FW-WTR-GDL-01).

Table 15. Summary of plan components for aquatic ecosystems– revised forest plan alternatives B, C, D, and E

Plan Component(s)	Summary of expected effects
FW-WTR-DC, GO, OBJ, STD, and GDL	Forestwide watershed plan components provide extensive direction to guide management actions to maintain and enhance watershed conditions across the Forest. Collectively, they would improve stream channel function, water quality, groundwater, and enhance aquatic habitat. They will help provide resiliency in the face of warming climate.
FW-RMZ-DC, GO, OBJ, STD, and GDL	Implementation of the riparian management standards and guidelines include directions for management actions within RMZs would improve riparian, floodplain, water quality and stream channel conditions across the planning area. The new riparian zone widths would increase width and would have a limiting effect of management actions that could occur with RMZs. The exception would be the west side of the divide as there would be little difference between (Amendment 14) INFISH and proposed RMZ widths. They will help provide resiliency in the face of warming climate.
FW-FAH-DC, GO, OBJ, STD, and GDL	Implementation of the fish and aquatic habitat standards and guidelines include directions for management actions within streams, riparian and wetlands areas would benefit habitat conditions.
FW-CWN-DC, GO, OBJ, STD, and GDL	Implementation of the conservation watershed network standards and guidelines include directions for management actions within native fish populated watersheds would improve habitat and provides additional protection to maintain the viability of the populations. They will help provide resiliency in the face of warming climate.
FW-SOIL-DC, GO, OBJ, STD, and GDL	Soil standards, guidelines and desired conditions provide management directions that would avoid detrimental soil conditions and maintain soil organic material.

Municipal supply watersheds and drinking water, source water protection

Table 16 provides a summary of draft forest plan components for municipal watershed sources. FW-WTR-DC-06, requires that water quality will meet or exceed state water quality standards and fully support designated beneficial uses, and water is of sufficient quality to support surrounding communities. FW-WTR-STD -01 ensures management activities conducted in source water protections areas would be consistent with source water protections and activities in source water protection areas support long-term benefits to aquatic resources and water quality.

The current four municipal watersheds and their current 1986 plan directions (Management Area J on the Lewis and Clark and MA H-1 for the Helena NF) were brought over to the proposed plan revision. Drinking water systems receive additional protections under the current legal framework than just the FS designation of being a municipal watershed. Lewistown municipal watershed was not recognized in the 1986 forest plan and would be designated within the Draft Plan. Lewistown uses Big Spring Creek in the Snowy Mountain GA. Specific plan direction for individual municipal watershed are listed under the appropriate GA.

Activities that alter the quantity, timing, or quality of water resources have the greatest potential for adverse effects, and that risk generally decreases as the distance away from streams or wetlands increases. Some land management actions would be undertaken with the explicit purpose of improving water quality, such as streambank restoration, riparian planting, installing bridges or larger capacity culverts in roads, or undertaking road storage or decommissioning. Actions that are intended to improve water quality often result in short-term adverse effects to water quality, specifically if the implementing actions occur within a water body. Short-term adverse effects are anticipated and considered acceptable when activities are needed to provide long-term protection or improvement of water quality (FW-WTR-STD-01 and FW-WTR-GDL-04).

The greatest change in the revised forest plan with respects to watershed, aquatic and water quality would be the adoption of plan components for activities that occur inside RMZs (FW-RMZ-STD-01). The Draft Plan components were based on INFISH guidance with modifications and would be implemented across the planning area to move watershed, aquatic habitat, and riparian areas towards desired conditions. Desired conditions are meant to provide for "healthy, functioning watersheds, riparian areas, and associated fish habitats." This Draft Plan direction would result in additional protection for watersheds and riparian areas by implementing RMZ widths. Plan directions would also provide increased aquatic habitat and water quality protection which would maintain or move watershed resources towards desired condition. These effects would be most dramatic on the east side of the Continental Divide since management in riparian areas do not have a fixed width. The widths are determined based on "geographic boundaries of riparian areas by onsite characteristics of water, soil, and vegetation." Vegetation management buffers on the Forest are currently primarily constrained by Montana State SMZs and desired conditions are better defined in the revised plan. See Riparian areas, environmental consequences section for detailed discussion on riparian plan components.

Table 16. Summary of plan components for municipal watershed sources, proposed forest plan, alternatives B, C, D, E

Plan Component(s)	Summary of expected effects
FW-WTR-STD-01 thru 03 and GDL-01 thru 04, FS-RMZ-STD and GDL, FW-FAH-STD and GDL	Standards and guidelines include direction that would continue to maintain or improve water quality and aquatic resources. All 1986 plan components for existing municipal watersheds have been revised, updated and carried forward into the revised Draft Forest Plan. Lewistown would be added to the proposed plan and will be included on the municipal water supply map and be subject to the municipal watershed components.

Alternative A

There are currently three guiding documents providing management directions within the planning area. The Lewis and Clark NF is currently under the management directions in their 1986 Forest Plan (USDA, 1986b). The Helena NF is at present under management direction in their 1986 Forest Plan (USDA, 1986a) and for areas west of the Continental Divide, INFISH (USDA, 1995a) amended to the forest plan (Amendment 14) in 1996. All current management activities are required to follow the 2011 national best management practices and the State of Montana Streamside Management Rule (Montana Department of Natural Resources and Conservation, 2006) for timber management. Also required throughout the planning area is the Montana Stream Nondegradation Act which assures that all reasonable land, soil, and water conservation practices are applied and existing and anticipated beneficial uses would be fully protected.

The current 1986 forest plans are not consistent with the 2012 Planning Rule, since the current plans do not contain the direction "water resources in the plan area, including lakes, streams, and wetlands; ground water; public water supplies; sole source aquifers; source water protection areas; and other sources of drinking water (including guidance to prevent or mitigate detrimental changes in quantity, quality, and availability)." The plan must include plan components, including standards or guidelines, to maintain or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity. The plans must take into account, water temperature, blockage of water course, sediment, aquatic and terrestrial habitats, connectivity restoration needs, and floodplain needs, as well as establishment of RMZs around all lakes, perennial and intermittent streams, and open water wetlands.

Table 17. Effects of plan components for aquatic ecosystems, alternative A

Plan Component(s)	Summary of expected effects
Helena NF	

Plan Component(s)	Summary of expected effects
Forestwide Fisheries Standards II/22.	This section provides standards that would guide and/or limit management activities. Water quality, habitat for fish and riparian areas receive the maximum protections for spring and fall spawning habitats. See below for INFISH amendment.
Forestwide Watershed, Soil, & Air Standards II/24-26.	This section provides standards that would guide and/or management activities. These standards are generally more qualitative and less specific than the revised plan components found in the action alternatives.
Forestwide Riparian Standards, II/34-36	These standards would limit activities in riparian areas, and are less quantitative than the plan components found in the draft revised plan.
Management Areas (III/2-III/93)	Management area guidance describes management standards and goals providing protections for watershed, soil, water quality, fisheries and riparian areas.
1996 INFISH amendment: west side of the Continental Divide: Amendment 14	INFISH standards and guidelines impose directions for management actions within riparian habitat conservation areas. These have been effective at improving and maintaining riparian habitats and water quality on the west side of the Continental Divide.
Lewis and Clark NF	
F-3, Soil, Water and Air Protection (2-51 and 52)	This section provides standards that guide and/or limit management activities. This standard includes components that guide management actions to maintain water quality, sustaining soil and site productivity, and prompted revegetation of disturbed areas.
Management Areas MA-R (3-88 thru 95)	This section provides standards for specific to riparian areas that guide and/or limit management activities. Management area guidance describes special considerations for the minimization of activities in riparian areas, standards for stream crossings, and measures to avoid stream contamination.

As discussed under the affected environment section, there are source water protection areas as delineated by MTDEQ on and downstream of NFS Lands. The greatest concern is with surface water intakes. It has been found that pollution impacts on water quality from forestry activities are generally local in nature, short-lived, less frequent, and are less extensive in nature than activities related to either agricultural or urban activities (Dissmeyer, 2000).

The Lewis and Clark and Helena 1986 forest plans have directions for the protection and management of municipal watersheds and water quality (Table 18). The Lewis and Clark forest plan includes management direction for municipal watershed under MA-J. Forestwide directions specific to riparian areas (MA-R) for soil and watershed protections during all management actions and includes directions to implement BMPs, meet state water quality standards and revegetate disturbed areas. The Helena forest plan includes general watershed guidelines for protection of water quality during management actions. The Helena NF plan also includes directions to delineate riparian areas prior to any management activities and includes a riparian buffer of 100 feet from the edge of all perennial streams. Both plans require the adherence to the State of Montana water quality standards and the State of Montana Streamside management zone (SMZ) laws during timber harvest. Additionally, both forest are required to design and implement mitigation measures through the use of the 2012 National BMPs to control erosion and protect water quality.

Table 18. Summary of plan components for municipal watershed sources, 1986 forest plan, alternative A

Plan Component(s)	Summary of expected effects
Helena 1986 Forest Plan: Municipal Watershed Guidance's	Numerous Municipal directions would continue to maintain water quality.
Lewis and Clark 1986 Forest Plan: MR-1	Numerous Municipal watershed directions would continue to maintain water quality. Lewistown (Big Springs Creek) would not be allotted additional protections under alternative A.

Plan Component(s)	Summary of expected effects
Municipal Watershed Guidance's	

Unchanged from its original wording in alternative A, INFISH amended (Amendment 14) the Helena Forest Plan in 1996 and currently only affects planning areas west of the Continental Divide; the west side of the Divide and all of the Upper Blackfoot GAs. INFISH reduced the risk to watersheds, riparian and aquatic resources by improving riparian habitat conservation area protections. There are riparian management objectives and goals to protect and restore, water quality, stream channel integrity, instream flows, meadow and wetland standards, riparian plant, and aquatic habitat. Included are numerical riparian management objectives that include pool frequency, water temperature, large woody debris, bank stability, lower bank angle, and width/depth ratio. INFISH includes management directions for timber, roads, grazing, recreation, minerals, and fire management.

Riparian areas

Effects common to all alternatives

The road network on the Forest affects water and aquatic resources on both a short and a chronic, long term basis. There are motorized roads open to the public as well as administrative use within the forest administrative boundary, including roads managed by other entities such as state highways, a variety of county roads, federal/state land management agencies, and private timber companies. Many roads and motorized trail are located within RMZs that include many road-stream crossings. Routes located closest to water resources potentially provide a background level of disturbance that contributes to direct and indirect effects on aquatic and riparian resources. Motorized trails function similar to roads in regards to soil disturbance however impacts are generally less as there is less disturbed surface area.

Past culvert failures and road slumps have impacted water quality of the HLC NF, particularly at the site-level scale. Forest roads that are maintained on an annual basis are typically those roads that have the most administrative and visitor use. Closed roads receive less maintenance, and not all of these roads were put into proper long-term storage or had their culverts removed. There are stream crossings located on administratively closed FS roads with some culverts remaining that do not receive regular maintenance. Inspection and monitoring of culverts is a monitoring item to address this concern and provide maintenance.

Effects common to all action alternatives

No significant adverse impacts on wetlands or floodplains are anticipated. Wetlands values and functions would be protected in all action alternatives through the implementation of the RMZs and by following the FS's National BMPs for Water Quality Management on NFS Lands. Under the requirements of Executive Order 11990 and Clean Water Act, Section 404, wetland protection would be provided by ensuring that new construction of roads and other facilities would not have an adverse effect on sensitive aquatic habitat or wetland functions. In addition, wetland evaluations would be required before land exchanges or issuance of special-use permits in areas where conflicts with wetland ecosystems may occur.

Plan components have been designed to conserve riparian areas and protect floodplains under the action alternatives. Executive Order 11988 also requires site-specific analysis of floodplain values and functions for any project occurring within the 100-year floodplain zone, and prior to any land exchange involving these areas.

Protective measures for riparian areas include the delineation of RMZs around all water resources and the extent of unstable areas. Management activities within the RMZ must comply with all proposed direction, as well as the previously mentioned national and state BMPs and other state water quality regulations.

Floodplains would be managed by locating critical facilities outside of floodplains or by using structural mitigation measures. Further protections are provided in forestwide standards and guidelines for management of RMZs.

Livestock grazing in the planning area has the most impacts to wetlands. Livestock degrade wetland habitat through vegetation removal, bank trampling and hoof damage to wetland sub straights. The removal of organic material and increase in water surface area has resulted in the loss or reduction in the size of many wetlands throughout the forest.

All action alternatives include new forest plan direction that would establish designated widths of an inner and outer RMZ bordering streams, lakes, wetlands and other water features, as well as requires plan direction for management actions within the inner and outer RMZs. The width of the RMZs for all action alternatives are delineated as follows (FW-STD-RMZ-01):

Category 1 Fish-bearing streams: RMZs consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream channel), whichever is greatest.

Category 2 Permanently flowing nonfish bearing streams: RMZs consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet total, including both sides of the stream channel), whichever is greatest.

Category 3 Constructed ponds and reservoirs, and wetlands greater than 1 acre: RMZs consist of the body of water or wetland and: the area to the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or the extent of unstable and potentially unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance from the edge of the wetland greater than 1 acre or the maximum pool elevation of constructed ponds and reservoirs, whichever is greatest.

Lakes and natural ponds - RMZs consist of the body of water and: the area to the outer edges of the riparian vegetation, or to the extent of seasonally saturated soil, or to the extent of unstable and potentially unstable areas, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance, whichever is greatest.

Category 4 seasonally flowing or intermittent streams, wetlands, seeps and springs less than 1 acre, and unstable and potentially unstable areas: This category applies to features with high variability in size and site-specific characteristics. At a minimum, the RMZs should include:

•The extent of unstable and potentially unstable areas (including earthflows).

•The stream channel and extend to the top of the inner gorge.

•The stream channel or wetland and the area from the edges of the stream channel or wetland to the outer edges of the riparian vegetation, extending from the edges of the stream channel to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest. A site-potential tree height is the average maximum height of the tallest dominant trees for a given site class.

•Intermittent streams are defined as any non-permanent flowing drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two physical criteria. Fish-bearing intermittent streams are distinguished from non-fish-bearing intermittent streams by the presence of any species of fish for any duration. Many intermittent streams may be used as spawning and rearing streams, refuge areas during flood events in larger rivers and streams or travel routes for fish emigrating from lakes. In these instances, the guidelines for fish-bearing streams would apply to those sections of the intermittent stream used by the fish.

In order to achieve watershed desired conditions, the RMZ is broken into two areas called the inner and outer zones (Table 19). Some activities are prohibited or restricted in the inner zone, whereas more active management is allowed in the outer zone. RMZs are not intended to be “no touch zones,” but rather “carefully managed zones” with an increase in protections in close proximity to water resources.

Table 19. Typical widths[1] of inner and outer areas within RMZs proposed as standards for all action alternatives

Stream type/habitat feature	Inner RMZ width (ft)	Outer RMZ width (ft)	Total RMZ width[1] (ft)
Category 1 – Fish bearing stream	100	200	300
Category 2 – Perennial, nonfish bearing Stream	100[2]	50	150[1]
Category 3 – Natural Lakes and ponds, Constructed Ponds and Reservoirs, and wetlands greater than 1 acre	100	50	150[1]
Category 4a – Intermittent steep (>35% side slope)	100[1]	0	100
Category 4b – Intermittent flat (<35% side slope) Disconnected intermittent MT State SMZ Class 3 and wetlands <1 acre.	50	50	100

1. Widths listed are for each side of the stream, total width would be double the numbers listed.
2. Management zone widths extend either to the distance listed or to the top of the inner gorge slope break, whichever is greater.

RMZs are portions of watersheds where riparian associated resources receive primary emphasis, and management activities are subject to specific plan components including standards and guidelines. In order to achieve watershed desired conditions, some activities are prohibited or restricted in the inner RMZ, whereas more active management is allowed in the outer RMZ.

As compared to current standard INFISH widths west of the Continental Divide, RMZ total widths remain the same for Category 1, 2 and 3 habitat features while all Category 4 habitat features would have a 100 foot RMZ width in contrast to some INFISH features which had only a 50 foot width. The inner RMZ, which is the most restrictive area, would be at least 100 feet on either side of the edge of the active channel for all stream and waterbodies except those in Category 4b (intermittent flat streams <35% slope, disconnected intermittent MT State SMZ Class 3 streams and wetlands <1 acre), where it remains a 50 foot width. With properly implemented BMPs, best available science information indicates the inner RMZ widths are the minimum required to protect aquatic habitat and water quality.

East of the Continental Divide, fixed widths for RMZs would be established on each side of the stream or river from the edges of the active channel to 150 feet on non-fish bearing, perennial streams, and 300 feet on each side for fish bearing streams. For riparian areas east of the Continental Divide the adoption of RMZs would increase the area protected by plan components (Table 20). This change expands protections from one hundred feet from the edge of all perennial streams, lakes, and other bodies such as aquatic ecosystems, floodplains, and areas dominated by riparian vegetation on the Helena portion of the combined forest. On the Lewis and Clark portion of the combined forest, the change would be substantive since standards only require adherence to state water quality standards and to maintain soil productivity. In addition, all areas would continue to comply with State SMZ rules. The additional plan directions would provide protection to riparian areas and move them towards desired conditions. The adoption of RMZs would substantially increase protection of water quality and habitat conditions. In the planning area west side of the Continental Divide, which is 13 percent of the area within the HLC NF, adoption of RMZs would not be expected to provide largely different outcomes than from current INFISH directions in alternative A.

Table 20. Comparison of RMZs across the HLC NF

	West of Continental Divide, Helena	East of Continental Divide, Helena	East of the Continental Divide, Lewis and Clark
Percentages of lands, old Forest boundaries	34%	66%	100%
Percentages of Lands, HLC Combined Forest	13% of entire HLC	25% of entire HLC	62% of entire HLC
Alternative A (current Plans)	subject to INFISH Widths	subject to 100’ buffers, plus State SMZ rules for Timber, 50’	Buffers unspecified, TBD on the ground, plus SMZ rules for Timber, 50’
Action alternatives B-E	RMZs, not a significant change, increase in flexibility with inner/outer rules	RMZs, more significant change	RMZs, most significant change

The proposed direction change in action alternatives for RMZs is based on research in recent years that documented that in some cases active RMZ management can advance riparian condition while preserving the functional attributes for riparian, aquatic, and water resources. The proposed RMZ plan components were designed to improve riparian vegetation within the RMZs, while limiting activities that create long-term degradation, such as road building and clearcutting. Treatments would be designed to reflect the composition, structure and pattern of vegetation that would be consistent with the NRV, as described in the desired conditions. The proposed RMZ standards in all action alternatives establish a differentiation between the inner and outer portions of RMZs with regard to limitations on vegetation management (FW-STD-RMZ-01, 03, 04). Management of the outer RMZ would allow for other management objectives such as the reduction of uncharacteristic fire as long as treatments did not create long-term degradation to riparian and aquatic condition. The proposed standards were developed to explicitly recognize that RMZs can benefit from active management and that the areas closest to water have greater importance for protection of water quality and aquatic resources based on the best available science.

Table 21 displays the estimated size of RMZs in acres. This was estimated from MTFWP fish distribution data for only perennial fish bearing streams east and west of the Continental Divide. The information can be used to provide a programmatic comparison of changes in the size of areas across alternatives.

Table 21. Stream type/habitat feature acres by GAs proposed as standards for all action alternatives[1]

GA	Category 1	Category 2	Category 3	Category 4	Total
Big Belts	15,055	5,291	3,155	27,852	51,352
Castles	2,258	3,098	2,078	2,975	10,408
Crazies	1,585	3,278	918	2,244	8,025
Divide	11,923	5,769	4,611	6,814	29,117
Elkhorns	7,058	3,892	1,959	4,919	17,828
Highwoods	3,257	568	27	1,953	5,806
Little Belts	43,733	11,261	12,591	47,197	114,783
Rocky Mountain Range	37,387	34,005	7,720	26,236	105,349

GA	Category 1	Category 2	Category 3	Category 4	Total
Snowies	3,610	367	596	8,134	12,707
Upper Blackfoot	24,323	4,633	8,979	12,729	50,665
Grand Total	150,189	72,162	42,635	141,053	406,039

1. See Table 9 for category descriptions

While the proposed implementation of inner RMZs east of the Continental Divide essentially doubles the existing comparative widths on some, but not all, streams, the largest change in action alternatives east of the Continental Divide is in the outer RMZ area, which is also the area where greater flexibility for management activities would be maintained (Table 22). For comparative purposes, 80,620 acres would be the estimated size of the outer RMZs for perennial fish bearing stream reaches east of the Continental Divide for all action alternatives, and 20,630 acres west of the divide for a total of 101,250 acres forest wide. The acreage estimated west of the Continental Divide represents greater flexibility for management when compared to alternative A and does not represent an increase in riparian protection widths west of the divide. While this example for fish bearing streams examines just a single subset of the RMZ categories, it provides a relative comparison of action alternatives with the existing condition. This comparison does not include other categories than fish bearing streams and it includes areas on the HLC NF that cannot be harvested as well as areas within current or RWAs.

Table 22. Estimated size (acres) of RMZs for only perennial fish bearing streams (minimum SMZ east of divide and INFISH Category 1 west of the divide)

Planning area location	Alternative A – existing conditions	Alternatives B,C,D,E 100 foot Inner RMZ	Alternatives B,C,D,E 200 foot outer RMZ
East of the Continental Divide	20,240[1]	40,450	80,620
West of the Continental Divide	30,870[2]	10,340	20,630
Total	51,110	50,790	101,250

1. Represents the minimum State SMZ size
2. Category 1 fish bearing streams

The 2012 planning rule emphasizes integration of management direction in recognition of ecological sustainability and the interdependence of ecological resources, and the proposed RMZ areas would also contribute to wildlife habitat connectivity and protection of plant species and animal communities associated with wetlands. RMZ direction under all action alternatives was refined through plan components to guide appropriate management based upon best available science. The entire RMZ is classified as not suitable for timber production, based on the determination that a scheduled flow of commercial timber products using a rotation age could not be expected to occur on these lands due to management requirements and desired conditions for other resources. However, timber harvest is allowable, with restrictions as specified in the plan, such as to meet the RMZ desired conditions outlined in the revised plan. Other vegetation management activities that may occur and are expected to occur to maintain riparian conditions include prescribed fire, thinning, planting of trees or shrubs, and fuel reduction. Vegetation management in the inner RMZs for categories 1, 2, 3, 4a and 4b would occur expressly for the purposes to restore or enhance riparian, fish and aquatic resources (FW-STD-RMZ-03), with specific exceptions. Vegetation management in the outer RMZ (FW-STD-RMZ-04), would allow more opportunity to manage vegetation resources to achieve desired vegetation and riparian conditions so long as conditions in the inner RMZ were not adversely affected and wildlife needs were met to achieve desired conditions (FW-RMZ-DC-01 and 02). Refer also to later section on effects to riparian areas from timber and vegetation management.

Fire is a natural disturbance process that has historically influenced the forests within watersheds, including riparian areas and forests adjacent to water features. The natural role of fire, as well as other natural disturbances, in creating the diversity of successional stages, species compositions and structures in riparian areas is incorporated into the design of the desired forest and vegetation conditions outlined in the plan (FW-RMZ-DC-01 through 02). In areas where use of fire (including wildfire) or other natural disturbances is limited or not feasible, vegetation treatments could be applied where determined appropriate to achieve desired conditions within riparian areas.

Alternative A

Alternative A does not incorporate a watershed approach to the management of hydrology and watershed processes; there would not likely be watershed scale consideration and protection of hydrologic and riparian area/wetland processes and functions. Current plan directions do not establish fixed RMZs, standard, guidelines or desired conditions for riparian areas. This would likely result in the continued maintenance of areas currently in satisfactory condition and areas currently in unsatisfactory would remain unchanged.

The existing 1986 forest plans are unchanged in alternative A. Forestwide direction in the current forest plans address water quality, stream channel integrity, and other features associated with aquatic and riparian areas that provide protection for the riparian-associated resources and values. East of the Continental Divide, the Lewis and Clark NF riparian areas are currently protected by forest plan direction (Management Area R), which requires adherence to State of Montana water quality standards, Montana SMZ laws during timber vegetation management, and FS National BMPs. Riparian areas are delineated and evaluated prior to implementing any project activity. On the east side of the divide, there are currently no fixed riparian widths. The widths are determined based on "geographic boundaries of riparian areas by onsite characteristics of water, soil, and vegetation." For vegetation management the Montana SMZs widths (Table 23) are required statewide for timber management only and do not affect many activities occurring on the forest, like recreation, grazing, and wildfire suppression. The 1986 Helena forest plan has specific management directions for riparian areas for timber harvest. Harvest would only occur in riparian acres in conjunction with sale activities adjacent to lands and should be on a 240 year rotation. These directions and BMPs (i.e. upsizing and replacing old culverts, and upgrading and eliminating roads in riparian areas) during timber harvest have prevented adverse impacts to riparian habitats in close proximity to water resources.

Table 23. Basic widths of SMZs (SMZ) in Montana

Stream type	Inner (ft)	Total width (ft)
Class 1 and 2 Streams <35 percent slope	50	50
Class 1 and 2 Stream > 35 percent slope	100[1]	100[1]
Class 3 Streams and other bodies of water	50	50
Wetlands	**Edge of wetland**	

1. Management zone widths extend from both sides of streams and rivers from the Ordinary High Water Mark

The Inland Native Fish Strategy (INFISH) (USDA, 1995a), as it was amended to the Helena NF plan in 1996, is unchanged from its original wording in alternative A. This amendment only affects the GAs west of the Continental Divide; the Upper Blackfoot and west portions of the Divide GAs. INFISH reduced the risk to watersheds, riparian and aquatic resources by improving riparian zone protections.

Riparian habitat conservation areas (RHCAs) are established as management zones bordering streams, wetlands and other water features (Table 24). The RHCA direction from INFISH was added in addition to all other direction in the 1986 forest plans. The delineation of RHCAs is completed at the project site specific level on the ground (i.e. identified in the forest based on site characteristics) and the methods for delineating RHCAs is described in the amendment, including their minimum widths. INFISH PIBO monitoring results have shown statistically significant improvements in the majority of stream habitat attributes, including the overall index at the Regional scale since the standards and guidelines were implemented in 1996.

Table 24. Standard widths defining INFISH RHCAs[1] by stream category or water body, alternative A, west side of the Continental Divide on the HLC NF

Stream type/habitat feature	Width on each side of stream (ft)
Category 1 – Fish bearing streams	300[1]
Category 2 – Perennial, non-fish bearing streams	150[1]
Category 3 – Natural Lakes and ponds, constructed ponds and reservoirs, and wetlands greater than 1 acre	150[1]
Category 4a – Intermittent or seasonal streams and wetlands <1 acre in Priority Watersheds[2]	100
Category 4b – Intermittent or seasonal streams and wetlands <1 acre in not in Priority Watersheds	50

1. RHCA widths extend either to the distance listed or to the top of the inner gorge slope break, or to the outer edges of the 100 year floodplain, whichever is greater.
2. Priority on HLC include Copper Creek in the Blackfoot River Drainage and the Little Blackfoot River upstream of the confluence with Dog Creek and includes Dog Creek.

Under alternative A, current forest plan directions for riparian, water quality, and wetlands would continue on the east side of the Continental Divide. The plan has directions to define riparian areas on the project level with onsite characteristics of vegetation and soils. With the exception of the Montana SMZ rule for timber management actions, there are no fixed riparian areas. For areas on the west side of the divide, current forest plan directions would continue to apply as well as incorporated INFISH standards and guidelines that protect or minimize effects to riparian and aquatic resources. Current trends in riparian area across the planning area would be expected to continue.

Alternative A is not consistent with the 2012 Planning Rule, since the current plans do not establish RMZs around all lakes, perennial and intermittent streams, and open water wetlands, specifically on the old Lewis & Clark NF.

Wetlands

Effects common to all alternatives

Under all alternatives, stewardship projects could result in funds being available for restoration. The highest priority for these restoration actions would be within the conservation watershed network under the action alternatives to benefit native fish (FW-CWN-GDL-02). It is expected that temporary and short-term impacts to fish, stream channels, water quality, etc. from culvert removals, in-channel restoration, and habitat surveys would still occur. It is also expected that long-term positive effects would occur from these restoration activities.

Effects common to all action alternatives

Plan components would promote watershed restoration projects to improve the long-term ecological integrity of ecosystems and conserve genetic integrity of native species (FW-WTR-GDL-04). The highest priority for restoration actions would be within the conservation watershed network (FW-CWN-OBJ-02) to benefit native fish. Riparian areas in these watersheds would receive the greatest benefits and actions would focus on stream crossings. The benefit of re-establishing riparian vegetation at these sites would not vary between alternatives.

For riparian areas east of the Continental Divide, the adoption of RMZs would increase the area protected by plan components. Therefore, the adoption of RMZs would provide more protection for water quality and riparian resources. The planning areas west side of the Continental Divide RMZs would largely not lead to different outcomes from current INFISH directions in alternative A.

The effect on aquatic resources would be the same across all GAs for restoration projects because all plan directions for restoration would be required across the planning area. Effects from restoration projects would have a long-term positive effect, but the short-term effects may be negative. Typically short term effects occur during implementation due to increased sediment, however, long term sediment reductions are accrued. Standards and guidelines would mitigate the general negative effects described above under all alternatives through the required implementation of BMPs, such as FW-WTR-STD-03.

The restoration directions under the revised forest plan include guidance to promote the long-term ecological integrity of ecosystems and conserve the genetic integrity of native species (FW-WTR-STD-04). Objective for restoration work is 1 to 5 acres of groundwater dependent systems with a focus on priority watersheds as determined in the watershed condition framework (FW-FAH-OBJ-01) and conservation watershed networks have the highest priority for restoration actions for the aquatic environment (FW-CWN-OBJ-02).

Restoration effects can be of a long term positive effect but be of a short negative nature; typically short term effects occur during implementation by increasing sediment, however, long term sediment reductions are accrued. Plan directions would mitigate the general negative effects described above under all action alternatives through required implementation of BMPs (FW-WTR-STD-03). Standards and guidelines would limit management in RMZs, and road construction.

Alternative A

A wide variety of watershed restoration activities may occur throughout the life of this plan. These activities include instream restoration projects, including the installation of large woody debris, riparian planting, fish barrier installations, and road restoration projects, including road relocation projects, road decommissioning, and fish passage projects.

The current 1986 Lewis and Clark and Helena forest plans do not specifically have plan directions for restoration projects. However, INFISH amended the 1986 Helena NF plan for those planning areas on the west of the Continental Divide and includes four guidelines for restoration. Restoration actions since that time have primarily focused on culvert removals, road decommissioning, road relocation and slump stabilization. These activities resulted in improved fish passage and sediment reduction. These activities would continue under alternative A. Stewardship funding is currently a tool often used for restoration projects as well as appropriated dollars for watershed and fisheries and would likely continue under alternative A.

There are no guidelines for restoration in either the 1986 Lewis and Clark or the Helena forest plans. Much of the restoration efforts in the planning area have been focused in riparian areas to restore mining and grazing impacts. Restoration activities have included planting, fencing, bank stabilization, and stream restoration. These activities have resulted in benefits to riparian functions and stream processes. Future benefits from these restoration projects are expected to continue under alternative A. On the west side of the divide, the INFISH amendment to the Helena 1986 plan includes four guidelines for fisheries and wildlife restoration (FW-1 thru FW-4) and two general watershed and habitat restoration guidelines (WR-1 and 2). These directions include instructions to design and implement restoration projects that promote long-term ecological integrity of ecosystems, conserve the genetic integrity of native species and contributes to the attainment of the riparian management objectives. Restoration actions since that time have primarily focused on culvert removals, road decommissioning, road relocation and slump stabilization.

Alternative E

Alternative E would result in the highest volume of timber production and therefore have the potential to generate more money from timber receipts for restoration projects for watershed and fisheries. If more money is available from alternative E then there would be more short-term impacts from restoration projects but there would be more long-term gains.

Removing aggrading substrate behind placed stream-structures can reduce the low-flow wetted channel width and the width-to-depth ratio, increase sinuosity and meander pattern, and over time restore floodplain connectivity. Installing woody debris structures can stabilize stream channels over the long term and make them more resistant to erosion by dissipating stream energy during periods of high runoff. Gravel bars typically re-vegetate with riparian species such as alder or willow, ultimately leading to channel narrowing and stabilization. Restoration of floodplain connectivity over time would result in more frequent inundation of the floodplain, fostering the creation of side channels, seasonally flooded potholes, and other kinds of off-channel habitats.

Placement of large wood can improve sediment routing while creating more physically complex fish habitat. The stability or longevity of this wood within streams is strongly linked to its size, orientation to flow, channel dimensions, watershed area above the structure, and the percentage of the log that is in the active channel. Eventually some movement downstream would take place. Pieces that move can become incorporated in larger wood complexes or hang up on streamside trees or other channel features.

Fisheries, aquatics and conservation watershed networks

Effects common to all alternatives

Many watersheds in the Rocky Mountain Range and Upper Blackfoot GAs that support the healthiest populations of native trout already have their headwaters protected through lands managed as Congressionally-designated wilderness areas (Bob Marshall and Scapegoat Wilderness) or the HLC NFs eligible wild and scenic rivers. These special places are the building blocks of a conservation network as naturally functioning headwaters have a large influence on the function of downstream reaches.

Effects common to all action alternatives

The greatest benefit to aquatic species occurs where non-native species do not negatively impact native populations. The effects of plan components on aquatic species do not vary between alternatives. Proposed estimated acres of wilderness would vary by alternative. However, the proposed acres are located in inventory roadless. Therefore the difference in roaded acres would not change substantially.

The most significant change between action alternatives and the existing plan (alternative A), is the incorporation of forestwide standards and guidelines that are specifically designed to protect aquatic resources. The impacts to aquatic resources from all action alternatives would provide a greater level of protection for aquatic and riparian resources than alternative A. Additional riparian protection would also be provided since the RMZ would be increased to 100’ for intermittent streams in all watersheds. There would also be a 300’ RMZ on all ponds and wetlands regardless of size which is a change from alternative A. RMZs are not exclusion zones but forest management is allowed to occur with greater flexibility in the outer portion of RMZs. Guidelines (FW-RMZ-GDL-01 and 02) are designed to protect riparian and aquatic resources by taking a multi-scale, multi-resource hard look at stream habitat and riparian conditions prior to entry. The greater protection provided by plan components, including RMZs and conservation watershed networks, in the action alternatives east of the Continental Divide would maintain and enhance habitat for aquatic species, including SCC, more rapidly than the no-action alternative.

Standard FW-FAH-STD-01 and FW-FAH-GDL-01 assures when improving stream diversion or constructing new diversions and associated ditches they are designed and screened to prevent fish capture.

FW-FAH-GDL-04 guides the development of allotment management plans to be designed to maintain water quality by minimizing disturbance from livestock grazing in active allotments. FW-FAH-GDL-05 states that all construction activities within the ordinary high water mark that may result in adverse effects to native or nonnative aquatic species would be limited to times outside of spawning and incubation periods.

Restoration activities would focus on "storm proofing" the existing road network in light of climate change. Maintaining migratory life histories is an important element of conservation. Selecting numerous watersheds rather than a select few provides the greatest opportunity to maintain connectivity and a migratory life history. Watersheds occupied by both bull trout and westslope cutthroat trout populations, which are, or are nearly genetically pure, correspond well with the primary conservation area for grizzly bears, which would also limit the road network.

Spread and introduction vectors are inherent to most projects and types of forest use. Thus, components of the plan require mechanisms for addressing aquatic invasive species. More general or universal objectives and procedures, such as using current best practices for equipment washing before and after entering an area, are recommended for inclusion in the fish and aquatic wildlife sections of the document. This better assures that these components are included as resource protection measures at the project level. These activities would include, but aren't limited to: transporting water across drainage boundaries for fire suppression, constructing stream fords, operating equipment in a riparian area and near a water course, and the use of pumps and sumps for fire suppression, or construction related dewatering activities.

All action alternatives would emphasize RMZs and would facilitate management of multiple ecological goals and long term ecological sustainability on a landscape basis. Updated aquatic and riparian desired conditions, objectives, standards, and guidelines would be applied in a consistent manner across the forest. The action alternatives would provide a mechanism to effectively prioritize activities and weigh multiple risks to various resources.

Under all action alternatives, the Conservation Watershed Network (appendix E of the Draft Plan) provides a network of watersheds designed to emphasize conservation of westslope cutthroat and bull trout by protecting and restoring components, processes, and landforms that provide quality habitat. The objective for selecting conservation watersheds is to contain the largest intact populations and provide long term protection to bull and westslope cutthroat trout populations across the Forest. All occupied or expected to be occupied bull trout streams were designated conservation watersheds networks. An objective of the conservation watershed network is to identify and conserve watersheds that would have cold water to support native fish into the future in the face of climate change.

A key strategy in these watersheds is no net increase in the road network and stream crossings as identified in guideline, FW- CWN-GDL-01. Reducing roads would reduce potential sediment inputs, benefit aquatic species, and improve ecological function.

The effects of implementing the conservation watershed network plan components would be similar across all action alternatives. All CWN priority watersheds on the east side of the divide are new for the proposed forest plan. West of the Continental Divide, priority watersheds were identified in 1996 after adoption of INFISH. Additional watersheds have been included in the proposed plan as part of the action alternative where native fish such as westslope cutthroat are present. These plan components provide direction that makes these watersheds a priority for restoration (FW-CWN-OBJ-02). Across the planning area, aquatic habitats and water quality within CWNs would receive additional protection from plan components that limit net increases in stream crossings and road lengths within RMZs (FW-CWN-GDL-01) and CWNs would receive priority for road closures or other strategies to reduce sediment (FW-CWN-GDL-02). Livestock grazing management would be subject to plan components designed to minimize damage to aquatic ecosystems, vegetation and streambanks (FW-CWN-GDL-03). The action alternatives provide additional protection to native species assemblages throughout the plan area compared to the no-action alternative.

The effects on fisheries and aquatics from other resources such as restoration, wilderness, noxious weeds, wildlife management, and recreation are the same as the riparian section since wetlands are a type of riparian area and can be found in those sections.

The Conservation Watershed Network (appendix E of the draft plan) provides a network of watersheds designed to emphasize conservation of westslope cutthroat and bull trout by protecting and restoring components, processes, and landforms that provide quality habitat. The objective for selecting Conservation Watersheds is to contain the largest intact populations and provide long term protection to bull and westslope cutthroat trout populations across the Forest. All occupied or expected to be occupied bull trout streams were designated conservation watersheds networks. An objective of the Watershed Conservation Network is to identify and conserve watersheds that would have cold water to support native fish into the future in the face of climate change. A key strategy in these watersheds is no net increase in the road network and stream crossings as identified in guideline, FW- CWN-GDL-01. Reducing roads would reduce potential sediment inputs, benefit aquatic species, and improve ecological function.

Many watersheds in the Rocky Mountain and Upper Blackfoot GAs that support the healthiest populations of native trout already have their headwaters protected through lands managed as Congressionally-designated wilderness areas (Bob Marshall and Scapegoat Wilderness) or the Helena-Lewis and Clark's WSRs. These special places are the building blocks of a conservation network as naturally functioning headwaters have a large influence on the function of downstream reaches. See additional conservation watershed network information in appendix E of the Draft Plan.

Alternative A

East of the Continental Divide the Helena and the Lewis and Clark 1986 forest plans are unchanged from their original wording in alternative A. The plans have directions for the protection and management of watersheds and water quality. The 1986 Lewis and Clark forest plan includes forestwide directions specific to riparian management areas (MA-R) for soil and watershed protections during all management actions and includes directions to revegetate disturbed areas. The Helena forest plan also includes general watershed guidelines for protection of water quality during the management actions. Included are directions to delineate riparian areas prior to any management activities and includes a riparian buffer of 100 feet from the edge of all perennial streams. Both plans require the adherence to the State of Montana water quality standards and the State of Montana SMZ standards would still apply during timber harvest. All management actions would continue to require design and implantation of mitigation measures through the use of the 2012 National BMPs to control erosion and protect water quality.

The INFISH implemented west side of the Continental Divide, as it was amended to the Helena forest plan in 1996, is unchanged from its original wording in alternative A. INFISH reduced the risk to watersheds, riparian and aquatic resources by improving riparian zone protections to protect habitat and populations of native fish. INFISH has standards and guidelines for timber, roads, grazing, recreation, minerals, and fire management that have improved water quality and stream habitat within the Upper Blackfoot GA and the western portion of the Divide GA. The continued implementation of INFISH direction, TMDL plan implementation, BMPs, reduction of road construction, and a reduction of timber harvest along streams due to riparian habitat conservation areas likely helped and continue to reduce sediment delivery to streams from roads, mining related impacts, and other actions.

As protection measures outlined in the 1995 INFISH BO continue to be implemented on the west side GAs (Divide and Upper Blackfoot), the goal of improving habitat conditions as well as benefitting designated critical habitat and stabilizing or increasing populations of TES would have a greater probability of success.

For the east side GAs, continued efforts to restore, enhance and stabilize riparian ecosystems would continue. The implementation of the State's streamside management law during timber management would continue in both east and west side GAs. Efforts directly related to protecting and maintaining the viability of existing populations of sensitive species in east side GAs would continue.

Under alternative A, it is anticipated that the level of diversity for the water quality indicator macroinvertebrate assemblage across the entire planning unit would be at least maintained, at current proportions. The discussion of effects of forestwide direction on water quality and INFISH also apply to the effects alternative A would have on aquatic threatened and endangered species and sensitive species.

At the time of the draft EIS, bull trout were listed as threatened while westslope cutthroat trout and western pearlshell mussels were sensitive species known to occur on the HLC NF. East of the Continental Divide, alternative A would not provide as much protection for fisheries and aquatics as the action alternatives and may provide for less and more gradual movement towards desired conditions.

The no-action alternative did not consider impacts from non-native and invasive species and plan components such as FW-CONNECT- GDL-01 would help educate the public about aquatic invasives species.

Conservation watershed networks are only delineated under the 2012 planning rule and are not included in the 1986 forest plans east of the Continental Divide. West of the divide, CWN adopted INFISH priority watersheds would maintain their status under alternative A.

Alternative A does not incorporate a watershed approach to the management of hydrology and watershed processes; there would not likely be watershed scale consideration and protection of aquatic habitat and riparian area functions. This would result in the continued protection of areas currently in satisfactory condition and areas currently in unsatisfactory would remain unchanged.

Soils

Effects common to all action alternatives

All action alternatives would emphasize RMZs and would facilitate management of multiple ecological goals and long term sustainability of soil resources on a landscape scale with consistency across the Forest. These alternatives would also provide a mechanism to effectively prioritize activities and weigh multiple risks to various resources.

Additional research is needed to establish minimal necessary amounts of organic matter by habitat type. In the interim, the soil management on the HLC NF has adopted the guideline FW-SOIL-GDL-05 that conserves the forest floor and coarse wood levels. This component would help ensure that soil productivity is maintained in the long term.

Alternative A

The existing forest plans have protections for native soil and dictates soil productivity will be maintained. Regional standards include a 15 percent detrimental soil disturbance limitation that are not included in the current plans. Alternative A does not incorporate a watershed approach to the management of soil resources. There would not be watershed scale consideration and protection of soil processes and functions. The result would be the continued protection of areas currently in satisfactory condition and areas currently in unsatisfactory would remain unchanged.

Effects of plan components associated with:

Recommended wilderness

Effects common to all action alternatives

Plan components for RWAs would be beneficial for water resources. The amount of RWAs varies by alternative; alternative D includes the most, followed by B/C, and E includes no RWAs (Table 25). The overall effect of RWAs in the Draft Plan are expected to be beneficial to water quality and quantity because of the limitation on land management activities within RWAs. However, the proposed RWAs are already, for the most part, located in IRAs which impose limitations on management actions (i.e. roads building, vegetation management) within those areas. Only 3 to 7 percent of the RWAs in the action alternatives are outside of the IRAs. Therefore, the magnitude of the positive effects to water resources of the action alternatives relative to the no-action alternative are small. Alternative E includes no RWAs therefore no additional protection outside of IRAs would apply. Recommending these areas as wilderness would ensure that wilderness characteristics are maintained and would provide protection of habitat conditions. If Congress were to designate the RWAs, activities that would negatively impact wilderness character, such as road building or timber harvest, would likely not occur.

Table 25. Summary of RWA acres in IRA acres by alternative

Alternative	Total RWA (Ac)	Total Acres Of RWA within IRA	Percent of RWA In IRA
A	34,225.87	33,759.73	98.64
B and C	213,075.67	207,403.62	97.34
D	474,588.71	441,044.92	92.93
E	0	0	0

RWAs would confer beneficial effects to riparian areas. However, these acres are largely IRAs and there is currently little active management. Recommending these areas would ensure that wilderness characteristics are maintained and protected and active management of RMZs limited to prescribed fire or use of wildfire. Revised forest plan components for the protection and management of riparian management areas would be the same for all action alternatives and provide the same level of plan direction.

The best remaining trout habitat conditions are found in wilderness and unroaded landscapes (Hitt & Frissell, 2000; Kershner, Bischoff, & Horan, 1997; Rhodes, McCullough, & Espinosa, 1994; USDA, 1995b). Across the west, roadless areas tend to contain many of the healthiest of the few remaining populations of native trout, which are crucial to protect (Kessler, Bradley, Rhodes, & Wood, 2001). Most of the recommended wilderness would be located in areas already designated inventoried roadless areas. These areas are a source of high quality water essential to the protection and restoration of native trout. The high quality habitats in roadless areas help native trout compete with non-native trout, because degraded habitats can provide non-natives with a competitive advantage (Behnke, 1992). Roadless areas tend to have the lowest degree of invasion of non-native salmonids (Huntington, Nehlsen, & Bowers, 1996). Areas of low road density also act as the foundation for the needed restoration of larger watersheds.

The RWAs are already situated in IRAs, RNAs, and proposed wilderness areas which already have limited management direction that minimizes disturbance in those areas. Therefore, the magnitude of the potential differences to water resources based on RWAs is relatively small at the programmatic level.

Alternative A

The current 1986 Helena NF plan as amended include 34,226 acres of RWAs. No RWAs are still proposed in the 1986 Lewis and Clark NF plan. The areas of RWAs are high elevation and would protect headwater habitats that would provide cold clean water downstream to fish and habitat and natural conditions would be maintained in the RWAs. Under the current plan, 99 percent of the RWAs are currently in IRAs and already have a high degree of protection from management activities which further protects water quality.

Wildfire and fuels

Effects common to all alternatives

Fire is a natural disturbance process that has historically influenced the forests within watersheds, including riparian areas and forests adjacent to water features (see section 3.2.5 Riparian areas and wetlands affected environment, natural disturbance processes). Fire is expected to continue to function as a natural process across the planning area, especially within designated wilderness and unroaded lands. Wildfires can affect water chemistry, water quantity, and stream channel structure through changes in transpiration, infiltration, ground water recharge, erosion and mass wasting, riparian shading, and the recruitment and delivery of coarse debris (Benda & Dunne, 1997; Gresswell, 1999; Moody & Martin, 2001a, 2001b; Wondzell, 2001). Potential post-wildfire risks from floods, landslides, and debris flows to human life, property, and/or municipal supply watersheds are an increasing concern across the western United States (Moody & Martin, 2001a).

Climatic events following wildfire can trigger surface erosion or mass failures (landslides), which in turn can deposit sediment that alters stream channel structure and function. Severe wildfire can result in large expanses of blackened areas that have a high potential for generating runoff and delivering sediment to streams during intense rainstorms. When wildfire burns through riparian areas, streams may be left with no shade leading to an increase in water temperatures.

The Forest has experienced an increase in large fires over the last two decades. Based upon monitoring from MTDFWP following the Fool Creek Fire (2007), juvenile fish populations increased in streams that experienced large fires. Additionally, bull trout redd counts demonstrated a strong increase following the Snow-Talon Fire in 2003 in the Copper Creek drainage. This is largely due to an increase in nutrients following the fire. Overall, fire is beneficial to fish as fish have evolved with fire over the last 10,000 years, with the exception of the last century due to fire suppression. Impacts to fish are largely a result of fire suppression activities due to increases in sediment, misapplication of retardant, withdrawing water if proper screens are not in place, and other actions. Standards and guidelines for fire management were first adopted with INFISH on the west side of the divide and are included across the planning area in this plan. Plan components do not differ between alternatives and the effects would be the same across alternatives: wildfires may result in short term impacts with long term benefits due to nutrients while suppression activities result in impacts that should be mitigated with plan components.

For the past twenty years fuels were treated with a combination of mechanical treatment and predominantly underburning instead of broadcast burning. Broadcast burning removes slash and understory vegetation to facilitate reforestation, but has had negative consequences by consuming the forest floor and groundcover. Underburning, on the other hand, results in low and moderate burn severity that retains soil groundcover and forest floor. It is also used in conjuncture with whole tree yarding that removes fuel even before burning. A tradeoff of whole tree yarding, however, is the export of nutrients offsite by removing foliage.

For the next planning period, the Forest would continue to treat fuels using a mixture of pile burning, mechanical removal and under burning. The treatment type affects soil condition by removing vegetation that would otherwise decompose in soil and build up soil carbon. The loss of vegetation by treating fuels is not far removed from natural processes since fire regularly removed vegetation. However, the impacts may vary by site type. In some areas, treating fuels aligns with ecological processes and the soils have a higher proportional amount of organic matter in the mineral soils to buffer the removal. For other moist types, the fuels treatment may not directly align with natural cycles. Treating fuels temporarily removes dense growth but the moist conditions favor quick regrowth. Repeated removal of vegetation to mitigate fire hazard would be out of sequence with the long periods between fires that these vegetation communities typically experienced. These treatments would reduce vegetation leaf and root litter contributions to soil with overall impacts depending on soil fertility.

Managing prescribed fire and wildfire for resource benefit poses temporary risk for erosion/ deposition during at least three years post fire depending on remaining groundcover. After fire, the blackened ground stabilizes as plant cover and roots secure the surface, and loose exposed soil transports downslope.

Effects of wildfire on stream runoff, sedimentation and nutrients are largely beyond the forest planning scope because we cannot predict when and where wildfires will burn.

Effects common to all action alternatives

All action alternatives would have similar direction for fire management. Specific plan directions to limit impacts from fire suppression activities include:

- RMZs and habitat may still be impacted in certain circumstances when no other suitable locations for incident bases, camps, heli-bases, staging areas, etc., exists (FW-GDL-RMZ-08).
- RMZs would have limited exposure to fire retardant (FW-RMZ-GDL-09)
- Fuels treatments often require the use of ground based equipment, the Forest would apply the same mitigation as for timber harvest to limit soil disturbance. The same guidelines for timber would also apply for retaining minimum levels of soils organic matter and ground cover (FS-SOIL-GDL-05). The levels may vary depending on the fire risk, site type, and soil condition (FW-TE&V-GDL-10).
- Only allow location of temporary fire facilities in rare circumstances (FW-RMZ-GDL-07)
- New direction strengthens protection against adverse impacts from fire suppression activities across the entire planning area to riparian zones.
- Fire line construction and use of heavy machinery would be conducted to minimize impacts to riparian areas (FW-RMZ-GDL-05).
- Storage of fuels or other toxicants would not be allowed except in rare circumstances, under which the approval of an aquatic or resource specialist is required (FW-RMZ-STD-03 and 06).
- Areas of high risk would be mapped to improve the communication of where aerial operations need to avoid dropping fire retardant (FW-RMZ-GDL-10).

Standards and guidelines would mitigate general fire management effects under all action alternatives. There is no differences in effects between alternatives because it is nearly impossible to predict the extent and location of large wildfires. However, it is assumed that impacts to riparian areas would still occur where fire management activities, primarily suppression efforts take place. Impacts to RMZs and habitat may still occur in certain circumstances when no other suitable locations for incident bases, camps, helibases, staging areas, etc., exists. Delivery of chemical retardant, foam, and other additives near or on surface waters may occur when there is imminent threat to human safety and structures or when a fire may escape causing more degradation to RMZs, than would be caused by addition of chemical, foam or additive delivery to surface waters in RMZs. Conversely, where management treatments are used to reduce wildfire hazard, positive long-term effects to riparian areas by not burning may be realized.

Wildfire suppression and prescribed fire tactics can affect watershed resources through the process of building fire line and large fuel-breaks, using fire retardant, causing soil disturbance, and removing vegetation. Ground-disturbance from wildfire suppression can cause a net decrease in effective ground cover that no longer resists rainfall runoff. These activities can route sediment to streams from compacted machine paths and linear features that channels runoff. Rehabilitation efforts after fire would mitigate these effects across the fire area. The action alternatives would minimize these effects by limiting fire suppression activities away from the most sensitive areas, RMZs (FW-RMZ-GDL-05 and 06). The action alternatives carry forward forest plan components to locate fire camps away from riparian areas where risk of sedimentation and risk of degradation to water quality are highest (FW-RMZ-GDL-08). The action alternatives would have stronger language to avoid degrading water quality from suppression activities by minimizing suppression activities in RMZs (FW-RMZ-GDL-06 and 11), and with specific direction to avoid prescribed fire ignition in RMZs without site specific analysis (FW-RMZ-STD-03).

All action alternatives include plan direction that supports the role of fire and its use across the Forest to a greater degree compared to current plan direction (see Fire and Fuels section). Managing fire (both planned and unplanned ignitions) for resource benefit would promote ecological processes by allowing low and moderate severity fire to burn within riparian areas at a more natural rate. It would also help create desired forest compositions and structures. Use of fire as a tool within RMZs would likely occur to a similar extent under all action alternatives, because of the potential ecological benefits and ability to help maintain or achieve desired vegetation conditions within RMZs.

The proposed riparian directions for fire management within riparian areas would be more restrictive on the east side of the divide (approximately 85 percent of the planning area) than the current forest plans. They would aid in the maintenance of water quality and riparian desired conditions from fire management. There would be no difference in fire management effects of plan components on the west side of the divide as the proposed plan components were adapted from INFISH standards.

All action alternatives would increase the area where fire may be used as a tool for resource benefit when compared to current direction under alternative A. Managing fire (both planned and unplanned ignitions) for resource benefit could increase incidents of sediment deposits, but would promote ecological processes by allowing low and moderate severity fire at a more natural rate. The amount of acres burned across all action alternatives are relatively small and the effects would not vary. Therefore the effects to water quality and quantity would not vary by alternative.

Alternative A

Fuels treatment would continue as a method to reduce fire risk. Prior to year 2000, fuels treatment was primarily a connected action to timber treatment. With the National Fire Plan passed in 2000, fuels treatment intensified steadily in tandem with commercial harvest and as a separate treatment. Fuels treatment also involves managing wildfire for resource benefit since many areas on the forest have not been subjected to fire over the last 100 years.

The 1986 Lewis and Clark NF and Helena NF plans includes plan directions for fire in riparian areas (Table 26). On the west side of the divide, INFISH standards include:

- FM-1 to design fuels treatments and fire suppression as not to prevent attainment of riparian management objectives.
- FM-2 has specific requirements for locating bases, helibases, staging areas and other centers for incident activities outside of Riparian Habitat Conservation Areas.
- FM-3 avoid delivery of chemical retardant, foam, or additives to surface water.
- FM-4 design prescribed burn project to contribute to the attainment of the riparian management objectives.
- FM-5 Develop a rehabilitation treatment plan to attain riparian management objectives and avoid adverse effects on inland native fish whenever RHCA are damaged.

Table 26. Effects of plan components for prescribed fire and wildfire for aquatic ecosystems – alternative A

Plan Component(s)	Summary of expected effects
Helena NF Forestwide Prescribed fire Standards II/33.	This section provides standards that would guide and/or limit prescribed management activities. Prescribed fire would not exceed natural fire intervals. Soil surveys would be used to assist with site selections to avoid potential soil and watershed degradation. See below for INFISH amendment.
Lewis and Clark NF Management Areas MA-R (3-91)	This section provides standards for specific to riparian areas that guide and/or limit management activities. Management area guidance describes special considerations for the minimization of activities in riparian areas, standards for active fuels reduction methods and planned ignitions for the enhancement and maintenance of riparian areas resources.

Invasive weed treatments

Effects common to all alternatives

Noxious weeds are often treated using an integrated approach, with a combination of control methods that include mechanical, biological, and chemical. The effects of some of these methods are discussed here.

Effects from herbicide application depend on the type, extent, and amount of herbicide that is used, the sites' proximity to a stream or wetland, a stream's ratio of surface area to volume, and whether transport from the site is runoff or infiltration controlled. Chemical persistence in the soil profile and surface water depends on the potential for the chemical to leach through groundwater, the size of the treatment area, velocity of streamflow, and hydrologic characteristics of the stream. Herbicide use on the forest abides by MCA 75-5-605 and Section 402 of the Clean Water Act.

Mechanical treatments can result in localized soil disturbance as plants are pulled. Increased sediment to streams along road cuts and fills within riparian areas is possible, but the increase would likely be undetectable due to several factors. First, not all vegetation in a treated area would be pulled, so some ground cover would still be in place. Second, not all sediment from pulling weeds along roads would reach a stream because many relief culverts divert ditch flow onto the forest floor away from streams. Finally, hand pulling is very labor intensive and costly; thus, only a few acres per year could be treated using this technique across a watershed.

Effects common to all action alternatives

Although many threats to water quality from chemical application may be reduced by applying BMPs, they cannot be eliminated. The Draft Plan include specific directions for invasive weed treatment in and around RMZs to protect water quality. Standard FW-STD-RMZ-05 would apply to RMZs to minimize effects to water quality by allowing the use of alternatives to chemicals for treatments within RMZs, thus reducing leaching or drift from chemicals into the water.

Alternative A

The 1986 plans have directions to apply soil and conservation and BMPs to protect water quality. The Lewis and Clark NF 1986 plan emphasizes preventing noxious weeds by reseeding, and adherence to state water quality standards (Soils and Water Management Standards F-3) as required in the Clean Water Act. The 1986 Helena NF plan has the following specific directions for the use of chemicals within riparian areas, "will be minimized to the extent feasible, and will be coordinated with wildlife, watershed, and fisheries personnel and a certified pesticide applicator."

Wildlife management

Wildlife management activities that could affect water quality may include road decommissioning, vegetation management, and stream and riparian restoration. The effects on water quality from those activities are discussed in the timber, RMZ, restoration, motorized travel, infrastructure and other appropriate sections.

Recreation

Effects common to all alternatives

General effects from recreational use, construction of facilities, and maintenance of facilities and sites to watershed resources can include undesirable changes to: (1) upland and riparian soil and vegetation conditions, causing increased erosion and runoff, decreased soil-hydrologic function, loss of vegetative cover and wood recruitment, and reduced water quality; (2) stream morphology, water quality, streamflow, and substrate; and (3) water quality from spills of fuel, oil, cleaning materials or human waste associated with equipment, and the pumping of toilets.

Trail maintenance can affect large wood recruitment and function that influences stream channel morphology and aquatic habitat. Bucking out fallen trees can reduce the tree’s length and sever the bole from its root wad. Smaller tree lengths are not likely to contribute as much to stream channel stability and are more likely to be washed out during high stream flow events. Smaller instream wood would also delay the recovery of channel features needed to maintain habitat for aquatic species, including overhead cover and low-velocity refugia during high-flow events.

Impacts from trails may include rutting, erosion, and loss of ground cover from user-created trails, trampling of vegetation, vegetation removal, and soil compaction of streamside and upland sites. Rutting may increase surface erosion associated with heavily used trails. High-use campsites may cause root damage in trees resulting in reduced vigor and mortality. In combination, these activities can lead to increased erosion and a reduction in water quality. Increases in recreational visitors increase risks to aquatic communities. The greatest threat from recreation is introduction of aquatic nuisance species. These species include any non-native plant or animal species and disease which threaten the diversity or abundance of native species, the ecological stability of infested waters, or commercial, agricultural, or recreational activities dependent on such waters. The Montana Aquatic Nuisance Technical Committee (2002) identifies over 70 nuisance species. Some, well known in Montana, include the New Zealand mudsnail, curley-leaf pondweed, whirling disease, and non-native fish. While non-native fish like brook and rainbow trout are desirable in many locations, there are places where they are not. An environmental assessment by the MFWP is now required before fish introductions can legally occur.

Most of the pathways of introduction and spread of aquatic nuisance species are related to human activities, both accidental and intentional. The New Zealand mudsnail and whirling disease can be accidentally transported and spread by way of recreational boats and wading boots. The Forest would continue to cooperate and support measures taken to limit the spread of aquatic invasive species. Streambank trampling, camping along the stream’s edge, heavy sport fishing, and wheeled motorized vehicle use on designated routes and areas usually result in the loss of vegetation within riparian areas. Loss of vegetation from shorelines, wetlands, or steep slopes can cause erosion and water pollution problems (Burden & Randerson, 1972).

Montana Fish, Wildlife, and Parks enforces laws, rules and regulations that are designed to prevent over-exploitation of fish populations through angling with catch and release fishing or low daily and possession limits for westslope cutthroat trout throughout most of the forest. All waters are closed to angling for bull trout and all fish must be release immediately. There is some incidental mortality to fish when they are caught and released. Habitat alteration from recreational camping and day use sites may cause site-specific impacts, but should not extensive enough to measurably limit fish populations. Localized impacts to vegetation and banks in riparian areas occur at lakes with trout and at river access sites. Effects would be the same between all alternatives. Unmeasurable effects on aquatic and riparian resources from fishing are to be expected.

In general, people who recreate in NFs participate in activities such as driving, hiking, horseback riding, hiking, and camping in the vicinity of lakes and streams. Recreational use is anticipated to increase in the coming decades. Projected increases in recreational use are commensurate with all alternatives.

Implementation of current forest plan direction and BMPs to protect aquatic and riparian resources notwithstanding, impacts to these resources would likely increase given increased public use because stream and lake environments would continue to attract forest users.

Effects common to all action alternatives

Table 27 summarizes the effects of Draft Plan components for recreation on aquatic ecosystems. The Draft Plan includes guidance to manage developed recreation facilities to be responsive to environmental changes such as water flow, fish and wildlife habitats (FW-REC-GDL-01). Plan components in all action alternatives direct the placement of new developed recreation facilities to avoid the inner RMZ to protect fishery resources and riparian-associated plant and animal species (FW-REC-GDL-03 and 04). The Forest should consider relocating recreation facilities that are currently located within RMZs that have documented degradation of aquatic or riparian resources (FW-REC-GDL-05). Forestwide guideline (FW-REC-GDL-06) would protect water resources by guiding new and reconstruction of sanitary waste facilities outside of the inner RMZ.

There are no differences in effects between action alternatives as all would adopt the RMZ plan components across the planning area. For riparian areas east of the Continental Divide, the adoption of RMZs would increase management directions within these areas. Therefore, the adoption of RMZs would provide more protection of water quality over the existing forest plan. On the west side of the Continental Divide RMZs would largely not lead to different outcomes from INFISH directions in alternative A.

Table 27. Effects of plan components for recreation– all action alternatives

Plan Component(s)	Summary of expected effects
FW-REC-GDL 01	Forestwide direction for developed recreation facilities should be responsive to environmental changes including stream flow, fish and wildlife habitats and vegetation.
FW-REC-GDL 03, 04, and 05	These directions restrict the location and placement of facilities outside riparian areas, groundwater dependent ecosystems, wetlands, channel migration zones. These new guidance's would have a limiting effect of management actions that could occur with these areas and would maintain or enhance habitats and water quality. The exception would be the west side of the divide as there would be little difference between (Amendment 14) INFISH and proposed RMZ widths. They would help provide resiliency in the face of warming climate.
FW-REC-GDL-05	This guideline provides directions where existing facilities within RMZs and are degrading aquatic or riparian resources they would be considered for relocation and the site restored. This would have a benefit to water quality and aquatic habitat.

Alternative A

The Lewis and Clark NF plan includes direction that protects riparian resources (MA-R) during the management of recreation. Riparian areas are delineated during project development. The plan provides direction to avoid construction of recreation facilities to protect riparian areas (i.e. roads, trails). The Helena forest plan east of the divide provides similar protections that discourage concentrated use in riparian areas, as well as the construction of roads in riparian areas.

The current 1986 Forest plans have forestwide direction to adhere to state water quality standards. On the west side of the Continental Divide, the INFISH provides additional standards and guidelines for recreation management mainly relocating or constructing new developed and dispersed sites outside of riparian areas. Many sites have been identified where excessive sediment from these sites are a concern. Dispersed sites typically do not have toilet facilities and concentrations of human waste at some locations have been found. Dispersed and developed sites are often located within riparian areas; the ground is often hardened and ground vegetation may have been removed. Trees have been felled for safety reasons in campgrounds and would continue to be felled. Under current direction, these trees would be removed or used as firewood and would not contribute to instream bank stability, thermal regulation, or fish habitat needs. Throughout the planning area, many developed recreation sites have been relocated due to adverse impacts to riparian management objectives and fish.

Motorized trails, travel management and roads

Effects common to all alternatives

The road network on the Forest affects water and aquatic resources on both a short and a chronic, long term basis. There are motorized roads open to the public as well as administrative use within the forest administrative boundary, including roads managed by other entities such as state Highways, a variety of county roads, federal/state land management agencies, and private timber companies. Many roads and motorized trail are located within RMZs that include many road-stream crossings. Routes located closest to water resources potentially provide a background level of disturbance that contributes to direct and indirect effects on aquatic and riparian resources. Motorized trails function similar to roads in regards to soil disturbance however impacts are generally less as there is less disturbed surface area.

Past culvert failures and road slumps have impacted water quality of the HLC NF, particularly at the site-level scale. Forest roads that are maintained on an annual basis are typically those roads that have the most administrative and visitor use. Closed roads receive less maintenance, and not all of these roads were put into proper long-term storage or had their culverts removed. There are stream crossings located on administratively closed FS roads with some culverts remaining that do not receive regular maintenance. Inspection and monitoring of culverts is a monitoring item to address this concern and provide maintenance.

A potential source for nutrients is phosphorus bonded to sediment (Ballantine, Walling, Collins, & Leeks, 2008; Wood, Heathwaite, & Haygarth, 2005). Detachment of soil particles and associated phosphorus is often linked to soil erosion, which provides a physical mechanism for mobilizing phosphorus from soil into waters (Wood et al., 2005). The greatest input of sediment is from roads.

Effects common to all action alternatives

Forestwide direction includes guidance that would alter road management on the Forest to address the detrimental effects of roads on water quality, wetlands, riparian areas, and aquatic species. The Draft Plan includes continued directions that road maintenance along open roads would include BMPs to minimize adverse impacts on water quality (FW-RT-DC-06). This desired condition along with those under other resource areas are intended to focus future road management to address the impacts of roads on water quality, aquatic, and riparian resources.

Many proposed plan directions that directly affect water quality related to routes and/or road management are the same or modified slightly from current direction, including:

- FW-RT-GDL-01, which is comparable to INFISH RF-2d, requires the Forest to minimize sediment delivery to streams from roads and road drainage to be routed away from potentially unstable channels, fills, and hillslopes. This guideline would reduce the amount of sediment delivered to streams both directly off road and from gullies and mass failures associated with unstable areas adjacent to streams.
- FW-RT-GDL-05, which is comparable to standards Facilities, Road Standard 3 under the Helena and Facilities L4 (22) under the Lewis and Clark forest plans (1986), requires that new and relocated roads, trails and other linear features should avoid lands with high mass wasting potential. This standard is intended to reduce road-related mass wasting and sediment delivery to watercourses, and is expected to prevent degradation of water quality at individual sites.
- FW-RT-STD-08, which is comparable to INFISH RF-2f, requires minimizing side casting into or adjacent to waterbodies when blading roads and plowing snow. This guideline is intended to prevent sediment and debris that are mobilized through blading and plowing from reaching streams and affecting water quality (suspended sediment) and fish habitat.

- FW-RT-GDL-11 requires that the transportation infrastructure should maintain natural hydrologic flow paths, (e.g., streams should be kept flowing in original channels). This guideline would ensure streams are not routed down ditches and into other stream channels in an effort to maintain current discharge and streamflow patterns and not increase erosion in roadside ditches.

Several plan components are modified slightly from current direction to have increased benefits for water quality and aquatic resources, including:

- FW-RT-STD-02, which is comparable to INFISH RF-4 and a new requirement carried over to the east side, requires that new, replacement, and reconstructed stream crossing sites accommodate at least the 100-year flow, including associated bedload and debris. This standard addresses stream crossing structures installed on roads and trails, including bridges and culverts, in order to, at a minimum, pass the 100-year flow plus associated bedload and debris, which would reduce the likelihood of blockages and mass failures at stream crossing sites. This standard differs from previous direction in that it applies more broadly to road and trail crossing structures, whereas INFISH RF-4 only required installation of a 100-year crossing structure where “a substantial risk to riparian conditions” exists.
- FW-RT-STD-04 prohibits side casting fill material when reconstructing or constructing new road segments within or adjacent to RMZs, which is comparable to the second part of INFISH RF-2f. This standard would apply across the entire forest, whereas the INFISH RF-2f standard only applies to INFISH priority watersheds. This standard is intended to expand benefits to riparian and water resources across all GAs, thereby reducing the likelihood of road failures and mass wasting into waterbodies across the entire forest.

Several plan components are new or expand upon concepts and benefits, such as:

- FW-RT-GDL-06 requires that roads that are to be decommissioned, made impassable, or stored would need to be left in a hydrologically stable condition. This standard would apply the concept of leaving a road in a stable condition if it is expected to no longer receive routine maintenance, including roads that are actively/newly stored, closed, or made impassable on the forest. Similarly, FW-RT-GDL-03 requires that travel routes that are to have a physical barrier blocking future access are first assessed for drainage features and treatments must be completed to avoid future risks to aquatic resources. In effect, this standard would require the forest to assess and treat drainage features on roads, skid trails, temporary roads, and trails prior to blocking off vehicular traffic to ensure the road is left in a hydrologically stable condition. The combination of these two standards would improve water quality downstream and adjacent to roads as a result of reducing the likelihood of sediment delivery from road failures where unmaintained culverts have become blocked and have failed.
- FW-RT-GDL-01 requires that the water drainage systems on roads, skid trails, temporary roads and trails should be hydrologically disconnected from surface waterbodies to prevent the delivery of sediment and pollutants and maintain the hydrologic integrity of watersheds. This guideline is a critical element to reduce non-point source pollution from forest roads and trails and is expected to have the greatest impact to maintain current water quality, prevent increased peak flows and water elevation in waterbodies, and maintain current hydrologic regimes across the forest. Under this guideline, water that is collected on hardened surfaces or in road ditches would be routed to the forest floor and allowed to infiltrate subsurface water systems in stable areas.
- FW-RT-GDL-04 requires that new or redesigned stream crossing sites should be designed to prevent diversion of streamflow out of the channels in the event that the crossing becomes plugged or experiences more water than the crossing was designed to handle. Under this guideline, effort would be taken when designing and installing stream-crossing structures to route high flows directly over the top of the road at that site to prevent water from running down the ditch or road surface, which can exacerbate more road failures and sediment delivery to streams. This guideline could be

considered similar to INFISH RF-2e, which requires each existing or planned road to avoid disrupting natural hydrologic flow paths.

- FW-CWN-GDL-01 requires that subwatersheds included in the conservation watershed network allow no net increases in stream crossings or road lengths (similar to the HNF road standard 1) within RMZs unless the net increase improves ecological function in aquatic ecosystems. This net increase is to be measured from beginning to end of each project. The no net increase of road lengths within RMZs is also expected to reduce the impacts of roads on water quality, as there would be less likelihood for road failures and mass wasting in the RMZ that could deliver sediment to streams.
- Relocation of current roads within riparian areas would be a priority for watershed restoration which would greatly improve riparian conditions and floodplain processes. There would be no net increase in the road network and stream crossings inside of RMZs for watersheds within the Conservation Watershed Network (FW-CWN-GDL-02).
- FW-RMZ-GDL-04 requires that new road construction, including temporary roads, is avoided in RMZs except where necessary to cross streams, a road relocation contributes to attainment of aquatic and riparian desired conditions, or FS authorities are limited by law or regulations. This guideline is consistent with and similar to the requirements of Montana’s SMZ law, which only allows road construction within the SMZ to cross streams, but the RMZs under the proposed plan are more comprehensive than the state-mandated SMZs. This guideline is expected to maintain water quality by reducing the likelihood for road failures and mass wasting in the RMZ that could deliver sediment to streams.
- FW-SOIL-STD-04 requires that soil function be restored when temporary roads are no longer needed and existing roads are decommissioned. The exact treatments necessary at any site would be determined based on site-specific characteristics, but in many cases, these standards would result in these road surfaces being decompacted and available slash would be applied. If the road has already revegetated and is found to already be in a hydrologically stable condition, these roads may not receive further treatment so as not to prevent disruption of the natural restoration process that has begun. But in the case when roads are decompacted and covered in slash, rainfall and water drainage is expected to infiltrate into the ground and no longer be delivered to waterbodies, which would reduce the likelihood of concentrating flow and improve water quality.
- FW-WTR-STD-03 and FW-SOIL-STD-03 require the use of BMPs to protect water quality.

Due to the programmatic nature of the DEIS, it is difficult to determine the effects of alternatives with respect to the use of roads during timber harvest. The effect on log hauling on aquatic resources is dependent upon a number of variables, such as, but not limited to: road surface, miles to access harvest units, number of stream crossings, proximity of a road to a stream, and amount of timber removed. These types of impacts are evaluated on a project-specific basis. Plan direction relative to roads is expected to minimize effects on aquatic resources.

The removal of stream-crossing culverts and reestablishment of a natural stream grade is expected to have the greatest impact on water quality and aquatic habitat in the action alternatives. As mentioned previously, Cook and Dresser (2007) found that stream-crossings that were restored through decommissioning delivered only 3 to 5 percent of the amount of fill material that was originally located in the road prism at the stream-crossing location. The action alternatives would sequentially improve crossings and reduce the risk of failure as funding is available across the forest and particularly in the conservation watershed network, which would decrease the amount of sediment delivery to streams that would result from potential road failures. These reductions would also result from the application of BMPs that prevent gully formation and downcutting through newly excavated stream channels, such as establishing a stream bed that mimics the natural stream gradient above and below the crossing, placing cobble-size rock in newly excavated streambeds, and distributing any uprooted vegetation and slash across stream-adjacent disturbed areas. Overall, all action alternatives are expected to provide a decrease in stream turbidity in forest waterbodies and streams, as well as an improvement of bedload size distribution and channel morphology over the long term.

The Draft Plan direction as well as the adoption of the RMZ directions would result in additional protection for riparian areas forestwide. The inner and outer riparian zone plan directions would also provide increased aquatic habitat and water quality protection which would maintain or move riparian resources towards desired condition. These effects would be most dramatic on the east side of the Continental Divide as indicated previously. Planning areas west side of the Continental Divide (approximately 421,000 acres or 15 percent of the planning area), the RMZs would largely not lead to different outcomes from current INFISH directions in alternative A.

Alternative A

Both east and west sides of the Continental Divide would continue to use the current forest plan directions and the application of national BMPs, all of which have shown to be effective at reducing the effects from roads on water quality. The 1986 Lewis and Clark NF plan has direction for riparian areas (Management R). Standards include the adherence to State water quality standards and maintain soil productivity. Require the use of flood proofing or alternative locations outside of flood plains. Soil and water standards specific to riparian areas require meeting state water quality standards, resource protections and watershed analysis to protect water quality require the design of roads and trails to mitigate damage to soil, watershed, and fish by road restrictions, other road management actions as necessary (L-2). Road and other facilities must be designed located (generally no closer than 100 feet) and constructed to protect riparian areas and to control erosion (L-4). L-4 also has restrictions for crossing of riparian areas and the operation of heavy equipment in streams. The 1986 Helena NF plan has road standards for road density and resource protection. The plan requires that a specialist in soils, watershed and fisheries to identify potential soil erosion, water quality, and fisheries problems and provide input to developing road design standards and maintenance. Unacceptable damage to soils, watershed, fisheries, wildlife, would be mitigated by road restrictions or other road management actions.

INFISH directions for GAs on the west side of the divide, require that all water bodies affected by existing or planned roads meet Riparian Management Objectives (RF-2) and a suite of protective measures, such as:

- Minimize road and landing locations in RHCA (RF-2b).
- Route road drainage away from potentially unstable stream channels, fill and hillslopes (RF-2d2)
- Avoid the disruption of the natural hydrologic flow paths. (RF-2e)
- Avoid side cast materials. (RF-2f).

RF-3 requires the influence of each road on the Riparian Management Objectives to be determined and to meet RMO and avoid adverse effects to inland native fish. Directions for the construction of new and improvements to existing culvert, bridges, and other crossings to accommodate a 100 year flood (RF-4) including associated sediment and debris and to provide, and maintain fish passage at all road crossings of existing and potential fish-bearing streams (RF-5).

In summary, outside of the INFISH areas, east of the Continental Divide, road building would continue to be allowed in riparian areas that surround water resources. Where new roads are constructed, including temporary roads, vegetation would be removed, the ground would become compacted, and gravel would be dumped to make a drivable surface for passenger vehicles. The amount of road building in riparian areas west of the divide would be constrained do to INFISH standards, but would be unconstrained on the east side of the divide.

Road maintenance is expected to continue at similar levels or slightly decreased levels compared to more recent management. Portions of the road network would be treated to repair and improve drainage structures, improve the running surface of the road, and to clear vegetation along roadsides. Short-term increases of sediment delivery to streams and waterbodies is expected as a result of road surface grading, and culvert and ditch cleaning near waterbodies.

Portions of the road system that are in particularly poor condition or are currently closed and in long-term storage would be reconstructed periodically, particularly in connection with land management activities, such as timber harvest projects. Road reconstruction includes application of surface rock, replacing damaged or poorly functioning culverts, adding stream-crossing or ditch relief culverts where necessary, some road widening, and removing roadside vegetation that is encroaching on the road surface and preventing vehicular passage. Again, these activities are expected to create some turbidity increases in nearby waterbodies, but BMPs would be employed to minimize erosion and sediment transport to waterbodies.

Watershed restoration actions within the HLC NF over the years have primarily focused on culvert removals/upgrade, road decommissioning, and road relocation. Under alternative A, road removal would continue to occur as funding allows. Water resources benefit from this decommissioning in the long term depending upon the proximity and extent of road near water. As described in the general effects, there would be some short term impacts to water quality from the sediment delivery during excavation activities in or adjacent to waterbodies.

Proper decommissioning or storing a road can eliminate long term effects from roads. Culverts that are not maintained or are undersized may become blocked with sediment and debris, eliminating its ability to pass water, bedload and debris downstream and increasing the likelihood of road failure and mass wasting. Many roads found during road decommissioning surveys were found to still contain culverts at stream-crossings. Most culvert found during these surveys have been removed. There would be no requirement to reduce stream crossing numbers and the lengths of roads in RMZs within the conservation watershed network, as required in the action alternatives (FW-CWN-GDL -01).

Motorized and nonmotorized winter recreation

Effects common to all alternatives

Nonmotorized winter uses may include but is not limited to cross country and alpine skiing, snowshoeing, and ice fishing. Motorized winter uses include motorized over-snow vehicle use, such as snowmobiling. Damage to vegetation and soil erosion may occur if there is inadequate snowpack to protect these resources. Also, winter motorized activities can result in compacted snow from grooming which often forms barriers that alter spring runoff patterns which can result in soil erosion and gullies.

Contamination by petroleum products such as motor oil and gasoline may degrade water quality in waters adjacent to areas of concentrated use such as parking lots and snowmobile staging areas. The likelihood and magnitude of the these impacts due to these activities are dependent on site-specific factors such as average slope, aspect, elevation, vegetation, weather conditions, available facilities, and the amount of use. Because site conditions vary, and because these sites are relatively small in area and widely dispersed, it is reasonable to assume that cumulative impacts would not be measurable at the forestwide scale.

Effects common to all action alternatives

For riparian areas east of the Continental Divide, the adoption of RMZs would increase the area protected by plan components. Therefore, the adoption of RMZs would provide more protection of water quality and resources. The planning areas west side of the Continental Divide RMZs would largely not experience different outcomes from current INFISH directions in alternative A.

Alternative A

The Forest has identified very few impacts from winter recreation on riparian areas while implementing the two 1986 forest plans as amended. Damage to vegetation and soil erosion may occur if there is inadequate snowpack to protect these resources. Also, winter motorized activities could result in compacted snow from grooming which often forms barriers that alter spring runoff patterns which can result in soil erosion and gullies.

Hiking and stock (nonmotorized)

Effects common to all alternatives

Hiking and stock trails are popular among forest users on the forest, though trail networks and trail use can adversely affect water quality. Given the popularity of trails among forest users, and the expected increase in recreation use, it is reasonable to expect demands by the public for additional hiking trails over the coming decades. If those demands are met, an expanded trail system could result in the alteration and degradation of water resources.

Nonmotorized trails typically have very little impact on water resources relative to roads. Sediment from trails generally gets routed onto the forest floor with no impact to water quality. However, there are locations where sediment is routed to streams at crossings. There are time when trails have slumped into streams due to their location paralleling a stream and not due to their use. Wildfires as well as high flow events have washed out trails both inside and outside of wilderness areas. These are temporary, localized impacts whish would not result in watershed scale impacts.

If facilities are insufficient for developed recreation, then recreational use may be shifted to dispersed sites. The result of this could be additional and unregulated deleterious effects on soils, vegetation, and riparian values. Recreational use is expected to increase in all alternatives and with the increased use, impacts would be expected to increase. These affects would be the same between alternatives as nonmotorized trails generate very little sediment and they are often located on ridges leading from trailheads to higher locations with views.

Effects common to all action alternatives

Forestwide guidelines FW-GDL-RT-01, 03, 04, 05, 06, 07, 09, 11, and 12 are designed to maintain the hydrologic integrity and water quality from the delivery of sediments and pollutants to water. This guidance would provide for drainage systems to minimize sediment input by assuring that water bars are in place, stream crossings are hardened, and the risk of slumps has been reduced. By doing so, any potential pollutants such as sediment, nitrogen and phosphorus would be routed to the forest floor rather than the stream network. Protection and direction for riparian areas includes limiting activities in RMZs to those would protect key riparian processes, including maintenance of streambank stability, input of organic matter, temperature regimes and water quality (FW-RMZ-GDL-13). To maintain hydrologic integrity of watersheds trails would be hydrologically disconnected from delivering water, sediment and pollutants to water bodies (FW-RT-GDL-01, 07, 11).

These Draft Plan directions result in additional protection for riparian areas by adopting RMZs. The inner and outer riparian zone plan directions would also provide increased aquatic habitat and water quality protection which would maintain or move riparian resources towards desired conditions. These effects would be most dramatic on the east side of the Continental Divide as indicated above. In the planning areas west side of the Continental Divide (421,000 acres or 15 percent of the planning area), the RMZs would largely not lead to different outcomes from current INFISH directions in alternative A.

Alternative A

The Lewis and Clark and the Helena 1986 forest plans include directions for resource protections to mitigate unacceptable damage to soils and watersheds. The plans direct the Forest to design and construct tails to protect riparian areas and control erosion.

Livestock grazing

Effects common to all alternatives

Approximately 1,756,541 acres (61%) of the HLC NF are classified as capable for cattle grazing, while 483,159 acres (17%) are suitable for grazing. There are a total of 234 grazing permittees with 240 active allotments in the planning area; 12 are vacant and 23 are closed allotments. There are 94,785 head months currently used on the HLC. The forest plan alternatives do not propose changes to allotment boundaries or use.

When mismanaged, livestock grazing can have numerous direct and indirect effects on soil and water resources, particularly along water courses and in riparian areas. Soil trampling can cause decreased infiltration, greater soil compaction, and loss of vegetation cover on both upland and riparian sites. Reduced infiltration by soil compaction can lead to overland flow of sediment. Soil and water quality can be indirectly affected by the resulting increased soil runoff and erosion, and sediment delivery to riparian areas and streams.

Impacts are often greater in riparian zones because they are preferred by livestock due to the availability of shade, water and more succulent vegetation. Overgrazing in riparian zones can reduce bank stability through vegetation removal and bank trampling, it can compact soil, increase sedimentation, cause stream widening or down cutting and often changes riparian vegetation, resulting in insufficient overhead cover for fish (Platt, 1991). Livestock grazing near streams can result in changes in channel morphology (A. J. Belsky, Matzke, & Uselman, 1999). Livestock trailing, chiseling, and general soil displacement along stream bank areas can result in collapse of undercut bank areas and an overall increase in bank angle, loss of bank cover, and stream widening along the entire stream reach. Over long time periods, loss of riparian habitats by stream channel widening or degradation, and lowering of water tables through channel degradation may occur. Fecal wastes can increase bacterial concentrations in water through direct introductions into live water or riparian areas.

Removal of riparian vegetation through livestock management can influence the amount of solar radiation and alter water temperature regimes. Greater temperature fluctuations (diurnal and seasonal) can occur when riparian vegetation is removed or decreased. These changes can ultimately lead to shifts in dissolved oxygen and pH. In addition, removal of riparian vegetation and increased temperatures combined with increased nitrate levels can increase undesirable or nuisance biological production in water.

The effects of livestock can be seen across the planning area, particularly in riparian areas. Historical grazing and agricultural activities such as irrigation, led to riparian vegetation changes and stream channel degradation on grazed streams. Various allotments have seen improvements through BMPs and updated allotment management plans. However riparian and aquatic habitat improvements within grazing allotments continue to be a challenge across the plan area. Most allotments managed under a season long grazing strategy continue to have impacts to RMZs.

The severity of the effects of livestock grazing on aquatic wildlife populations can be expected to increase under warmer climatic conditions with lower summer flows. Within current conditions, these impairments impact population sizes and recruitment success at levels of occurrence. These impacts can accelerate the replacement of native species with nonnative populations. However, effects are not limited solely to native trout and char species. Several recreational fisheries are limited by habitat loss and lower recruitment rates.

PIBO monitoring data show streams in managed sub-watershed across the planning area have lower median values or habitat conditions for many of the measured indexes (Archer & Ojala, 2016) (Archer & Ojala, 2017). The methodology selects managed sites that are representative of managed conditions for that portion of the planning unit. Managed sites in grazed sub-watersheds are considered representative of grazing impacts typical for low gradient habitat in that pasture. Qualitative comparisons of PIBO data sets to data collected by the forest collected data show that livestock impacts in riparian areas and streams continue to occur.

Effects common to all action alternatives

Table 28 summarizes the effects of Draft Plan components for livestock grazing on aquatic ecosystems. Existing grazing permits would continue to be administered under current allotment management plans. However, they would be required to meet or be moving towards desired conditions for riparian areas as outlined in the revised forest plan. When allotment plans are updated they would need to be adapted to meet or move toward RMZs desired conditions FW-RMZ-DC-01and 02, FW-FAH-DC-01 through 04, and 07, and FW-GRAZ-DC-02 and 03.

Forestwide plan components would protect and minimize the effects of grazing on riparian resources in all action alternatives. Standards specific to grazing, FW-GRAZ-STD-01, 02, 03 and 04 require authorization of new and existing management plans to avoid, minimize, or mitigate adverse effects to riparian habitats. Indicators such as forage use, bank alteration or riparian stubble height would be used to move rangeland vegetation, riparian function and wildlife habitat towards desired conditions. Forestwide guidelines would limit management activities inside RMZs (FW-RMZ-GDL-01 through 13 and FW-GRAZ-GDL-03 through-07). Specifically, all activities within RMZs, including grazing, should protect key riparian processes, including maintenance of streambank stability, input of organic matter, temperature regimes, and water quality (FW-RMZ-GDL-13).

Effects to fisheries would be similar to alternative A west of the divide, as the RMZ plan components generally meet the intent of the standard and guidelines from INFISH. East of the Continental Divide, the RMZ plan components for grazing provide additional protection to riparian areas compared to the current plans. There are no differences in effects between the action alternatives as all would adopt the RMZ standards and guidelines. Regional PIBO monitoring indicates that implementation of grazing standards adopted from INFISH led to improving trends to some monitoring indicators. That trend is projected to continue in the west side GAs and is expected to occur within eastside GAs as RMZ plan directions would be adopted forestwide. The proposed forest plan would provide directions to move RMZs towards desired conditions under all action alternatives.

Implementation of these RMZ plan directions would result in an improving water quality trend under all action alternatives. There is no differences in effects between action alternatives, as all would adopt the RMZ plan components across the planning area. For riparian areas east of the Continental Divide, the adoption of RMZs would increase management directions within these areas. Therefore, the adoption of RMZs provide more protection of water quality. As the proposed forest plan directions are incorporated into allotment management plans and implemented, it is concluded that degraded riparian areas would move toward desired conditions. West side of the Continental Divide RMZs would lead to similar outcomes from current INFISH directions in alternative A.

Table 28. Effects of plan components for livestock grazing– all action alternatives

Plan Component(s)	Summary of expected effects
FW-GRAZ-DCs	Desired conditions for livestock grazing emphasize sustainable grazing, stable soils, diverse vegetation and native plant communities, as well as riparian and wetland health. Movement toward these desired condition will be achieved through implementation of the standards and guidelines for grazing as well as the other resource areas. Changes toward meeting DCs on some allotments would likely not be realized until implementation of new allotment management plan/project are completed.
FW-GRAZ-STDs and GDLs	Generally would affect how allotment planning is implemented. Collectively with the additional WTR, FAH and RMZ plan components, the allotment management planning process will be guided by this directions so that future grazing management will move resource conditions within allotments toward desired conditions.

Alternative A

The 1986 Lewis and Clark NF plan includes forestwide standards for the management of livestock in riparian areas. Management Standard D-3 is specific to protecting riparian areas, water quality, and soils. D-3 (2) requires the use of BMPs to minimize livestock damage to soil, stream sides and other fragile areas. D-3 (3) necessitates the use of offsite water away from riparian areas, fencing springs, and directing salt blocks to be located away from riparian areas. The 1986 plan also includes measurement indicators of livestock damage to aquatic habitats adjacent to low gradient (less than 2%) streams, including: total physical bank damage on key areas in excess of 30%, poor reproduction survival of streamside shrubs, and excessive grass/forb use. If these standards "are not effective at keeping livestock use of riparian areas within management objectives, the plan directs the FS to construct and maintain fencing as necessary to achieve these objectives". The plan also include limitations of livestock use in municipal watersheds and research natural areas (RNAs). PIBO data indicates there are fewer metrics trending in the desired direction on the HLC NF than in Region 1 as a whole, which suggests less movement towards desired conditions. Effects from the livestock grazing components are discussed in the watershed effects of plan components above and in the livestock grazing section.

Grazing is a major component of land management within the planning area and would continue to occur across all GAs. Livestock grazing management has been and continues to have a major impact on watershed, riparian, and water quality throughout the planning area. Livestock management has only slightly changed since the last planning period and livestock rates are less than or equal to historical levels. The1986 Lewis and Clark and the Helena NF Plans include standards to manage livestock grazing as well as riparian grazing standards to incorporate the use of BMPs and requisites to meet state water quality standards as required in the Clean Water Act. The plans also have requirements to maintain current soil productivity. A breakdown for grazing within specific GAs is provided in the Livestock Grazing section.

On the east side of the divide current forest plan components for water quality, riparian areas and wetlands would continue to apply. Monitoring of allotments by the forest over the last decade has shown impacts to stream banks and streamside vegetation. Geomorphic changes (i.e. increasing width depth ratio, and decrease in sinuosity) have also been observed. Management under alternative A would continue to have an effect on riparian areas as a whole with continued reduction in stubble height, impacts to streambank vegetation, and shrub components may continue to occur unless management changes occur.

On the west side of the Continental Divide, INFISH standards and guidelines that protect or minimize effects to riparian and aquatic resources from livestock grazing include modifying grazing practices, locating new facilities outside of RHCAs, relocating or closing facilities, and limiting livestock handling efforts (INFISH GM-1, 2, and 3).

The 1986 Helena NF Plan includes a forestwide standard that grazing management "will protect soils and water resources, riparian areas and threatened and endangered species." Where analysis shows range damage, the cause would be identified and corrective action would be initiated through allotment management plans. Allotment management plans would specify utilization standards of key plant species needed to protect the soil and water quality.

For areas on the west side of the divide, current forest plan directions would continue to apply, and INFISH standards and guidelines that protect or minimize effects to riparian and aquatic resources from livestock grazing would also apply. Existing grazing permits would continue to be administered under current allotment management plans and new plans would be adopted as funding allows.

As indicated above, livestock grazing impacts are substantial throughout the planning area resulting in habitats and water quality that do not meet desired conditions on many streams and riparian areas. It is expected that the current trends in watershed conditions across allotments would continue.

Timber and vegetation management

This focuses on the effects of the action alternatives in respect to harvest of forest canopy and skidding systems, fuel reduction activities, and prescribed fire. Effects from roads are treated separately due to their higher risk for affecting water quality and quantity.

Effects common to all alternatives

Vegetation management would occur under all alternatives, including timber harvest and prescribed burning. Water quality effects attributed to timber harvest could include increased sediment, nutrient load, and temperature. The difference in alternatives would be subtle since management controls the extent of harvest within drainages. Risk may be somewhat arbitrary since management controls harvest extent across the watershed and below a threshold of concern. Instead of harvesting whole watersheds, harvest is scattered. Also, recent studies showing the water yield changes from beetle epidemic have brought out the complex relationships between forest canopy and water yield in snow dominated regimes (Biederman et al., 2015). Though decreases in forest cover can increase snowpack and available moisture, the lack of shading can accelerate snowpack runoff (Varhola, Coops, Weiler, & Moore, 2010). Shading can offset snowmelt losses where the forest canopy remains. Furthermore, (Grant, Lewis, Swanson, Cissel, & McDonnell, 2008) a review of water yield studies showed that fall soil deficits between cut and uncut stands explained water yield differences; cut stands lacked the transpiration and thus were prone to generate greater yield since soils had more available water and thus were less prone to infiltrating fall storm moisture. For the HLC NF, soils rarely have saturated soil conditions during fall and thus these differences would be subtle.

The impacts from prescribed burning would be minor since burning is designed to result in low and moderate severity that has low potential for delivering sediment. The effects of prescribed burning are generally insignificant with regard to a wide range of hydrologic and water quality variables (Robichaud, Beyers, & Neary, 2000).

Effects common to all action alternatives

The effects related to timber harvest and prescribed burning would vary only slightly by alternative, based on modeling of expected prescribed burning acres. Alternative E may result in fewer harvest and prescribed burning acres and associated impacts as compared to the other alternatives.

The action alternatives would not increase risk for impairing water quality over the current direction. For uplands, the Draft Plan directions continue using BMPs to reduce offsite transport of sediment to streams from either timber harvest area or prescribed burn slopes. Standard FW-WTR-STD-03 re-enforces this commitment. Additional improvements in water quality may offset past impacts with FW-OBJ-WTR-01 and 02 that directs restoration activities to priority watersheds and conservation watershed networks. The effectiveness of BMPs for avoiding sediment was reviewed in a contemporary study in California. Out of 220 units examined, sixteen instances were found where skid trails delivered sediment to streams (Litschert & MacDonald, 2009). The authors concluded that in most cases the BMPs were effective. Surface roughness on skid trails was one of the factors that was found to alleviate overland flow and sediment delivery. The HLC NF uses slash in addition to waterbars to stem overland flow and reduce sediment delivery. Also, the belt rock geology of the Forest would have less potential for producing sediment than the granitics in the Litschert and MacDonald (2009) study area based on findings from Sugden and Woods (2007).

The action alternatives would carry on similar protections using BMPs to stabilize skid trails and landings and disconnect these from road ditch and stream networks drawing from Region 1 Soil and Water

Conservation Practices (FSH 2509.22, Region 1/Region 4 Amendment No. 1). The effects would reduce risk for runoff and sediment. As discussed above, protections were strengthened in the Draft Plan by increasing widths of RMZs (FW-RMZ-STD-01) and limiting designated skid trails and landing constructions in RMZs.

Effects from timber harvest on nutrient loads in streams would not vary measurably across alternatives. However, the use of wider RMZs (FW-RMZ-STD-01) would substantially reduce increase nutrient loading from adjacent harvest areas.

Stream temperatures would likely not vary by alternatives from vegetation management actions. The established RMZs would preserve streamside vegetation, and vegetation management would only be allowed in the inner RMZ in order to restore or enhance aquatic and riparian-associated resources (FW-RMZ-STD-03). In the outer RMZ, vegetation management to meet desired conditions for fuel loading and silvicultural desired conditions are allowed as long as they do not prevent attainment of desired conditions (FW-RMZ-STD-04). The Forest would not clear-cut forest within RMZs (FW-RMZ-GDL-12).

Draft Plan direction and the adoption of RMZs forestwide would result in additional protection for RMZs. The inner and outer riparian zone plan directions would also provide increased aquatic habitat and water quality protection, which would maintain or move riparian resources towards desired condition. These effects would be most dramatic on the east side of the Continental Divide as indicated previously. In the planning areas west of the Continental Divide (15 percent of the planning area), the RMZs would largely not lead to different outcomes from current INFISH directions in alternative A. The action alternatives would also provide a greater level of protection for aquatic and riparian resources than alternative A. The adoption of the plan components for RMZs would increase RMZ widths more than the current required SMZ widths across the planning area. These greater widths would also result in a higher proportion of acres in RMZs within the boundaries of the areas designated suitable for timber production.

The proposed forest plan includes standards and guidelines that serve to reduce risk of impacts that might occur with vegetation management. This direction includes the following:

- A standard that controls the use of herbicides, pesticides and other toxic chemicals, with exceptions only if necessary for restoration and when aquatic and riparian resources are maintained (FW-RMZ-STD-05).
- For timber harvest treatments, FW-RMZ-GDL-02, 03, 04, 05, 07, 08, and 12 control activities, including temporary roads and landings, that may disturb soils or result in ground disturbance that may result in sediment input to streams or wetlands. Guidelines for treatments in RMZs are designed to avoid ground-disturbances that may deliver sediment to streams and wetlands (FW-RMZ-GDL-04, 09, and 13; FW-RT-STD-02, 03 and 04). New and temporary road construction and new landing construction would not be allowed within the entire width of category 1, 2 and 3 RMZs, except where needed to cross streams or when site-specific analysis and mitigation measures are determined appropriate by an aquatic resource specialist to protect resources (FW-RMZ-GDL-11).
- FW-RMZ-GDL-09 restricts logging and yarding methods that may cause ground disturbance in category 1, 2 and 3 RMZs.
- These same restrictions on road and landing construction and logging methods apply to the inner portion of category 4a and 4b RMZs (FW-RMZ-STD-01). The character and terrain typical of wetlands and pond features is different from stream features. Establishing higher level of restrictions on ground disturbance in the inner RMZ, in combination with the other plan direction, would be adequate to protect the ecological values associated with category 4a and 4b. Other plan direction includes all the RMZ desired conditions, standards, and guidelines that would guide and influence the type and extent of treatments that may occur in RMZs. For example, desired conditions describe the diverse vegetation structure, habitat connectivity and other key ecological conditions to maintain or move toward in RMZs; guidelines specify criteria for leaving live trees, snags and wildlife cover.

Other plan direction also includes the forest plan standards and guidelines associated with soil disturbance (FW-SOIL-STD-01 and 02, FW-SOIL-GDL-01, 02 and 03), and with road construction, reconstruction and maintenance in the infrastructure section (FW-RT-STD-01, 02; FW-RT-GDL-01, 03 through 13).

- Tree canopy would be retained, as described earlier, with retention of live trees in harvest areas (e.g., no clearcutting) and retention of forest cover to meet wildlife connectivity needs (FW-RMZ-GDL-11 and 12. The use of prescribed fire, particularly under burning, may be desirable in RMZs to restore natural ecosystem function, reduce forest density or fuel loadings. FW-RMZ-DC-01 promotes the use of prescribed fire consistent with natural fire regimes.

RMZs are not exclusion zones but areas where vegetation management is allowed to occur, guided by the desired conditions for vegetation and aquatic resources associated with RMZs. Revised forest plan components were developed to reduce risk of potential effects to riparian and aquatic resources. An inner RMZ area is defined with greater restrictions on treatments, to provide a higher level of protection to the most critical areas closest to the stream or wetland (FW-RMZ-STD-03). FW-RMZ-STD-04 provides more management flexibility in the outer RMZ, recognizing the role that active management (i.e., thinning, harvest, fuel treatments, and prescribed fire) could achieve in some areas and landscapes, as long as those treatments promote desired conditions within the inner RMZ. Vegetation management inside of RMZs would consider condition of the riparian vegetation as well as stream conditions. Site specific, interdisciplinary analysis at multiple scales would occur before actions proceed within RMZs.

One aspect of vegetation management is fuel reduction, primarily within the wildland-urban interface. FW-FIRE-DC-02 “Within the wildland-urban interface and around high value resources, surface fuel loading and crown spacing provide conditions for low severity surface fire that minimizes threats to values,” is designed to maintain the natural function of fire to mitigate the effects of wildfire. To achieve this desired condition, fuel reduction activities could be conducted in portions of the WUI. Standard FW-STD-RMZ-01 is designed to protect riparian and stream related function and processes by restricting vegetation management activities within the inner RMZ. However, exceptions are made for the non-mechanical treatments of prescribed fire and sapling thinning, which may be a tool used to achieving desired ecological conditions. Guidelines FW-RMZ-GDL-05, 06, 08, 10, and 11 would apply to any treatments occurring within RMZs. These guidelines provide direction on the implementation of ground-disturbing management activities within RMZs. Based upon the very small proportion of the RMZs that might be affected by the exception, allowing mechanical fuel treatments, and the direction within these guidelines, the potential impacts to RMZs under the action alternatives should be minimal from mechanical fuel treatments.

Revised forest plan direction provides protection for soils that would also protect aquatic habitats and values associated with riparian areas. Refer to Soils section for additional discussion on effects associated with timber harvesting. Project-specific BMPs shall be incorporated into road maintenance activities (FW-WTR-STD-03) which would protect riparian values.

The Draft Plan direction would result in additional protection for riparian areas with the adoption of RMZs forestwide. The inner and outer riparian zone plan directions would also provide increased aquatic habitat and water quality protection which would maintain or move riparian resources towards desired condition. These effects would be most dramatic on the east side of the Continental Divide since vegetation management buffers on the forest are primarily constrained by Montana State SMZs. Vegetation management in the inner RMZ would be limited and only occur in order to restore or enhance aquatic and riparian-associated resources. Plan directions for the outer RMZ does not prevent vegetation management in that zone as long as those actions would not prevent attainment of desired conditions of the inner RMZ. The west side of the divide has been using INFISH standards and the effects would be the same as current vegetation management as the new RMZ were developed from the INFISH (RHCA) standards.

The direction for FS management of soil directly tiers to the NFMA (16 USC 1604) which stipulates to "ensure…evaluation of the effects of each management system to the end that it would not produce substantial and permanent impairment of the productivity of the land." The past forest plan standards along with current guidance from the Regional and Washington offices interpret NFMA's direction to manage for sustained soil productivity. The proposed forest plan would continue to manage for long term soil and site productivity on lands designated for growing vegetation. Areas dedicated to infrastructure such as administration sites, mines, system roads and campgrounds are not part of the productive land base.

The revised forest plan includes requirements to design and implement management activities that conserve soils physical, chemical, and biological function and improve these functions if they are impaired (FW-SOIL-STD-01). Current regional direction includes the requirement that all vegetation management activities shall not create detrimental soil conditions on more than 15 percent cumulatively of an activity area (FW-SOIL-STD-02) and the requirement to incorporate project specific BMPs and design features to protect soil resources (FW-SOIL-STD-03). These standards are currently required on the forest and would be continued to provide protections to soil quality and function.

Management guidelines specific to timber management include direction that ground based equipment should only operate on slopes less than 35 percent (FW-SOIL-GDL-01) and should not occur on landslide prone areas in order to protect and maintain soil stability and quality. Guidelines are included that would require maintenance of 85 percent effective groundcover (FW-SOIL-GDL-04) and maintain organic matter for soil functions (FW-SOIL-GDL-05).

The Draft Plan leaves flexibility for coarse wood levels to vary at the project level depending on the fire risk, site type, and soil condition, but guidelines range between 5 to 30 tons per acre. See Snags and Downed Wood section, FW-VEGF-DC-09 and FW-VEGF-GDL-06, coarse wood debris components.

Standard practices in addition to new reclamation measures would contain offsite erosion. FW-SOIL-GDL-04 would lessen surface soil erosion by ensuring management activities maintain at least 85 percent cover. Use of slash on skid trails is one measure adopted more commonly that increases groundcover and facilitates vegetation regrowth on disturbed soil surfaces.

The proposed HLC NF plan has, as a desired condition, management activities that do not de-stabilize areas with highly erodible soils or mass failure potential. Most of the erosion issues from road failures associate with either decommissioned or abandoned roads. Due to current engineering techniques and harvest equipment, the risk would be less than the initially proposed jammer logging in the 1970's. The main triggers for road failure involve saturating rain on snow events. FW-SOIL-GDL-03 guides management to avoid landslide-slump prone areas.

Forest reduction in system roads has increased reliance on temporary roads to access timber. Most temporary roads are historical routes that have existing prisms. Direction for temporary roads continues to evolve, although once the forest removes the roads from administrative infrastructure then these areas become part of the productive landbase. Soil function shall be restored on temporary roads when management completes activities that use these roads. Restoration treatments shall be based on site characteristics and methods that have demonstrated to measurably improve soil productivity (FW-SOIL-STD-04). The standard applies to both newly constructed and re-used templates.

Standard mitigation techniques to limit soil damage from ground based equipment would be carried forward into this next planning cycle. Standard practices limit equipment operation on steep slopes (FW-SOIL-GDL-01) and control seasonal operation when soils are more vulnerable to compaction and displacement (FW-SOIL-STD-03). However, the plan does not stipulate operation restrictions to particular conditions. Such limitations would be evaluated on a project basis due to variable soil properties.

The forest plan further addresses potential soil damage by avoiding certain sensitive soils (Table 29). These areas were considered not suitable for timber production since harvest operations could produce irreversible soil damage and reforestation is uncertain. The areas were selected using mapping from the Helena-Lewis and Clark NF land system inventory (USDA-NRCS 2017) and the R1 Potential Vegetation Type (PVT) Layer. The forest plan lowers risk of soil damage outside of these unsuitable areas with guidance that ground-disturbing management activities should not occur on landslide prone areas (FW-GDL-SOIL-03).

Table 29. Landtypes with sensitive soil

Landtype	Soil Geologic Hazards	Sensitive Soil Group
15, 15C, 150	Landslide-prone and wet soils	Landslide and Slump Prone (Wet Soil)
14, 14A, 14B, 14C	Slump-prone and wet soils	Landslide and Slump Prone (Wet Soil)
12A, 12B, 12C, 12D, 13A, 14, 14A, 14B, 14C, 15, 15C, 36B, 100, 101, 130, 136, 150	Vulnerable to compaction and rutting	Wet Soil and Flood Prone
100, 101	Flood Prone areas and wet soils	Wet Soil and Flood Prone
110	Flood-prone areas	Wet Soil and Flood Prone
12B, 12C, 49B, 56, 57, 57A, 58, 59, 59A, 59B, 76, 76A, 77, 77B, 79, 89, 90, 790, 791	Highly erodible soils and vulnerable to compaction	Loess with Volcanic Ash

Alternative A

1986 Helena NF and Lewis and Clark NF Forest Plan direction for water quality includes the requirement to incorporate BMPs and to follow Montana Streamside Management rules to ensure state water quality standards are met or exceeded. Current vegetation management activities have been restricted under the state of Montana streamside management laws since 1991. These laws prohibit certain forest practices along stream channels and directs suitable streamside management practices. These forest practices also included slope limitations, buffer widths, hauling and broadcast burning. These laws have been the main mechanism to regulate forest practices along streams in the NF. Timber management action include the requirement to meet state water quality standards per CWA (33 U.S.C. 1232) and memorandums of understanding. Also, standards include requirement to complete project analysis of watersheds that would involve significant vegetation removal and the prerequisite not increase water yield or sediment delivery beyond acceptable limits.

The 1986 Helena NF and Lewis and Clark NF plans include vegetation management directions for riparian areas. The Helena plan includes management area directions to maintain water quality, stream bank stability and not to increase runoff that would result in long term stream channel degradation. Also included are directions that limit when and what age class would be harvested within riparian areas. The Lewis and Clark forest plan includes direction within riparian areas; management area R (MA-R). Management area R direction includes type and age of trees and the type of logging systems allowed in riparian areas while maintaining or enhancing other resource values. Both plans require the adherence to the State water quality standards and current soils productivity.

The GAs west of the Continental Divide, approximately 15 percent of the planning area, have had limited riparian harvest since 1996 when INFISH amended (Amendment 14) the Helena 1986 plan. Under alternative A timber harvest within riparian habitat conservation areas except for salvage or where silvicultural practices were needed to attain Riparian Management Objectives would continue to be limited. Monitoring data from PIBO demonstrates that stream habitat conditions (temperature, LWD, pool frequency, etc.) associated with riparian protections have trended in desired directions for some indicators.

Timber and fuels projects would continue as the management activities with the highest areal impact on soil condition over the next planning period. The amount of regeneration harvest has trended downward, and intermediate harvest (thinning) and salvage harvest has trended upward. There has also been increased emphasis on timber harvest in the WUI.

The majority of harvest would occur on lands designated as suitable for timber production in the plan (see Timber section of the DEIS). The exact location of future timber harvest would depend largely on factors of road access and site specific forest conditions relative to the desired conditions as outlined in the forest plan. However, uncertain disturbance events would also influence location and extent of harvest. For example, outbreaks of mountain pine beetle in lodgepole pine stands, and salvage harvests.

Road access would largely dictate timber harvest since the HLC NF continues to reduce the road network to a manageable level. The costs of road maintenance and managing for habitat were also factors in the Forest's decision to decrease the road template.

Within an activity area, typically defined as a treatment unit, timber harvest over the next planning cycle may impact soils at the same disturbance intensity as over the last five years. HLC NF soil monitoring over this period found logging systems resulted in detrimental soil disturbance, on a percent area basis, of 8 percent average for ground based, 4 percent average for skyline, and 4 percent for hand treatments based on HLC NF Soil Monitoring data from 2012-2016 (see project record). Historical timber harvest and site preparation practices left up to 30 percent of the soil area severely impacted (Clayton, 1990; Klock, 1975) at least twice the disturbance area of contemporary harvest practices.

Minerals, oil, and gas

Effects common to all alternatives

Historically, there have been hundreds of locatable mineral mining operations across the forest, having occurred both on patented and unpatented mining claims. The largest historic mining areas identified on the Forest with severe water quality impacts include the Upper Little Blackfoot River as well as the upper reaches of the Blackfoot River in the vicinity of the Upper Blackfoot Mining Complex in the Upper Blackfoot GA, the Upper Tenmile Creek including their tributaries drainages in the Divide GA, the Dry Fork Belt and Carpenter Creek, in the Little Belt GA.

Recreational mining activities such as panning (gold and/or sapphires), metal detecting, hand-sample collection, and the use of small-scale sluice or suction dredge systems occur across the forest, particularly in areas of historic lode or placer mining activities. Unless an authorized officer determines that an activity is or will cause a significant disturbance to surface resources, a Plan of Operations is not likely to be required. Recreational activities, to include suction dredging, often do not require a FS authorization in advance, however factors such as access, scale and duration may dictate otherwise. Suction dredging is regulated by federal and State mining laws and regulations. MTDEQ has seasonal restrictions on suction dredging and other in-stream mining activities on many of the forest's bull trout and cutthroat streams, therefore impacts will not be seen in those streams. Large increases in mining activity are not anticipated for the future, but cannot be ruled out. In accordance with laws governing locatable minerals activities on NFS lands (the 1872 General Mining Law, the Organic Administration Act of 1897, the Mining and Minerals Policy Act of 1970, et al.), the public has a statutory right to conduct locatable mineral exploration and development activities, provided such activities are reasonably incidental to mining and comply with all other Federal laws and regulations. The FS role as directed by Federal regulations (36

CFR 228A) is to ensure that mining activities minimize adverse environmental effects to surface resources and comply with all applicable environmental laws. Congress has not given the FS authority to unreasonably circumscribe or prohibit reasonably necessary activities under the 1872 General Mining Law that are otherwise lawful.

Salable minerals include common varieties of sand, stone, gravel and decorative rocks. The FS salable mineral material policy (FSM 2850) states that disposal of mineral material will occur only when the authorized officer determines that the disposal is not detrimental to the public interest and the benefits to be derived from proposed disposal will exceed the total cost and impacts of resource disturbance. The forest uses gravel, riprap, and crushed aggregate for maintenance and new construction of roads, recreation sites and repair of damages caused by fire, floods and landslides. These materials come from FS developed pits and quarries. The type, volume, and source location of in-service mineral material varies year-by-year and according to need.

There are no active oil and gas leases on the forest and therefore no effect to watersheds, fish or riparian areas from any of the alternatives.

There are no effects to fish, watersheds, or riparian areas from any of the alternatives from free-use permits issued to the general public for the collection of limited volumes of rock for personal uses (i.e., non-commercial).

Effects common to all action alternatives

Table 30 summarizes the effects of Draft Plan components for minerals, oil and gas on aquatic ecoystems. The effects of additional RWAs would not be changed from alternative A. Generally, gravel pits would be situated away from riparian areas. FW-RMZ-GDL-07 would exclude gravel pits and sand operations from RMZs. Hauling of gravel, rocks and materials from these sites may impact water quality along haul routes and would be the same for all alternatives. FW-EMIN-GDL-01 and 02 are designed to minimize effects on water quality through guidance's of mineral and energy authorization and development in RMZs. The effects of minerals management would be the same for all action alternatives.

Table 30. Effects of plan components for minerals, and oil and gas – all action alternatives

Plan Component(s)	Summary of expected effects
FW-EMIN-GDL-01 and 02	Direction would minimize adverse effect to aquatics and riparian resources. Mineral operations would avoid RMZs or would ensure operations take all applicable measures to maintain, protect and rehabilitate water quality.
FW-RMZ-GDL-07	This guideline exclude gravel pits and sand operations from RMZs. This would benefit water quality and riparian habitats.

Alternative A

The 1986 Lewis and Clark NF plan includes directions (G-1) to avoid unnecessary damage to improvements, and prevent pollution of soil, water and air resources. It also requires the soil and water protection as outlined in forestwide Soil and Water Management Standard F-3. No surface occupancy stipulations are required to be applied to drainages supporting populations of westslope cutthroat trout that are considered either “managed-as-pure (98-100% genetically pure) or “indicator” (90-70% genetically pure). The 1986 Helena NF plan has directions to maintain water quality and bank stability.

Lands and special uses

Effects common to all alternatives

The forest issues a variety of permits for projects under the lands and special uses programs. FS permits can lead to interrelated and interdependent effects on private lands that are enabled by issuing a road use permit or right-of-way grant.

Management activities that result in ground disturbance near streams and other bodies of water have the potential to affect water quality. These potential increases are based on site-specific factors such as slope, soil types, proximity to waterbodies, residual ground cover, re-vegetation, etc. Conversely, soil erosion, loss of long-term soil productivity, stream sediment, and turbidity can increase due to increased road activity from issuance of road use permits or granting of right-of-ways.

Effects common to all action alternatives

The proposed guidelines (FW-LAND USE-GDL-03 and 04) would require new authorizations or reauthorizations of exciting facilities to include conditions to avoid or minimize adverse effects to fish, water, and riparian resources. Potential impacts on RMZs would strive to improve conditions or site them outside of RMZs. New hydropower support facilities would be sited outside of RMZs to reduce effects to fish, water, and riparian resources. Support facilities include any facilities or improvements (e.g., workshops, housing, switchyards, staging areas, transmission lines) not directly integral to its operation or necessary for the implementation of prescribed protection, mitigation, or enhancement measures. Some riparian vegetation could be removed or curtailed from re-establishing at the site-specific scale due to clearing of power lines, outfitter camps, etc., but that the cumulative effect is minor and would not affect riparian processes. Acquisition of areas along designated WSRs would continue to be a priority for land exchanges. The guidelines are similar for each action alternative as they were modified from alternative A, which adopted the INFISH guidelines in 1996 under an amendment to the Helena 1986 plan and would be implemented across the two forests. Permitted power and telephone line construction and maintenance would continue under all alternatives. Clearing brush and trees in riparian areas may increase solar radiation to streams and the forest floor, increasing water temperature. The limbing, topping, or removal of hazard trees near utility lines can also reduce in-channel wood. The very nature of power and telephone lines would result in riparian vegetation to be reduced where they cross and/or adjacent to the stream network. The permitting process for new authorizations would look at options to minimize this effect.

However, it is assumed that temporary and short-term impacts would still occur where special uses are allowed or mandated. Actions may also occur where the risk of short-term effects is worth taking because there would be significant benefits to watershed resource conditions over the long term. Where facilities cannot be located outside of RMZs, effects would be minimized to the greatest extent possible, but not completely eliminated.

Alternative A

The Helena NF and the Lewis and Clark NF 1986 plans have standards that govern activities that would impact soils and water resources. In the Lewis and Clark NF plan, new land use permits must not conflict with the goals of the management area (MA-R). The Lewis and Clark plan standards J3 (5 and 6) require all new special uses to avoid riparian areas if possible and all special uses protect soil and water resources. The Helena NF plan, as amended by INFISH, includes four plan components on the area west side of the Continental Divide, specifically LH-1 through LH-4. These require riparian resources to be restored, and new hydroelectric ancillary facilities to be located outside of RHCAs. This would avoid effects that would retard or prevent attainment of the riparian management objective. Land acquisitions, exchanges, and conservation easements would meet riparian management objectives.

Ski facilities

Effects common to all alternatives

All alternatives would continue to permit the existing ski areas as well as cross country ski areas.

Two special use downhill ski areas, Showdown located in the Little Belt GA and Teton Pass Ski Resort located in the Rocky Mountain Range GA operate under special-use permits. Both ski areas are located on the east side of the divide. Both areas contain many RMZs within their permitted areas. Showdown is located in the headwaters of Sheep Creek and includes approximately 1.5 miles of stream corridor. The permitted area also has many springs and seeps. Teton Pass Ski area is located in the headwaters of Waldron Creek, a tributary to the West Fork Teton River, and includes riparian areas along streambanks and springs.

Ski area development can lead to increased runoff and erosion through timber clearing for lifts, runs and other facilities. Ski areas and snow resorts typically remove forest vegetation from much of the area, which would no longer be allowed in RMZs under the action alternatives. Snowmelt runoff is increased, especially when cleared areas are compacted. Substantial amounts of such disturbances can increase the size and duration of spring high flows. Maintenance roads on the ski slopes can route runoff and sediment to streams and wetlands. Stream channel damage can result from increased runoff that leads to erosion. Ski areas also typically disturb soils throughout cleared areas. Erosion and sediment can result, especially from soils that are near streams, unstable, or highly erosive. Aquatic habitat can be damaged as a result. In addition, these uses can also degrade wetlands and riparian areas by draining or filling them or by altering their vegetation.

Effects common to all action alternatives

The draft plan would require the adoption of the RMZs directions which would result in an increase widths over current plan directions. Management directions for riparian areas would also be more restrictive. Under the draft forest plan standards, RMZs standards would be required. Extra protection for wetlands, fens, peatlands, and other groundwater dependent ecosystems (FW-RMZ-GDL-03) would be protected by a RMZ measuring 100 feet from management activities that disturb or compact soil, vegetation, and/or alter water chemistry. Plan directions would establish 300 feet RMZ for (FW-RMZ-STZD-01) fish bearing streams. Management actions would be limited to protect key riparian processes (FW-RMZ-GDL-14).

Because the ski areas are both located east of the Continental Divide, the RMZ plan components would provide more protection for water resources under the action alternatives than under alternative A.

Alternative A

Under the current 1986 Lewis and Clark NF Plan riparian widths are not designated within the special use permit areas. The 1986 forest plan standards required riparian areas to be delineated and considered at the project planning stage and the state of Montana SMZ laws are required during timber management actions within permit areas.

Past effects have been identified with regards to operation of developed winter sites. For example, high sediment deliveries from large runoff events have been documented on both permitted ski areas. Showdown Montana uses groomers that have concentrated snow in the headwater tributaries of Sheep Creek. Impacts from these types of activities are localized. These effects are few in nature but they can and do occur at times and can be prevented through proper monitoring and road maintenance. Current size of riparian areas during harvest are currently managed under the state SMZ rules. Effects associated with potential increases in water yield from clearing for ski runs would be the same as effects for timber harvest as discussed in that section.

Infrastructure

Effects common to all action alternatives

As a means to sustain productivity, the forest would evaluate not only stabilizing these old road areas but prescribe treatments to promote soil recovery (FW-SOIL-STD- 4).

Alternative A

The forest would continue to reduce the road system towards a manageable amount as funding allows. Future road building would likely be confined to realignment, while the main emphasis would continue. Where roads are built, the average amount of soil disturbed is 2.5 acres per mile, assuming a fifty foot wide prism. The road decommissioning treatment repurposes the road area back to productive land base and no longer manages these as administrative areas.

Cumulative effects

Cumulative effects to water quality can only be described in terms of potential to generally affect trends on a subwatershed to basin scale. In other words, the cumulative effects of a program at the forest plan scale as opposed to the effects from a project at the project scale can only be discussed in terms of general programmatic tendencies either toward improved or declining water quality or fisheries habitat at no specific site.

Other federal agency plans were reviewed. These include: Glacier National Park, Blackfeet Tribe, BLM and Bureau of Reclamation. Glacier National Park borders the north end of the Rocky Mountain Range GA. There would be little to no cumulative effects from park management actions as most areas are managed to protect ecological values. East of the Rocky Mountain GA, the Blackfeet tribal lands are located downstream therefore there would be no effects from management actions on these lands. The BLM lands are also located downstream of the planning area and would have little effect on the forest. The Bureau of Reclamation manages large dams across the planning area, i.e. Gibson and Swift.

Non-federal land management policies would be likely to continue affecting riparian and aquatic resources. The cumulative effects in the planning area are difficult to analyze, considering the broad geographic landscape covered by the GAs, the uncertainties associated with private actions, and ongoing changes to the region’s economy. Whether those effects would increase or decrease in the future is a matter of speculation. However, based on the growth trends and current uses identified in this section, cumulative effects could increase.

State owned school trust lands managed by the MTDNRC in the State Forests, would continue to support a variety of uses from livestock grazing to mining, timber harvest and recreational fishing and hunting. A host of activities would occur on private lands within the planning area. These include, water diversion; irrigation; livestock grazing; farming with varied cash crops; timber harvest, mining, water based hunting, outfitted and non-outfitted angling, establishment of sub- divisions, housing and commercial development, building and stocking of private fish ponds, chemical treatment of noxious weeds, flood control and stream channel manipulation, and hydropower management. The effects of these activities on federal lands would likely be minimal as they are mostly located downstream from the forest. Impacts to streams in known fisheries may have impacts to migration and spawning habitats downstream.

Stream systems in the planning area originate in high elevation headwater drainages and flow downstream through the planning area onto some lands owned or administered by entities other than the FS. The streams ultimately flow into three major river systems; the Missouri, Blackfoot or Clark Fork Rivers. Many fish populations, whether they move off-forest as part of their life cycle or are resident populations, require interconnectivity of these streams to survive as a population. For most all species, genetic interchange between subpopulations is necessary to maintain healthy fish stocks. The more wide-ranging a species such as bull trout is, the more critical interconnectivity may be in order to access important habitat components. Thus, activities off-forest that disrupt fish migration corridors can have significant impacts to fish populations upstream on the HLC NF.

The potential for introduction of disease and aquatic nuisance species exists on all lands within the cumulative effects analysis area. The extent of influence exerted by disease or exotic species is often determined by an area’s suitability. If conditions are favorable enough to promote and perpetuate them, then effects are determined by the fishery’s susceptibility to be influenced. The effects of these introductions could range from extreme to negligible, based upon the species.

MTDFWP is the responsible agency for managing fish populations throughout the planning area. Regulations would most likely continue to allow angling and harvest of fish, with variations on fishing limits and times when angling can occur and some gear restrictions. The Upper Blackfoot and Divide GAs are critical to maintaining bull trout in the Blackfoot and Clark Fork river systems. The east side GAs are as important for maintaining westslope cutthroat trout populations in headwater streams of the upper Missouri River basin. For the most part, fish populations within the planning area are isolated with little connectivity in upper headwater tributaries. MTDFWP is also responsible for administrating water quality requirements under the Clean Water Act for instream restoration work and construction activities.

The most complex cumulative effects are related to the restoration of bull trout and westslope cutthroat trout habitats within the planning area. The complexity of these life histories have exposed them to many factors affecting their abundance and viability. Cumulative effects to native fish include: (1) predation, hybridization, and competition with non-native fish; (2) destruction or degradation of spawning and rearing habitat from logging, livestock grazing, placer mining, road construction/maintenance and urban development on private and other non-federal lands; (3) degraded water quality as a result of polluted runoff from urban and rural areas; (4) heavy-metals contaminated or acidic mine drainage and runoff; and (5) migration barriers that result from roads on private or other non-federal lands.

Conclusions

Alternative A is not consistent with the 2012 Planning Rule (36 CFR Part 219.8(3)(ii)), since the current plans do not establish RMZs around all lakes, perennial and intermittent streams, and open water wetlands. Alternative A does not incorporate a watershed approach to the management of hydrology and watershed processes; there would not likely be watershed scale consideration and protection of hydrologic and riparian area/wetland processes and functions. As such, alternative A has been described herein to establish the baseline from which all action alternatives would be compared against.

All action alternatives would emphasize a watershed approach to the management of hydrology and watershed processes as well as a Conservation Watershed Network to identify important watersheds to conserve native fish. These alternatives puts emphasis on RMZs and would facilitate management of multiple ecological goals and long term ecological sustainability on a landscape basis. Updated watershed, riparian, and aquatic desired conditions, objectives, standards and guidelines would be applied in a consistent manner across the Forest to provide a mechanism to effectively prioritize activities and weigh multiple risks to various resources to move watersheds to a desired condition.

The biggest change in the proposed forest plan would be that all action alternatives would adopt forest plan direction that would establish designated widths of an inner and outer RMZ (RMZ) bordering streams, lakes, wetlands and other water features, as well as require plan direction for management actions within the inner and outer RMZs. The width of the RMZs for all action alternatives are delineated in the RMZ section above. The new standards and guidelines would limit management actions within these areas. These new directions would have the beneficial effect and increase protections for water quality and aquatic habitats, particularly east of the Continental Divide. Conservation watershed networks and those riparian areas currently not in desired conditions would receive priority for restoration.

Municipal watersheds for the Cities of Helena, Neihart, East Helena, and White Sulphur Springs would continue to receive special forest plan directions to protect water quality as all 1986 forest plan directions were brought into the new plan, as well as additional directions to insure attainment of water quality standards. The municipal watershed for the city of Lewistown would be added to the proposed plan.

The following key points summarize the conclusions for the soil resources:

- The current Forest plan does not sufficiently address current soil related issues on the Forest.
- The revised Forest plan would address these soil functions: soil biology, soil hydrology, nutrient cycling, carbon storage, soil stability and support, and filtering and buffering.
- The action alternatives contain desired conditions and standards that would help to ensure that the soil functions listed are maintained to greater extent than the current forest plan.
- Soil is the foundation of the ecosystem; in order to provide multiple uses and ecosystem services in perpetuity these functions must be maintained.

Table 31 provides a summary of the relative contribution of soils desired conditions by alternative. The land use categories are ranked in descending order of existing and potential impact to uplands and riparian resources.

Table 31. Comparison of alternatives by resource issue - magnitude or relative contribution to desired condition

Resource Area	Indicator	1	2	3	4	5
Watersheds	Water Quality	BCD	E	A		
	Water Quantity	ABCDE				
	Movement toward desired conditions	BCD	E	A		
Municipal Supply watersheds, drinking water and source water protection	Water quality	ABCDE				
Riparian areas	Riparian desired condition	BCDE	E	A		
Watershed and stream restoration projects	Stream function	BCDE	A			
Fish and Aquatics	Habitat	BCDE	A			
Soils	Riparian	BCDE	A			
	Uplands	D	BC	A	E	

Aquatic species

The analysis in the DEIS of existing habitat conditions based upon PIBO monitoring form the basis of the desired conditions in the plan, as well as the effects that may occur with implementation of the plan. The revised plan includes plan components that would provide the ecological conditions necessary to maintain, improve and restore ecological conditions within the plan area that maintain viable populations of at-risk aquatic species. Based on the analysis of alternatives, other interrelated and interconnected activities, and the cumulative effects of other federal and non-federal activities within the plan area, the implementation of the plan components would support recovery of bull trout.

The USFWS (USFWS, 2015a, 2015b) released the final Bull Trout Recovery Plan in September 2015. That plan outlines the conservation actions needed to recover bull trout. The overarching goal of the recovery plan is to conserve bull trout so that the fish are geographically widespread with stable populations in each of the six recovery units. Accordingly, the plan's recovery criteria focus on effective management of known threats to bull trout. The Coastal, Columbia Headwaters, Klamath, Mid-Columbia, Saint Mary and Upper Snake are the six designated recovery units that are home to the threatened population in the lower 48 states. That portion of the HLC NF west of the Continental Divide is in the Columbia Headwaters recovery unit. The Columbia Headwaters Recovery Unit Implementation Plan has identified threats and recovery actions. The habitat threats to bull trout identified on the Forest by the Recovery Unit Implementation Plan were upland/riparian land management and water quality (U.S. Department of Interior, 2015). The Recovery Unit Implementation Plan listed actions to address habitat threats that included these that are applicable to the HLC: 1) Prioritize Blackfoot River Tributaries for restoration, 2) Improve habitat through BMPs (BMPs) and conservation easements, 3) Protect and improve water quality, and 4) supply cold water. In addition, there are other actions identified under demographic threats and non-native species that the Forest would need to work cooperatively with our partners to address.

A conservation watershed network would conserve bull trout and genetically pure stocks of westslope cutthroat trout by identifying areas where cold water is expected to occur into the future. A conservation watershed network is a collection of watersheds where management emphasizes habitat conservation and restoration to support native fish and other aquatic species. The goal of the network is to sustain the integrity of key aquatic habitats to maintain long-term persistence of native aquatic species. Designation of conservation watershed networks, which include watersheds that are already in good condition or could be restored to good condition, are expected to protect native fish and help maintain healthy watersheds and river systems and benefit aquatic systems as part of the action alternatives.

Coarse filter plan components primarily related to watersheds, RMZs, Conservation watershed network, and road management would improve ecological conditions for bull trout, westslope cutthroat trout, and other aquatic species and maintain persistence of the species across the planning area. The conservation watershed network protects a network of connected aquatic species populations in cold water refugia by reducing effects associated with roads. The revised forest plan adds an active restoration component through desired conditions, objectives, guidelines, and standards that would supplement the retained passive components of INFISH and expands those protections forestwide. The revised forest plan would also help move projects and activities towards the desired conditions and improve aquatic habitats.

As part of the revision process, the forest will consult with the USFWS on the plan’s effects. A biological assessment will disclose the effects of the revised HLC NF Plan on the threatened bull trout and designated bull trout critical habitat.

3.6 Air Quality

3.6.1 Introduction

There are two primary types of air quality effects concerning the Forest and forest operations. First is the effect of regional air pollution on forest natural resources and human health. Second is the effect of forest emissions on forest natural resources, human health, and regional air sheds.

Air quality on the HLC NF is dependent on the type and amount of pollutants emitted into the atmosphere, those that currently exist, or are in the “background” in the atmosphere, the size and topography of the airshed, and the prevailing meteorological and weather conditions. Sources of pollution within the Forest may include particulates and ozone precursor gases generated from timber and mining operations, prescribed and wildland fire, forest administrative operations, and recreational use.

The focus of this section is on smoke and how the various alternatives could affect smoke production through the use of prescribed fire, the management of naturally caused wildfires to meet resource objectives, and the management of damaging wildfires. Of all potential sources of air pollution from management activities that occur on the Forest, smoke is the most substantial contributor to air quality and visibility. Smoke can exacerbate human health conditions as well as reduce the ability to view the scenery on the Forest. However, as discussed in the "Fire and Fuels Management" and forest "Terrestrial Ecosystems and Vegetation" sections, there is an established need to use fire to maintain and restore the fire-adapted ecosystems on the Forests and to reduce hazardous fuels in the wildland-urban interface.

3.6.2 Regulatory framework

Federal Law, Regulation and Policy

1999 Regional Haze Rule: The 1999 Regional Haze Rule mandates that states address control of man-made air pollution that impacts visibility in designated Class I airsheds (such as the Bob Marshall Wilderness area). The goal is to return visibility conditions in Class I areas to natural background conditions by the year 2064.

Prevention of Significant Deterioration: The Clean Air Act requires federal land managers,"…to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, … and other areas of special national or regional natural, recreational, scenic, or historic value." Prevention of Significant Deterioration addresses resource protection through the establishment of ceilings on additional amounts of air pollution over base-line levels in "clean" air areas, the protection of the air quality-related values of certain special areas, and additional protection for the visibility values of certain special areas.

State law, regulation and policy

The Montana Ambient Air Quality Standards: The Administrative Rules of the State of Montana, Chapter 17.8, Subchapter 2, Ambient Air Quality, state air quality requirements. Montana's standards are as stringent as, or more stringent than, the national ambient air quality standards. Some of the state standards have different averaging periods or have been converted from concentration units (ppm) to mass units (µg/m3) using different standard conditions.

Montana State Implementation Plan: The collection of Environmental Protection Agency-approved programs, policies and rules that the State of Montana uses to attain and maintain the primary and secondary National Ambient Air Quality Standards.

Other documents that guide specific actions in the plan area

- Montana/Idaho Airshed Group Operations Guide (Montana/Idaho Airshed Group 2010)
- Helena NF Fire Management Plan (2014)
- Lewis and Clark NF Fire Management Plan (2014)

3.6.3 Best available scientific information used

The air quality analysis relies on existing and most current analysis, research, and planning documents. Information from several government, academic and private partnership consortiums that have conducted air quality emissions inventories, modeled pollution impacts and worked on air quality planning on a regional scale in and around the HLC NF area was used.

3.6.4 Affected environment

The HLC NF typically has good air quality across the entire plan area. Annual data from the air quality monitoring sites were evaluated for all available years. The major source of pollution is $PM_{2.5}$ emissions in the plan area include: 1) fires (including wildfires, prescribed fires, and agricultural field burning), 2) dust (road dust and construction dust), and 3) agriculture (crop and livestock dust). Fires tend to contribute a higher proportion of total particulate matter emissions in the western part of the plan area while agriculture contributes a higher proportion in the eastern part of the plan area.

Sources of air pollution and effects

In addition to the major non-point or area sources of particulate matter, emissions including fires, dust, and agriculture, there are also five point, or stationary sources of pollution contributing to particulate matter emissions in the plan area. They include electricity generated via combustion, industrial facilities, a petroleum refinery, a chemical plant, and a cement plant. The HLC NF is also subject to long-distance transport of emissions from sources to the west in Idaho, Oregon, Washington, and California, most notably wildfire smoke as it tends to be the most visible.

The Environmental Protection Agency classifies local air quality using the air quality index. The air quality index provides information on air quality to the general public as well as people with health concerns or target age groups.

The historical profile for Lewis and Clark County indicates periods in 2007 and 2010 when the air quality index was rated as unhealthy (red) for the general population. However, there are periods almost every year when the air quality index is rated as unhealthy for sensitive groups. The majority of days rated as unhealthy and unhealthy for sensitive groups occur in December and January with a small occurrence in September (EPA 2014a). For both Lewis and Clark and Cascade counties, prescribed fire or wildfire smoke could contribute to ratings of unhealthy or unhealthy for sensitive groups in August and September but would not contribute emissions in December or January.

The daily particulate matter air quality index for Cascade and Lewis and Clark counties for ten years from 2007 to 2016 shows relative improving air quality over time. However, wildfires and winter time conditions consistently increase particulate pollution and cause infrequent exceedances.

Wilderness air quality related values

Mandatory Class I federal areas have additional protection mandated by amendments to the Clean Air Act in 1977. There are three designated mandatory Class I federal areas, within the plan area wholly or partially managed by the HLC NF - the Bob Marshall, Scapegoat, and Gates of the Mountains Wilderness Areas. The FS has the responsibility to protect the air quality related values.

Snowpack chemistry

Snow chemistry is monitored at three sites within the planning area as part of the Rocky Mountain Regional Snowpack Chemistry Monitoring Project. This project aims to identify the sources of acid deposition that may affect mountain watersheds (USGS 2015/2017).

Regional haze and visibility

The 1977 amendments to the Clean Air Act recognized the importance of reducing haze and protecting visibility in national parks and wilderness areas.

In 2017, the MTDEQ reported overall, visibility on the clearest days in a given year has improved at all Class I areas in Montana. This is because clear days are primarily affected only by very low levels of haze caused by manmade air pollution and emissions of visibility-impairing pollutants have decreased over time.

On the other hand, the MTDEQ reports visibility on the haziest days in a given year has worsened at all but two of Montana's Class I areas. Analysis shows that the haziest days are primarily caused by wildfire activity both in and outside the state. At most Class I areas in Montana, these haziest days usually occur during wildfire season in the summer and fall when air monitors record high variability of organic and elemental carbon particles in the air. Wildfire activity is considered natural and is not something the state can control with regulatory measures or technology.

By contrast, the MTDEQ stated the measured contribution to haze that is associated with manmade pollutants, like sulfates and nitrates, has decreased at all but one Class I area on these same poor visibility days. In other words, although visibility on the haziest days has worsened over time, monitoring data suggests that this is due to increasing wildfire events and not increasing manmade air pollution. This conclusion reflects the same general downward trend in manmade emissions that has contributed to visibility improvement on the clearest days.

Visibility is measured by an air-monitoring network called Interagency Monitoring of Protected Visual Environments. The MTDEQ reports that at all of these monitors have shown improved visibility on the 20% best days. Every Montana Class I area is currently meeting its 2018 reasonable progress goal for the best days. This suggests that Montana’s clean air strategies were sufficient to not only protect visibility on the best, clearest days, but also improve it.

The MTDEQ reports that despite seeing improvements in visibility on the best days, most Montana Interagency Monitoring of Protected Visual Environments sites did not see improvement on the worst days.

The MTDEQ found that the conclusion that visibility did not improve at six of eight Interagency Monitoring of Protected Visual Environments sites does not necessarily mean that the Montana’s clean air strategies were insufficient. As discussed above, many factors contribute to visibility impairment. In addition, the initial regional haze implementation period covers the years 2008-2018, with progress goals set for the end of the ten-year period. The Montana plan was not published until late 2012 and polluting stationary sources were given five years to install controls and comply with the prescribed emission limits.

Management of forest emissions

The potential effects of activities proposed on NFS lands must be assessed as directed by the NEPA, including effects to air quality. The MTDEQ often works collaboratively to measure air pollutants associated with activities such as prescribed burning using mobile air quality sensors. The NFMA directs agencies to protect and improve the quality of air resources, in addition to soil and water.

The HLC NF Forest Plan Revision is a programmatic level decision document and will not serve to authorize the implementation of individual air pollution emitting projects or forest operations. Subsequent site-specific environmental analysis would occur in order to implement future projects and general conformity would be addressed in the project level analysis.

3.6.5 Environmental consequences

Effects common to all alternatives

Smoke from wildfire is anticipated to be the primary source of pollutants and associated impacts to air quality on the forest, as it has been historically. There is limited ability to alter or control the location or extent of this effect, due to the unpredictable nature of wildfire. Wildfires have the greatest potential to influence short-term air quality and visibility in local areas.

The Forest will continue to adhere to the current state smoke management plan, and obtain required permits and approval from the MTDEQ to conduct prescribed burning operations and implementation of wildfires used for resource benefit. These controls provide for protection of public health and welfare by mitigating the impacts of air pollution, while still allowing fire to be used in maintaining healthy ecosystems.

Anthropogenic emissions

The MTDEQ reports that continued implementation of air pollution control measures make it likely that anthropogenic emissions of visibility-impairing pollutants would continue to decrease with time. On and off-road fuel standards as well as fleet turnover are likely to continue to reduce nitrogen oxide emissions from mobile sources. In addition, pollution control technology is constantly evolving as research, new emission standards, and litigation push for further reductions from point sources (MDEQ 2017).

Clean air would continue to be produced and filtered through the forests. The major impact to air quality in the plan area is fine particulate matter ($PM_{2.5}$), from agriculture, wildfires, and prescribed fires, dust, and residential wood smoke. Agricultural burning and prescribed burning are regulated throughout the plan area and residential wood smoke is regulated in certain areas including Lewis and Clark County (Lewis and Clark County 2011). Guidelines governing these sources may become even more stringent in the future.

Wildfire and prescribed fire emissions

The HLC NF and adjacent communities generally have very good air quality. December and January tend to register the highest $PM_{2.5}$ concentrations during the winter months. The months of July, August, and September are likely to register increases in $PM_{2.5}$. During these months, wildfires, prescribed fires, agricultural burning, and agriculture dust can adversely impact air quality, although pollutants do not generally reach unhealthy levels based on the air quality sensors. Much of the plan area is sparsely populated and subject to transport winds that serve to disperse pollutant emissions but high pressure systems common in the summer can stall dispersion and impact air quality. Smoke from agricultural, personal debris burning, prescribed burning, or wildfires can settle for days, producing unhealthy conditions in valley bottoms. Usually, these conditions only occur for a few days at a time. However, the fine particles associated with smoke from wildland fires can be especially problematic for those with ongoing health problems and for the elderly and children, increasing their risk of hospital and emergency room visits or even the risk of death (EPA 2003). The MTDEQ and counties regulate open burning throughout the year while working with the Montana/Idaho Airshed Group to coordinate projects and potential air quality impacts from each prescribed burn.

Air quality impacts from wildfires may intensify in the future if these fires occur with greater frequency or the amount of burned area increases. Many climate projection scenarios indicate warmer temperatures in the plan area (Wear et al. 2013) which could lengthen the wildfire season. If warmer temperatures indeed occur, the window for available burning by wildfires may broaden which would affect fire frequency in mid to upper elevation areas where fuel moisture and burning conditions during summer months currently inhibit fire spread in many years. Spracklen et al. (2009) indicate that increases in emissions from wildfires may increase organic carbon concentrations by 40 percent and elemental carbon concentrations by 20 percent over the western U.S. by 2050. Large fires will continue to occur on the the Forest, driven by climate, weather, and fuel conditions, including the influence of the Pacific Decadal Oscillation, El Niño Southern Oscillation, and the Atlantic Multidecadal Oscillation (Kitzberger et al. 2007).

National direction for FS management actions would continue to have a profound effect on how wildfires and fuels are managed across the HLC NF. Variable fire budgets would impact suppression efforts, prescribed fire implementation, hazardous fuels planning, and wildland fire implementation. National direction will also continue to provide forests with guidance in the management of wildland fires and fuels on the landscape. National direction would likely continue to focus on increasing the occurrence of fires managed for restoration, resiliency and resource benefit objectives; hazardous fuels reduction; and accelerated restoration and resiliency objectives.

Cumulative effects

In addition to smoke emissions from land management activities, climate change would affect smoke emissions. Decreasing snowpack, earlier spring time conditions and snow melt, and longer, warmer fire seasons would increase the frequency and area burned by wildfires.

Effects common to all action alternatives

Air quality under the action alternatives would experience short and long term effects under proposed management alternatives. Continued use of prescribed fire has the potential to influence short-term air quality and visibility in local areas. All action alternatives must meet air quality standards established by the Environmental Protection Agency and MTDEQ through requirements of State Implementation Plans (concerning National Ambient Air Quality Standards) and the state smoke management plan. Use of prescribed fire under the all alternatives would be restricted by how much vegetation, (i.e. fuel loading/acre, acres that can be burned per day), when and where burns can occur and budget constraints. These constraints limit the use of prescribed fire and affect the rate of emissions and volume of smoke and particulates, which in turn limits impacts to human health and visibility.

Under alternatives B, C, and D, the amount of prescribed burning in forested ecosystems is anticipated to be about the same as it has been in the recent past, approximately 4,800 acres per decade. Under alternative E prescribed burning in forested areas would be about 3,000 acres per decade. The Forest would be treating nonforested ecosystems as well. However, nonforest areas were not modeled in appendix B. In the draft revised Forest plan there is an objective to treat 15,000 acres per decade within the WUI which would be a mix of prescribed fire and mechanical treatments. In addition, the current Forest fuels treatment target is around 10,000 acres a year, again a mix of mechanical, prescribed fire, and wildfire used for resource benefit purposes. Adherence to required air quality regulations is expected to minimize adverse effects to air quality due to prescribed burning, and thus minimize impacts to public health and visibility. Wildfire is expected to remain the primary source of smoke and potential degradation of air quality on the HLC NF.

Cumulative effects common to all action alternatives

Most impacts to air quality and visual quality are related to the contribution of smoke from areas to the south and west of the Forest including all the way to the west coast. Historically, when there are not large fires providing additional smoke to the area, prescribed fires and most wildfires have not produced long-term decreases in air quality or visibility. Occasionally, smoke from Canada also contributes to decreased air quality in the area. Currently, there is no coordination across the border regarding smoke management.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 32, for those plans applicable to air quality.

Table 32. Summary of cumulative effects to air quality from other resource management plans common to all alternatives

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All plans address fire and fuels. Generally speaking, management of fire and fuels is consistent across all NFs due to law, regulation, and policy. The cumulative effect would be that the management of fire and fuels would be generally complementary. This includes specific adjacent landscapes that cross Forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
Montana Statewide Forest Resource Strategy (2010)	This plan guides fire and fuels management on state lands. It includes many concepts that are complementary to revised plan components for the HLC NF, for example state direction is for suppression of wildfires. While specific desired conditions are not stated in

Resource plan	Description and Summary of effects
	the same terms as the HLC NF, it is likely that some elements such as provide for firefighter and public safety would be similar. State forest lands may be actively managed to a greater degree than NFS lands, and would likely contribute to achievement of desired fire and fuels conditions across the landscape.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components related to fire and fuels, and would therefore likely be complementary to the plan components for the HLC NF.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the fire and fuels characteristics in this area are therefore likely similar to the wilderness areas in the adjacent Rocky Mountain Range GA and would likely complement these conditions.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily nonforested, and calls for managing for fire and fuels. This plan would be generally complementary to the HLC NF through direct fire suppression outside the impact zone and the potential for the use of prescribed fire.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Fire and fuels is a component of these parks, although not always the primary feature. Specific fire and fuels conditions would not necessarily contribute to the desired conditions as described for the HLC NF.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy. The vegetation conditions described would be complementary to the conditions being managed for with the HLC NF revised forest plan.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	This plan is relevant to an area that lies adjacent to NFS lands in the Divide GA, in proximity to the City of Helena. The plan emphases forest management and wildfire mitigation. This would be complementary to management on some HLC NF lands, specifically the South Hills Special Recreation area (alternatives B, C, and D).

Portions of the HLC NF adjoin other NFs, each having its own forest plan. Generally speaking, management of vegetation is similar across all NFs due to law, regulation, and policy. In addition, the HLC NF is intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some GAs contain fragmented inholdings of such lands, while others are less fragmented. The GAs which are island mountain ranges are typically surrounded by private lands.

Table 33 displays estimated acres of wildfire and prescribed fire for all alternatives based on modeled future projections over five decades. Future estimates are derived from a modeling analysis explained in appendix B.

Table 33. Projected average acres per decade of wildfire and prescribed fire by each alternative

Component and Indicator	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
All Wildfire (USFS): acres burned	126,469	122,741	122,741	124,446	125,412
Forested Areas Prescribed Fire (USFS): acres burned	48,760	47,840	47,840	47,870	27,780

Alternative A, no action

Current plan direction is to coordinate all FS management activities to meet the requirements of the State Implementation Plans and State Smoke Management Plan (Montana/Idaho Airshed Group (MDEQ 2010)), and Federal and State air quality standards.

Under the fire management program, direction is to conduct prescribed fire objectives under constraints established by the Montana/Idaho Airshed Group. Air quality is to be maintained at adequate levels as described by state, county, and federal direction, and all prescribed burns conducted on the HCL NF will be governed by this direction and meet this objective.

The airsheds of the Bob Marshall, Scapegoat and Gates of the Mountains Wilderness Areas are managed as Class I areas. The forest areas outside the Class I areas are managed as Class II.

Air quality under the no-action alternative would experience continued short and long term effects under current management, both from wildfire and prescribed fire. Continued use of prescribed fire has the potential to influence short-term air quality and visibility in local areas. The current management direction requires meeting air quality standards established by federal and state agencies through requirements of state implementation plans and smoke management plans. Current direction limits the use of prescribed fire by restricting how much vegetation can be burned and when and where burns can occur. The costs of conducting prescribed fires also increase as a result of burning regulations, which also constrains the amount of acres that is burned. Limited use of prescribed fire affects the rate and volume of smoke and particulate emissions, which in turn limits impacts to visibility.

Alternatives B and C

Compared to alternative A, alternatives B and C increase RWAs to 213,076 acres restricting the use of mechanized vegetation and fuels treatments and increases the area available for wildfire management (used for resource benefit). These alternatives increase the areas suitable for timber production to 443,057 acres and where harvest may occur for other purposes to 1,572,918 acres. Increased timber harvest would increase the use of prescribed fire for activity fuels and hazardous fuels reduction purposes.

Modeling results in appendix B show a decrease in wildfires (122,741 acres/decade, down from 126,469 acres in alternative A) and a slight decrease in prescribed fire (4,784 acres, down from 4,876 acres in alternative A).

Alternatives B and C have additional acres in RWAs compared to alternative A. Increases in the use of lightening caused wildfire to meet resource objectives would increase smoke emissions from RWAs. There would be limitations on prescribed fire in these areas if RWAs become designated wilderness.

Alternative D

Compared to alternative A, Alternative D increases RWAs to 474,589 acres, restricting the use of mechanized vegetation and fuels treatments and increases the area available for wildfire management (used for resource benefit) substantially more than in alternatives B and C. This alternative increases the areas suitable for timber production to 435,014 acres and where harvest may occur for other purposes to

1,195,171 acres. Increased timber harvest would increase the use of prescribed fire for activity fuels and hazardous fuels reduction purposes and would be similar or the same as in alternatives B and C.

Modeling results in appendix B show a decrease in wildfires (124,446 acres/decade, down from 126,469 acres in alternative A) and a slight decrease in prescribed fire (4,787 acres, down from 4,876 acres in alternative A). The modeling results are similar to or the same as in alternatives B and C.

Alternatives D has about 14 times the amount of acres in RWAs compared to alternative A. Increases in the use of lightening caused wildfire to meet resource objectives would substantially increase smoke emissions in these areas. There would be limitations on prescribed fire in these areas if RWAs become designated and prescribed fire would be substantially reduced compared to current conditions. Smoke emissions from prescribed fire outside of wilderness would increase nearly two times compared to current conditions and be virtually the same as in alternatives B and C.

Alternative E

There are no RWAs that would restrict the use of mechanized vegetation and fuels treatments and would not increase the area available for wildfire management (used for resource benefit).

Modeling results in appendix B show a decrease in wildfires (125,412 acres/decade, down from 126,469 acres in alternative A) and a decrease in prescribed fire (2,778 acres, down from 4,876 acres in alternative A). The modeling results for wildfires are similar to alternatives B, C and D, and prescribed fire would be reduced by about 2,000 acres/decade compared to alternatives B, C, and D.

Prescribed burning would take place in many of the harvested forest stands, as well as in other non-forest areas. However, alternative E would result in less prescribed burning and smoke production because it is focused on timber production rather than prescribed burning.

Conclusions

The air quality in and around the HLC NF is generally good and the state of Montana forecasts improving air quality conditions across the state and improving visibility in wilderness areas. However, air quality is compromised during winter months in communities where wood smoke causes health standard exceedances, and during fire season months when wildfires causes exceedances across broad portions of the state. Prescribed fires, agricultural burning, and agriculture dust can adversely impact air quality, although the pollutants do not generally reach unhealthy levels.

The HLC NF forest plan revision proposed action incorporates legal and policy direction that implements actions designed to enhance and maintain ecosystem resiliency and sustainability, and protect values at risk of damage from wildfires. These actions include vegetation and fuels management practices that require the use of prescribed fire and the management of wildfires used for resource benefit. The proposed action would maintain current levels of the use of prescribed fire and the management of wildfires used for resource benefit, and increase smoke emissions, compared to current forest plan direction. The modeling analysis in appendix B shows that implementation of the proposed action would reduce wildfires and corresponding smoke emissions by about 3-4% under alternatives B, C, and D, and about 1% under alternative E. However, climate change effects could reverse the forecasted trend and increase the frequency of large wildfires and increase smoke impacts.

The Forest would continue to adhere to the state of Montana smoke management plan, and obtain required permits and approval from MTDEQ to in order to conduct prescribed burning operations and implementation of wildfires used for resource benefit purposes.

Therefore, the results of this action upon air quality would meet the purpose and need because the expanded use of prescribed fire and wildfires used for management for resource benefit would improve ecosystem sustainability and resiliency, and protect values at risk from damaging wildfires, while meeting air quality requirements mandated by the Clean Air Act. Adverse effects of increased smoke emissions would be mitigated by the Forest's adherence to following the legal framework that regulates air pollution sources in the state of Montana.

3.7 Fire and Fuels

3.7.1 Introduction

Fire is a critical ecological function across the HLC NF that plays a central role in providing quality habitat for both plant and wildlife species. Wildland fire includes both wildfire (unplanned ignitions) and prescribed fire (planned ignitions). Fire management includes the strategies and actions used both before and during wildland fire. Management of wildland fire influences whether fire effects create beneficial or negative impacts to values such as water quality, air quality, habitat, recreation areas, or communities. Wildfire management includes a spectrum of responses from protection objectives to resource objectives. Suppression is a management strategy used to extinguish or confine an unwanted wildfire.

Manipulation of vegetation to change fire characteristics when it burns is called "fuels management".

Several indicators and measures are considered.

- The primary indicator is *future vegetation treatments*, measured in acres of projected harvest, mechanical and prescribed fire activities in forested types. Estimated acres treated provides an indication of potential movement toward desired vegetation conditions. The location of potential treatments relative to the WUI is considered as part of the measurement of acres.
- *Flexibility for fire management* is measured by the distribution of land allocations that influence the flexibility to carry out mechanical and prescribed fire treatments. Land designations that influence this management flexibility include wilderness, RWAs, and IRAs. Designated wilderness has the most restrictive requirements for mechanical and prescribed fire fuels management activities. Areas that limit mechanical treatment will result in a cascading effect on other fire and fuel treatment options. Without mechanical treatments, the use of prescribed fire would be reduced. With reduced mechanical and prescribed fire, managing unplanned natural ignitions would be reduced due to the lack buffer areas treated prior to a natural ignition. The primary measure for this indicator is the acres of RWAs by alternative.
- Expected *future wildfires and fire regimes* are an indicator of how vegetation change and other factors over time may influence fire's role on the landscape, which in turn would influence fire regimes. The measurement for this indicator is projected acres of wildfire burned by fire type.

The effects of fire on the landscape was raised as an issue by many members of the public, including an interest in allowing fire to play its natural role in the ecosystem, as well as concerns about the effects of large wildfires on other resources including water quality and quantity and scenery.

3.7.2 Regulatory framework

Wildfire Suppression Assistance Act of April 7, 1989 (HR 4936)

Healthy Forest Restoration Act of 2003 (HR 1904): Aimed at expediting the preparation and implementation of hazardous fuels reduction projects on federal land; encouraging collaboration between federal agencies and local communities; requiring courts to balance effects of action versus no-action prior to halting implementation; and requires federal agencies to retain large trees under certain conditions.

“**Urban Wildland Interface Communities within the Vicinity of Federal Lands That Are at High Risk from Wildfire” Federal Register** Vol. 66, No. 3, 2001: List of communities in the vicinity of federal lands that are at high risk from wildfire.

National Fire Plan, August 2000: Outlines a plan of action for federal agencies in order to protect wildland-urban interface and be prepared for extreme fire conditions.

Federal Wildland Fire Management Policy of 1995 (updated January 2001): Guides the philosophy, direction, and implementation of wildland fire management on federal lands.

2002 President’s Healthy Forest Initiative: Emphasizes administrative and legislative reforms to expedite fuels treatments and post-fire rehabilitation actions.

Interagency Prescribed Fire Planning and Implementation Procedures Guide 2014: Provides standardized procedures associated with the planning and implementation of prescribed fire.

Guidance for Implementation of Federal Wildland Fire Management Policy 2009: Guidance for consistent implementation of the 1995/2001 Federal Fire Policy.

National Cohesive Wildland Fire Management Strategy (2014): The National Cohesive Wildland Fire Management Strategy is a strategic push to work collaboratively among all stakeholders and across all landscapes, using best science, to make meaningful progress towards the three goals: 1) Resilient Landscapes; 2) Fire Adapted Communities; and 3) Safe and Effective Wildfire Response.

Interagency Standards for Fire and Fire Aviation Operations (NFES 2724): Documents the standards for operational procedures and practices for the FS fire and aviation management program.

3.7.3 Assumptions

- Climate trends will continue to be warmer and drier than historical conditions.
- Naturally ignited wildfire will continue to be the largest contributor to fuels management.
- Development in the WUI will continue.

3.7.4 Best available scientific information used

This analysis also draws upon the best available literature citations that were found to be relevant to the ecosystems on the HLC NF. Literature sources that were the most recent; peer-reviewed; and local in scope or directly applicable to the local ecosystem were selected. Uncertainty and conflicting literature was acknowledged and interpreted when applicable. In addition, local studies and anecdotal information that is not peer-reviewed is included where appropriate to provide context.

Best available information was used to build the fire suppression logic and assumptions within the SIMPPLLE model, including corroboration with actual data, and professional experience and knowledge. Refer to appendix B and the terrestrial vegetation section for detailed discussion on model development and outputs associated with fire and resulting vegetation changes.

3.7.5 Affected environment

Natural fire regimes and NRV

A fire regime represents the periodicity and pattern of naturally occurring fires, described in terms of frequency, biological severity, and aerial extent (Anderson, 1982). The natural fire regime is a classification of the role fire would play across a landscape in the absence of modern human intervention but including the influence of aboriginal fire use (Hann et al., 2008). Five natural fire regimes are classified based on the average number of years between fires (fire frequency or mean fire interval) combined with severity (the amount of vegetation replacement) and its effects to the dominant vegetation (ibid). Table 34 displays the extent of the five natural fire regimes on the HLC NFs.

Table 34. Fire regimes on the HLC NFs

Fire Regime[3]	Definition[3]	Existing Vegetation Types[1, 3]	Approximate Acres[2]	Proportion (%)
I	0- to 35-year frequency; low / mixed severity	Mountain sagebrush; Ponderosa pine; Dry Douglas-fir; Wooded draws/ravines	1,214,264	38
II	0- to 35-year frequency; replacement (high severity)	Grasslands; Mixed-grass prairies; Great Plains shrubland	213,263	7
III	35- to 200-year frequency; mixed / low severity	Wyoming big sagebrush ; Low sagebrush; Riparian systems (cottonwood); Limber pine/Rocky Mtn juniper; Dry lodgepole pine; Moist Douglas-fir; Whitebark pine	686,748	21
IV	35- to 200-year frequency; replacement (high severity)	Aspen; Moist lodgepole pine; Subalpine fir Engelmann spruce	937,182	29
V	Greater than 200-year frequency; any severity	Poor-site lodgepole pine; Subalpine forbs and grasses	56,960	2
Sparsely Vegetated	National Land Cover Database (NLCD) class	N/A	15,441	<1
Barren	NLCD class	N/A	81,250	3
Snow/Ice	NLCD class	N/A	172	<1
Water	NLCD class	N/A	3,249	<1

[1]Vegetation types are not the same as existing vegetation types discussed elsewhere in this chapter.
[2] Acre summaries in this section may differ slightly due to the data source (raster versus vector GIS data).
[3]Table information is adapted from Barrett et al. 2010

Recent wildfire history and trends

Fire data in the forest GIS database shows wildfire areas burned since 1940 (Figure 3).

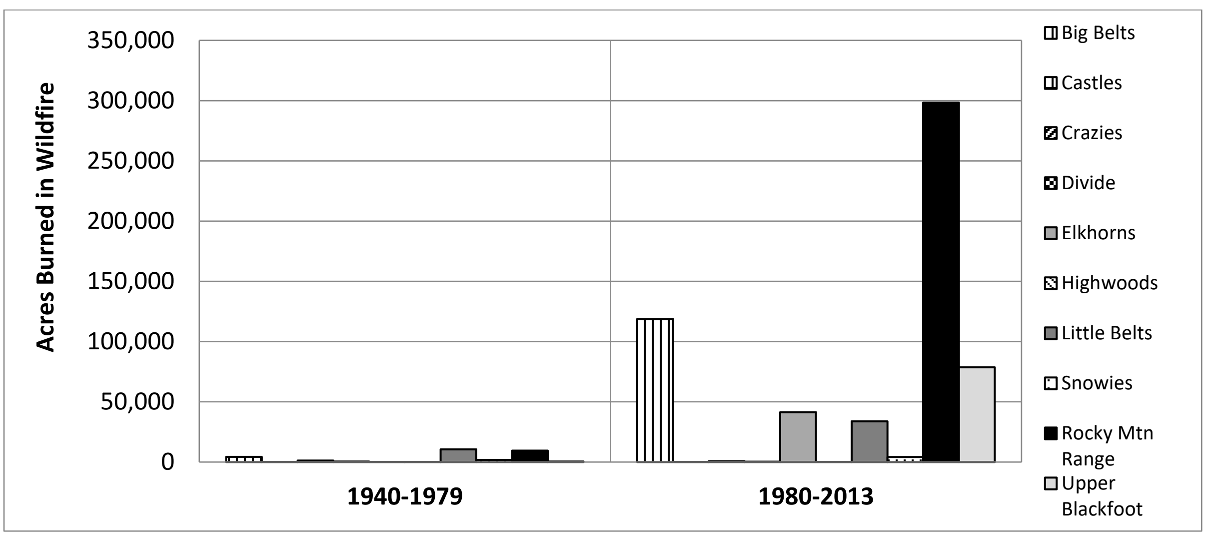
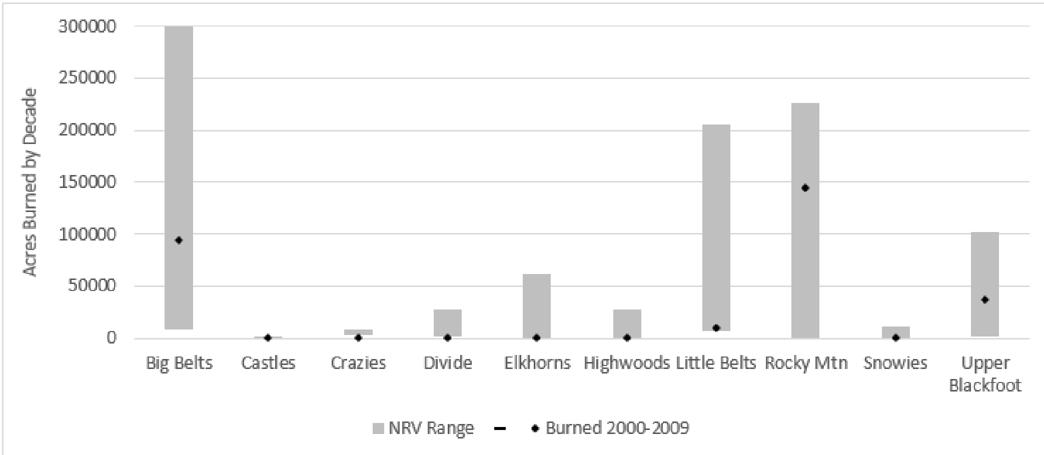


Figure 3. Wildfire acres burned by GA, 1940-1979 and 1980-2013

As described in the Forest NRV Analysis summary report March 2017, Figure 4 displays the average acreage burned per decade by GA, compared to the existing condition. The existing condition is represented by the acres burned from 2000 to 2009.



Source: NRV range from SIMPPLLE represents the 5 to 95 quartile. Existing condition from HLC NF fire history GIS database.

Figure 4. Acres burned per decade compared to acres burned 2000-2009, by GA

In areas that have burned recently, future fires may be somewhat self-limiting in extent because of the variability in residual vegetation conditions. Along with many other factors, the fire history of each GA has influenced the quantity and pattern of recent fires and will influence potential effects of future fires.

Naturally ignited wildfires have been used to meet resource objectives since the approval of the 1986 forest plans (Table 35). In recent years, including 2017 specifically, several fires burned into past wildfire footprints. It was observed that fire activity and spread was substantially reduced when fires burned into areas that have burned within the past two decades.

Table 35. Wildfire acres managed for resource benefit[1] by decade

1980-1989	1990-1999	2000-2009	2010-2017
89,735	5,723	79,121	160,530

1. Data obtained from Forest Activity Tracking System (FACTS) includes; Wildfire-Fuels Benefit, Wildfire-Natural Ignition, and Wildland Fire Use

There are many ignitions across the HLC NF every year and most are suppressed or are extinguished naturally. Over 5,000 detectable ignitions have been mapped since 1940. The number of ignitions is not necessarily proportionate to burned area. For example, fire starts were not especially numerous in the 1980's but the fires that escaped suppression grew to large sizes. Most fires are caused by lightning, but some by human causes such as campfires, smoking, vehicle or railroad sparks, or arson. The Helena NF, in particular, has shown a slight trend of an increasing proportion of human-caused fires, commensurate with urban development and recreation. Lightning strikes appear to be concentrated in some areas due to weather patterns and topography.

3.7.6 Environmental consequences

Effects common to all alternatives

Climate change

Of all of the ongoing and foreseeable future actions that have the potential to affect fire, especially unwanted wildfire, climate change is likely to be the single most important factor. Regardless of alternative, the effects of climate change would likely combine with some of the effects that result from implementing the alternatives, to produce cumulative impacts. In general, the fire seasons are expected to become longer, large wildfires are expected to occur more often, and total area burned is expected to increase (Halofsky et al., in press-a). By increasing the amount of prescribed fire use, the action alternatives would be expected to partially offset predicted effects from climate change (Wiedinmyer & Hurteau, 2010). The more fire use (Parks et al 2016) (and mechanical treatments) that occurs as a result of the action alternatives, the greater the fuels will be reduced and the forest vegetation restored to more resistant and resilient conditions, which could mitigate climate change effects. The windows for prescribed fire may become longer with a warmer climate.

A recent comprehensive synthesis of the science surrounding climatic change and ecosystems (Walthall et al., 2012) concluded that all fire regimes in western forest ecosystems would experience some increase in fire risk. More fires occur in all forests because of longer fire seasons and higher human populations (Vose, Peterson, & Patel-Weynand, 2012). Fire intensity and severity would probably be higher as well because of more extreme fire weather (i.e., hotter temperatures) and higher fuel loadings (i.e., tree mortality, increased forest densities). In moderate (mixed) severity regimes, more frequent fires could convert lands to more of a low severity fire regime, where frequent fires favor more open stand conditions and tree species resistant to fire damage. Increased fire risk and fire sizes in high severity fire regimes could have substantial local effects, especially where close to human population centers. Not well articulated in the climate change discussion is that risk also increases because of increased occupation of the wildland environment.

Flexibility for fire management

Key considerations of fire management are that, in general, there are a very large number of burnable acres of NFS lands that cannot be actively managed by mechanical means. Additionally, policy prohibits the use of mechanical treatments and places limits on the application of prescribed fire within areas designated as wilderness. Appropriately managing wildfire in places with an opportunity to obtain resource benefits and a low risk of potential damages may be the only way in many areas to increase the pace and scale of ecosystem restoration activities. Informed management of wildfire would also be needed to maintain areas once restoration has occurred. Parks et al 2016 found that within the Northern Rockies fire occurrence creates a “self-regulating effect of wildland fire on subsequent ignitions” These effects were found to generally last up to 20 years.

The alternatives vary from the fuels management perspective on the allocation of acres to different designated areas. The primary designated area that impact fuels management is recommended wilderness; this varies by alternative and is addressed in the section below. Within RWAs for each alternative it is expected there would be very little change in the occurrence of human caused fires. This is a result of very few fires being caused by vehicles within the HLC NF. From 1970 – 2016 there were 95 fires caused by equipment (about 3%). During the same span of time there were 534 fires caused by campfires (about 17%). The largest cause is lightning with 2,005 (about 64%).

Other management limitations apply to all alternatives. In IRAs, there are limitations on road construction and timber cutting, relating to the purpose and location of treatments in relation to identified WUI. Additionally, the implementation of the NRLMD (U.S. Department of Agriculture, Forest Service, 2007c) constrains treatments in lynx habitat outside the wildland-urban interface where multi-storied hare habitat or stand initiation hare habitat is present.

The use of prescribed fire within the WUI is a high-risk action and is often more expensive. Additionally, impacts from smoke emissions adjacent to homes for extended periods limit the number of acres that can be treated. Within the WUI, there is an increased need to rely on mechanical and hand treatments rather than fire. In addition, social issues (i.e., effects of treatments on scenery, air quality, noise, and wildlife viewing) can be more contentious.

Future wildfire and fire regimes

Natural, long-term variations in temperature and precipitation patterns have resulted in continuously changing fire regimes (Whitlock et al., 2008), and thus continually changing forest conditions. This past climatic variability has had major effects on the timing, frequency, intensity, severity, and extent of wildland fires, as would future changes in climate. The effect may be due to direct climate-related factors, such as increased temperature and greater drying of forest fuels; or indirectly, related to potential changes in forest composition and structure due partly to climate change. These climate-induced changes in fire regimes could have substantial impacts on ecosystems, with associated effects to communities and economies (Mckenzie, Peterson, & Littell, 2009).

Modeling predicts that wildfire will continue to a similar degree under all alternatives because of both natural and human caused ignitions and an expansive fuel source. Modeling shows only subtle differences in the predicted number of acres burned by alternative; generally the differences between alternative is likely due to inherent modeling uncertainty rather than a measurable change on the ground. There are also subtle difference between the amount and type of fire within and outside the WUI by alternative, as shown in Table 36. The expected results are similar across alternatives.

Table 36. Average acres burned over 5 decades, by alternative, inside and outside the WUI

Fire Type	Location	Alternative A	Alternative B/C	Alternative D	Alternative E
Light severity	WUI	1,617	1,598	1,615	1,557
	Non-WUI	2,581	2,608	2,593	2,591
Mixed severity	WUI	16,626	16,430	17,023	16,405
	Non-WUI	35,388	33,919	34,641	35,319
Stand-replacing	WUI	18,056	17,523	17,735	16,879
	Non-WUI	51,998	50,550	50,852	52,638
Total acres		126,266	122,628	124,459	125,389

Effects from plan components associated with:

Air quality management

The consequences to fire from air quality are the same for all alternatives. All alternatives have the same plan components to meet air quality standards established by federal and state agencies. The FS would meet the requirements of state implementation plans and smoke management plans. Laws and regulations on smoke emissions can limit opportunities to conduct prescribed burning. These limitations are most frequently encountered in high population density areas that reduces the use of prescribed fire in and around the WUI.

Canada lynx management

The NRLMD (U.S. Department of Agriculture, Forest Service, 2007c) would be implemented under all alternatives. This direction recognizes the importance of fuel treatments within the wildland-urban interface as designated by the Healthy Forest Restoration Act. However, opportunities to conduct vegetation treatments, including prescribed fire or mechanical fuels reduction treatments, outside the wildland-urban interface are limited under current lynx management direction. Restrictions on treating within these forest conditions is likely to reduce the ability and effectiveness of achieving desired forest and fuel conditions outside the WUI.

Lynx management direction restrictions on treatments in multi-story hare habitat and young seedling/sapling forests have the most impact. These forest conditions are widespread and common across the HLC NF, due to the dominance of subalpine fir-spruce forests and of fire as a natural disturbance process, creating large areas of seedling/sapling forest. Thinning of dense sapling stands is typically designed to create future forests composed of larger trees and desired species (such as fire resistant Douglas fir). These forests are more resilient in the face of future wildfire events, and may burn less severely, reducing potential future impacts to values at risk. Thinning in these young stands is generally not allowed under lynx management direction.

Prescribed fire is often the only feasible management tool available across much of the HLC NF. Typically, the objective of prescribed fires is to reduce stand densities by removal of the understory, and in some forest types (such as subalpine fir and lodgepole dominated forests), removal of portions of the overstory to create patches of more open forest conditions across the landscape. Prescribed fire management with these objectives would not be able to occur in multistory hare habitat, limiting the ability to manage landscape patterns and fuel conditions to achieve desired conditions. Use of wildfire (unplanned ignitions) to achieve desired conditions is frequently infeasible due to seasonal changes weather and fuel conditions.

Effects common to all action alternatives

All action alternatives contain desired conditions and guidelines that articulate what role fire should play. Management direction recognizes that risks to important values changes depending on seasonal changes in weather and fuels, providing the opportunity to use fire as a management tool when conditions are conducive to meeting various plan objectives. The revised plan continues to recognize that with certain weather, fuels, and topography fires can be managed with minimal risk to values. The acres of each designated area influence how fire management can be implemented for each alternative.

Alternative A, no action

The current Helena and Lewis & Clark NF plans, as amended, are the existing management direction being used by the HLC NF to address fire and fuels management. This direction represents the no-action alternative. However, because the no-action alternative is the baseline to which the action alternatives are compared, it is important to understand what actions would continue under the no-action alternative.

The existing Helena NF Plan (1986), and Lewis and Clark NF Plan (1986) include management area direction relating to fire and fuels management. Both existing plans specifically call for fire being permitted in wilderness and for prescribed fire to maintain healthy and stable ecosystems (1986 HLF Plan appendix R and 1986 LCF Plan, appendix P).

Under the no-action alternative, management of fire and fuels would continue following existing forest plans. With the focus on mechanical treatments, the use of unplanned ignitions to meet resource objectives could be expected to increase relative to all other alternatives. This is a result of the opportunity to treat critical areas prior to an unplanned ignition resulting in an increase in favorable forest structure.

Effects that vary by alternative

Future vegetation treatments

Prescribed fire is essential to reducing fuels; (E. D. Reinhardt, Keane, Calkin, & Cohen, 2008) found that it is possible to craft treatments that achieve both ecological restoration and fire hazard reduction, but ecological restoration will also include reintroducing fire and other active management. The most effective ecosystem treatments should include prescribed fire (E. D. Reinhardt et al., 2008).

In all alternatives, prescribed fire would continue to be used to move the forest toward desired future conditions. The amount of anticipated prescribed fire within forested areas varies by alternative as shown in Table 37. Alternative E is projected to result in the least amount of prescribed fire within forested vegetation types, due to an emphasis on timber production. Additional potential treatments in nonforested vegetation types are not reflected in the projections.

Table 37. Average prescribed fire acres[1] per year by alternative.

Time period	Alternative A	Alternative B/C	Alternative D	Alternative E
Decade 1	6,479	6,358	6,449	2,777
Decade 2	3,757	3,711	3,714	2,173

1. Acres are from the SPECTRUM model and only include forested areas. Non-forested area is not included in these figures. Figures include areas both inside and outside the WUI.

Harvest treatments can also be used to achieve fuel management objectives, such as reducing forest densities and favoring fire-resistant species. Relative to impacts to fire and fuels, treatments that may occur in the WUI may be the most important. Each alternative results in differing amounts of projected harvest treatments inside the WUI, as shown in Table 38. Alternatives A, B, C, and D treat similar amounts of the urban interface where alternative E treats less in the first two decades as a result of maximizing timber production. Alternative E emphasizes harvesting in high productivity forests, whereas alternatives A, B, C, and D focus treatments on dry vegetation sites that are most departed from desired conditions. Alternative E would be the least responsive in obtaining desired fuel conditions within the urban interface in the first two decades.

Table 38. Average harvest acres per year[1] in the WUI by alternative

Time period	Alternative A	Alternative B/C	Alternative D	Alternative E
Decade 1	2,201	2,137	2,126	1,078
Decade 2	2,408	2,255	2,254	1,427

1. Source: Spectrum model, average acres per year for decade 1 and 2, all harvest types, projected to occur in the WUI.

Flexibility for fire management

The alternatives vary from the fuels management perspective on the allocation of acres to different designated areas. The primary designated area that impacts fuels management is RWAs due to policy limitations on both mechanical treatments and prescribed fire. In RWAs, initial limitations would be for mechanical treatment of fuels. Wildfire would be used to meet resource objectives, with an emphasis on non-mechanical treatments and limited use of prescribed fire as allowed on these acres. There would be additional limitations on prescribed fire in these areas if RWAs become designated wilderness.

Within RWAs, there would be an additional focus on the natural role of fire. However, fuel management would be dependent upon the use of unplanned ignitions and the risk assessment associated with each season and event that may require suppression actions instead. The ability to use wildfire for resource benefit would likely be reduced due to constraints on mechanical treatments. This would limit opportunities to pretreat areas that would serve as buffers for naturally ignited wildfires. Additionally, the location of the ignition would weigh heavily on decisions relating to suppression. Table 39 displays the total amount of RWAs by alternative, and the acres of RWAs that occur within the WUI.

Table 39. Recommended wilderness and WUI by alternative

	A	B/C	D	E
Acres RWAs	34,222	213,076	474,588	0
Acres of WUI in RWAs[1]	4,551	31,694	97,189	0

1. WUI will change over time as population growth continues.

Alternative B would have more acres of RWAs compared to alternative A. The use of motorized/mechanized means for access and management would be restricted in RWAs. The use of prescribed fire and mechanical treatments could be expected to be less relative to alternatives A and E, but greater than alternative D. Alternative C is the same as alternative B with respect to RWAs, except that it would allow existing motorized use to continue in those areas. This would add flexibility allowing for some mechanical treatments and increased use of prescribed fire as compared to alternative B. A result of increased mechanical and prescribed fire activities would lead to increased flexibility to manage unplanned natural ignitions.

Alternative D includes the greatest amount of RWAs, especially in the WUI, and restricts motorized/mechanized access in those areas. Alternative D provides for the least flexibility for fire suppression and fuels management, resulting in the fewest opportunities of mechanical and prescribed fire treatments. This alternative may result in reduced flexibility for unplanned natural ignitions used to meet forest plan desired conditions. This alternative would require greater dependence upon the use of unplanned natural ignitions to meet forest plan desired conditions. However, with less flexibility in conducting associated fuel management activities, unplanned natural ignitions may require suppression actions instead.

Alternative E provides for the most flexibility for fire suppression by including no RWAs, resulting in the greatest opportunities for mechanical treatments and prescribed fire. Other existing constraints, however (such as IRAs), would result in similar fuel treatment opportunities as in alternative A. Access would be less restricted in this alternative compared to B, C and D. Alternative E would likely result in more opportunities for prescribed fire, increased opportunities for unplanned ignitions being used to meet forest plan desired conditions, and an increase in mechanical treatments. However, as shown in the future vegetation treatment discussion, an emphasis on timber production with this alternative could actually result in moving fewer acres toward desired future conditions within the WUI with fuels treatments.

Effects from plan components associated with:

Recommended wilderness

It is possible that RWAs could be designated by Congress as wilderness at some point in the future. Wilderness designation would result in reduced flexibility and options for vegetation and fuels management to achieve desired conditions. Use of prescribed fire is typically not allowed within designated wilderness areas, and the ability to use unplanned ignitions (wildfire) as a tool would be very limited within some of the RWAs due to proximity to the WUI. This is because of the small size and/or in locations that likely have to be aggressively suppressed to protect identified values (i.e., private lands). This effect would be most pronounced under alternative D, with some impact, though much less, under alternatives B and C modified. There would be little impact under alternatives A. Alternative E would have no effect as there are no RWAs in this alternative.

General wildlife management

Wildlife management direction has low impact on fire and fuels management, especially within the WUI, because management direction recognizes the importance of managing vegetation to modify fire behavior. Fire on the landscape is an important part of the natural function of the ecosystem, and as such helps create and maintain habitat conditions for native wildlife species.

Specific plan components for wildlife may limit fuels management activities. For example, all alternatives include plan components that would limit disturbance to some species during critical times, such as nesting or calving, in specific areas. Such timing restrictions may result in missed prescribed fire windows at times.

All alternatives would adopt the Grizzly Bear Conservation Strategy. Associated plan components may limit access and disturbances such as prescribed burning within the primary conservation area, which would apply to the Upper Blackfoot and Rocky Mountain Range GA.

In addition, there are plan components that specify specific habitat conditions such as thermal cover, security, or hiding cover for species such as elk. These components are the most specific and limiting with alternative A. The action alternatives contain plan components with more flexibility related to elk habitat conditions. Alternatives C and D are the least limiting related to elk habitat, because no specific guidelines for elk security are included, whereas B and D do have guidelines related to elk security.

Watershed, soil, riparian and aquatic management

Consequences from forest plan components on the ability to restore or maintain ecosystems or reduce hazardous fuels would be generally similar for all alternatives. In order to meet the plan direction associated with these resources there would likely be occasions where prescribed or natural fires cannot be used due to potential negative effects that those activities could have on these resources. Fuels management activities occasionally require some soil disturbing activities or road construction, which may be limited to meet other plan components. Although it is difficult to quantify the effects, all the alternatives have components that would limit fire for ecosystem maintenance or fuels treatments in certain circumstances.

All alternatives would contain components that limit equipment use on steep slopes. However, the action alternatives also include guidelines that require a minimum amount of organic matter to be present following treatments, which may be difficult to achieve following prescribed fire in some cases. The revised plan also contains guidelines for the retention of coarse wood debris which would also factor in to prescribed burning prescriptions. Finally, the action alternatives include the adoption of RMZs, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. The plan components associated with RMZs would also influence prescribed burning prescriptions and techniques.

In summary, all alternatives include plan components for the protection of water, soil, and aquatic resources. The components for the action alternatives (B, C, D, and E) are more specific and potentially limiting to prescribed fire operations than those in the no-action alternative (A).

Timber management

Vegetation treatments are typically designed and implemented to achieve multiple resource, social and economic objectives, including those associated with fuels management. Where fuels reduction is an identified objective, the timber management program supports the accomplishment of that objective.

Under alternative A, the existing forest plan directs suppression of all wildfires in some of the Management Areas where timber production is an objective. The action alternatives do not have this limitation, but recognize that not all fire is detrimental to timber production. Therefore there is opportunity to allow wildfires to burn and help maintain/restore fire adapted ecosystems.

Access and recreation management

Changes in road access are the most under alternative D and least for alternative A. Alternatives B and C have a moderate change in access due to additional RWAs compared to alternative A and less RWAs than in alternative D. Alternative E would likely have the greatest access due to the most land suitable for timber production and no RWAs (refer to Recreation and Access section). This would influence fire management activity access and remove it where roads are decommissioned. Alternative means of treating fuels may be more expensive and thus prohibited.

Cumulative Effects

Human population increases and/or shifts towards wildland-urban interface

For the last several decades there has been more human development occurring around the "edges" of lands administered by the Forest. This trend is expected to continue in the future and is likely to have effects on the forest vegetation that are similar to those discussed above under the item titled "National Fire Plan, Healthy Forest Initiative, and Healthy Forest Restoration Act." In addition, with a greater number of people living and recreating in these wildland-urban interface areas, there is a greater probability of more human-caused wildfire ignitions that could have effects on the forest vegetation, in spite of efforts to suppress human-caused fires.

WUI has become the focus of suppression resources when large wildfires occur (Gude et al 2008). The future increase in WUI will continue to challenge wildfire management during large fire events as “Firefighters will likely have to protect dispersed housing over an extremely large area of fire-prone forest.” (Gude et al 2008). To work individually with property owners is costly and creates a patch work of defendable properties among those that are not.

The current trend of rural fire department staffing is on the decline, leading to limitations on their ability to support fire suppression and/or structure protection in their jurisdictions. This may lead to increased spread of fire from off forest.

To the extent that plan components (such as those related to soils and wildlife) limit the implementation (or increase the complexity) of prescribed fire, the ability for fire managers to use this tool for landscape fuels management in the WUI may be lessened.

Increased regulation and concern over smoke emissions

The ability to use fire to maintain and/or restore the fire-adapted ecosystems on the Forest, or to use fire to reduce hazardous fuels in the wildland-urban interface, is dependent upon air quality regulations. Therefore, to the extent that air quality regulations may become more stringent in regards to the quantity and timing of smoke emissions, there could be substantial effects on the ability of the Forest fire management program to utilize these fire tools. If past trends of increasing regulations and decreasing burn opportunities continue, the effects could be substantial and would likely result in not being able to use fire enough to make meaningful improvements to forest and fuel conditions and meet objectives.

Timber product manufacturing infrastructure and economics

The ability of the Forest to positively affect forest vegetation is partially dependent upon the ability to sell forest products to manufacturing companies and to use harvesting process (including the residual slash disposal activities) as a means to positively affect the forest vegetation and reduce hazardous fuels. If the forest products industry declines in areas surrounding the Forest to the degree that it is difficult to sell forest products or "stumpage prices" decrease substantially, it would affect how many acres could be treated and fuels reduced. While some treatments could be accomplished by using prescribed burn-only, it is generally very risky in the wildland-urban interface and expensive, leading to fewer acres treated.

Other plans

Since they were developed, national level plans, initiatives, and acts such as the National Fire Plan, Healthy Forest Initiative, and Healthy Forest Restoration Act (these are called "other plans" for the rest of this discussion) have influenced the vegetation and fuel management programs on the Forest. Therefore, they have had some effects on hazardous fuels and it is anticipated that they will continue to do so for the foreseeable future. In general, these plans have resulted in more vegetation treatments being implemented near wildland-urban interface areas with the objective of reducing hazardous fuels, and fewer vegetation treatments being conducted in areas located away from communities. In addition, the types of fuel treatments that are being used in response to these other plans are often more expensive due to the need to rely on mechanical and hand treatments rather than fire. Additionally, social issues can be more contentious. Therefore, higher public involvement, planning and implementation expenses are likely to lead to fewer acres being treated within a given budget level. Not only do these other plans emphasize the need to reduce hazardous fuels in the wildland-urban interface, but they also stress the need to restore the natural fire regimes and forest conditions to the larger NF landscape. These plans encourage the development of more resistant and resilient forest vegetation that would be less susceptible to large undesirable wildfires and/or insect outbreaks.

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 40, for those plans applicable to fire and fuels.

Table 40. Summary of cumulative effects to fire and fuels management from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All plans address fire and fuels. Generally speaking, management of fire and fuels is consistent across all NFs due to law, regulation, and policy. The cumulative effect would be that the management of fire and fuels would be generally complementary by creating resilient landscapes, fire adapted communities, and safe and effective wildfire response. This includes specific adjacent landscapes that cross forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
Montana Statewide Forest Resource Strategy (2010)	This plan guides fire and fuels management on state lands. It includes some concepts that are complementary to revised plan components for the HLC NF, for example, state direction is for suppression of wildfires which addresses safe and effective wildfire response. While specific desired conditions are not stated in the same terms as the HLC NF, it is likely that some elements such as provide for firefighter and public safety would be similar. State forestlands may be actively managed to a greater degree than NFS lands, and would contribute to achievement of desired fire and fuels conditions across the landscape.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components related to fire and fuels, and are complementary to the plan components for the HLC NF by creating resilient landscapes, fire adapted communities, and safe and effective wildfire response.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the fire and fuels characteristics in this area are therefore likely similar to the wilderness areas in the adjacent Rocky Mountain Range GA and would likely complement these conditions.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily nonforested, and calls for managing for fire and fuels. This plan would be generally complementary to the HLC NF through direct fire suppression outside the impact zone and the potential for the use of prescribed fire.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Fire and fuels is a component of these parks, although not always the primary feature. Specific fire and fuels conditions relating to protection of values through treatments within the WUI and through safe and cost effective suppression of wildfires contribute to the desired conditions as described for the HLC NF.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy (above). The vegetation conditions described would be complementary to the conditions being managed for with the HLC NF revised forest plan.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Managing for open forests and

Resource plan	Description and Summary of effects
	fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	This plan is relevant to an area that lies adjacent to NFS lands in the Divide GA, in proximity to the City of Helena. The plan emphases forest management and wildfire mitigation. This would be generally complementary and additive to management on some HLC NF lands, specifically the South Hills Special Recreation area (alternatives B, C, and D).

Conclusions

The following key points summarize the conclusions for fire and fuels management:

- Fire is a critical ecological function across the HLC NF that plays a central role in providing quality habitat for both plant and wildlife species. All alternatives would ensure fire remains a part of the ecological system and would move the forest toward desired future conditions. This is achieved through a variety of management actions including wildland fire and mechanical treatments.
- *Future vegetation treatments:* Alternative E would achieve the least amount of harvest and prescribed fire in forested areas, including in WUI areas due to focusing on maximizing timber harvest. Alternatives A, B, C, and D would tend to treat more dry forest types in WUI areas. However, there are also other factors that affect the number of acres treated to meet forest plan desired conditions relating to fire and fuels management. Some of these factors include budget allocation, climate and seasonal weather variation, and wildfire occurrence. Budget directly affects how much we are able to treat mechanically and with prescribed fire. Climate and seasonal weather variation affect the ability to conduct prescribe burns. Wildfire occurrence activity locally uses personnel and other resources that would be used for implementing mechanical and prescribed fire treatments.
- *Flexibility for fire management:* Different management designations, specifically RWAs, affect where different management tools, such as mechanical treatments and prescribed fire can be used. Alternatives B, C, and D would limit mechanical treatment options within RWAs, with D having the most area restricted. If these areas became designated wilderness then additional constraints on prescribed burning would exist. Under alternatives B, C, and D there may be increased opportunities and need to manage natural-wildfire to move toward desired future conditions because of the limitations on mechanical activities which would affect the use of prescribed fire. Alternative E has the greatest flexibility for fire and fuels management, but conversely may reduce the use of prescribed fire and wildfire managed for resource benefit because of the emphasis on timber production.
- *Future wildfire and fire regimes*: The projected levels of future wildfire, and their subsequent impact on fire regimes, is generally the same across alternatives. This is because vegetation over time is generally the same for all alternatives, and projected future treatments are also similar. Factors such as climate have a greater bearing on vegetation change and potential wildfire activity.

3.8 Terrestrial Vegetation

3.8.1 Introduction

The 2012 Planning Rule adopts a complementary ecosystem and species-specific approach, known as “coarse-filter/fine-filter”, to provide the natural diversity of plant and animal communities and ensure long-term persistence of native species in the plan area. Coarse-filter plan components are designed to maintain or restore ecological conditions for ecosystem integrity and diversity within agency authority and the inherent capability of the land. This section addresses the coarse filter characteristics of terrestrial ecosystems on the HLC NF, including both forested and nonforested plant communities. The coarse-filter approach addresses conditions at the ecosystem or plant community level in terms of providing for ecosystem integrity and diversity.

The key ecosystem characteristics listed in Table 41 were identified in the Assessment as measurable components of ecosystem integrity. They are measurable, quantitative or qualitatively. The desired condition for each characteristic and its relationship to the current and potential future conditions form the basis for this analysis.

Table 41. Terrestrial vegetation key ecosystem characteristics

Key ecosystem characteristic	Indicator(s)	Measure
Role of insects and diseases	Hazard ratings for mountain pine beetle, Douglas-fir beetle, western spruce budworm, and root disease	Percent of area
Vegetation composition	Cover types (forested and nonforested)	Percent of area
Tree species presence	Presence of at least 1 tree per acre	Percent of area
Forest size	Classes based on basal area weighted diameter	Percent of area
Large and very large trees	Presence of a set minimum trees per acre	Percent of area
	Total quantity	Trees per acre
Forest density	Classes based on canopy cover	Percent of area
Vertical structure	Classes based on canopy layers	Percent of area
Landscape pattern: early successional forest	Average and area weighted mean patch size	Acres

Several issues were identified through public scoping, and are also used to frame the analysis:

- Climate change
- NRV
- The role and effects of large fires
- The role of vegetation management (timber harvest, fuel reduction, restoration, and salvage)
- The importance of large trees
- The condition of specific plant species or types (whitebark pine, aspen, sagebrush, non-forested plant communities, spruce/fir)

3.8.2 Regulatory framework

Please refer to the introductory regulatory framework section of this chapter (3.3).

3.8.3 Assumptions

This analysis assumes that tree species evolved with specific fire frequencies that have been disrupted by fire exclusion. Relationships between climate, disturbances such as wildfire and insects, and human activities such as timber harvest and fire suppression are synergistic. Climate change presents uncertainty in future disturbance regimes and vegetative responses. Based on the best available science, this analysis assumes that future climates will be warm and dry.

The desired conditions for terrestrial vegetation are developed with an underlying assumption that the NRV provides context for future conditions, particularly conditions that occurred during warm, dry climate periods of the past. Assumptions associated with the NRV modeling, and the development of desired conditions, are detailed in appendix B.

The analysis relies on analytical vegetation models. By necessity, these models use assumptions to simplify ecosystem processes and potential silvicultural treatments as described in appendix B. In reality, silviculture prescriptions would be applied site specifically, designed to address forest conditions unique to the site, and therefore would be more variable in application and resulting vegetation conditions.

A further assumption of the analysis is that the vegetation strategies described in appendix C of the revised forest plan would generally be followed for all action alternatives.

3.8.4 Best available scientific information used

A variety of well documented data and analysis tools were used, as described in appendix B.

The data used represent the latest available, with the most recent plots being measured in 2016. The effects of more recent disturbances, including the wildfires of 2017, are not captured. However, the analysis includes the potential for future fire and therefore the relative comparisons for use at the programmatic scale remain valid.

This analysis draws upon the best available literature citations that are relevant to the ecosystems on the HLC NF. Literature sources that were the most recent; peer-reviewed; and local in scope or directly applicable to the local ecosystem were selected. Local studies and anecdotal information that are not peer-reviewed are included where appropriate to provide context.

Terrestrial ecosystems are highly complex and contain an enormous number of known and unknown living and nonliving factors that interact with each other, often in unpredictable ways. There are gaps in available information about ecological functioning. Vegetation is dynamic, changing constantly, and our ability to predict changes in the future is limited. The level of uncertainty depends on how predictable such factors as disturbances, climate change, or human activities may be.

3.8.5 Affected Environment

A primary goal of the revised forest plan (alternatives B/C, D, and E) is to provide for ecological integrity and sustainability, supporting the full suite of native plant and animal species, while providing for the social and economic needs of people.

The desired conditions for each key ecosystem characteristic reflect our best understanding of sustainable and resilient forest conditions based in large part on the NRV and take into account expected future climate by adjusting for past trends demonstrated during warm/dry climate periods. These desired conditions would not necessarily apply to alternative A, but are included in the analysis for all alternatives to provide for a comparison. Appendix B describes and displays the desired range of each characteristic as compared to the existing condition.

Broad potential vegetation groups

Terrestrial vegetation characteristics are stratified by *broad potential vegetation group (PVT)*, which identify sites of similar environmental conditions. These groups provide information on the inherent capability of the land to support vegetation and the nature of change in vegetative communities over time.

Figure 5 displays the proportion of each broad PTV forestwide, and in each GA. Three forested broad PVTs (warm dry, cool moist, and cold) are found on the HLC NF, and six nonforested types (alpine, riparian/wetland, xeric shrub/woodland, mesic shrubland, mesic grassland, and xeric grassland) plus sparsely vegetated areas. See appendix A for a map.

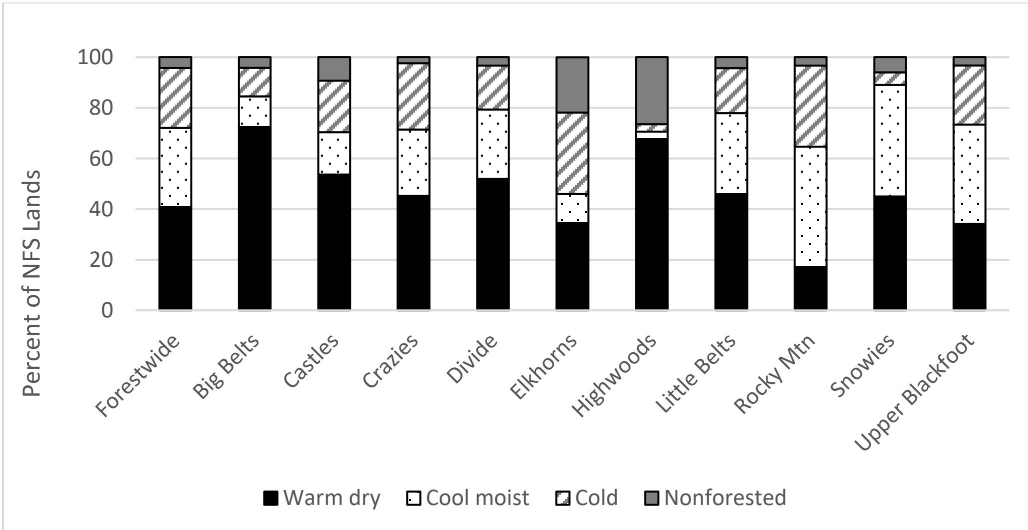


Figure 5. Percent of each broad potential vegetation type on NFS lands[1]

1. Data source: R1 Summary Database. Refer to appendix D of the draft forest plan and appendix B of the DEIS.

The warm dry broad PVT occupies the warmest and driest sites on the HLC NF that support forests. These sites support ponderosa pine and dry Douglas-fir habitat types. This group occurs at lower elevations, on warm southerly aspects, and/or on droughty soils. Forests are often dominated by Douglas-fir, ponderosa pine, or limber pine. Open forest savannas may occur on this group, where grasses or shrubs are dominant and trees are widely scattered due to repeated frequent fires.

The cool moist group comprises the most productive forest sites on the HLC NF. Moist Douglas-fir habitat types are in this group, along with lower subalpine fir and spruce habitat types. This setting occurs on mid to high elevation sites across all aspects. Lodgepole pine and Douglas-fir are the most common dominant species, with Engelmann spruce and subalpine fir common as well.

The cold broad PVT occupies the highest elevation areas that support forests. Some sites are cold, moist subalpine fir habitat types that support moderately dense forest cover. Remaining areas are cold, drier subalpine fir and whitebark pine types where growing conditions are harsher and tree density more open. Subalpine fir, Engelmann spruce, and whitebark pine are the most common species.

Nonforest broad PVTs consist of the persistent non-forested vegetation climax types. They occur on sites where establishment and growth of conifers is impeded, for example in areas of shallow or very droughty soils; very wet soils and high water tables; or very frequent disturbance. Persistent nonforested areas include alpine meadows, dry grasslands and shrublands, mesic grasslands and shrublands, and riparian areas. There are also areas on the forest that are non-vegetated, where very sparse or no vegetation grows, such as scree or barren areas. These are excluded from the analysis.

Ecosystem processes and disturbances

Vegetation is not static; it is constantly changing across space and time due to drivers such as climate, succession, fire, insects and diseases. The complex interactions between these processes over past centuries resulted in the vegetation that currently exists, and will influence changes into the future. Since the late 1990’s, national disturbance rates have been influenced primarily by natural disturbances (rather than anthropogenic ones), and increasing rates for forest decline have been concentrated in the western U.S. where extended droughts have coupled with increasingly high temperatures to create increasingly stressed and vulnerable forests (Cohen et al., 2016).

Climate

Climate strongly influences vegetation and ecosystem processes. Temperature and moisture patterns dictate what plants are able to establish and grow on a site, and influence factors such as growth rates and density. Drought can alter vegetation directly by killing plants, or indirectly, by increasing the frequency and/or severity of disturbances or rendering forests more susceptible to insect and disease. Over geologic time, changes in climate are natural; even so, as a consequence of climate change, forests may face rapid alterations in the timing, intensity, frequency, and extent of disturbances (Dale et al., 2001).

Considerable natural variation in climate has occurred historically. Future climate projections suggest that temperature increases will exceed the historical variation for average monthly maximum temperature. Specific changes in ecosystem components due to expected climate change are difficult to predict, and are highly uncertain, especially in the diverse terrain of the northern Rocky Mountain region.

In the western U.S., it is likely that water balance and disturbance dynamics will be more important than actual increased temperature in affecting vegetation. Longer, warmer growing seasons may increase growth rates; however, greater soil water deficits and increased evapotranspiration in the summer may offset this and increase plant stress. Growing sites on the HLC NF are generally moisture-limited as opposed to energy-limited. That is, there is plenty of sunlight, but growth is limited by moisture. Therefore, warm/dry climatic periods generally result in slower growth and decrease the ability of a site to support vegetation compared to cool/moist periods. Competition-based mortality increases during dry periods. Stress can also lead to higher mortality rates indirectly through susceptibility to insects or disease. Increasing soil water deficits can cause eventual shifts in species presence across the landscape as they become less able to regenerate or survive. Species located on sites at the margin of their optimal range would be most vulnerable. Species extent and distribution would be consequently impacted.

Climate changes are also expected to affect disturbances. There is a high degree of uncertainty associated with extrapolation of these effects to local sites. Persistent and recurring drought combined with high temperatures may give rise to “megadisturbances” in some areas that may cause tree mortality of a spatial extent, severity, and frequency surpassing that recorded during recent human history (Millar & Stephenson, 2015). Studies of potential effects of climate change on fire and insect/disease suggest the following may occur across the western U.S. (Halofsky et al., in press-b):

- Longer fire seasons, more days of high fire danger, increased frequency of ignitions, more frequent large fires, more episodes of extreme fire behavior, and increased average annual area burned.
- Given availability and spatial distribution of host species, there may be elevated levels of native insects and disease. Predicted increases in temperature and drought will probably serve to increase pathogen populations in the future because they are able to migrate to new environments at a faster rate than trees.

Vegetative succession

Vegetative succession is the sequential process of long-term plant community development. It entails the change in the composition, structure and function of plant communities over time, and is based on the concept that every plant species has a particular set of environmental conditions under which it will reproduce and grow.

The classical model of succession culminates in the climax community, a state of relative stability in composition, structure and function, with all existing species able to perpetuate themselves without disturbance. In disturbance-prone ecosystems (such as the HLC NF) the climax state may rarely be achieved because succession is interrupted by disturbances such as wildfire.

Successional pathways are complex and the rate of change can be variable; simplification of the process is necessary for analysis. The evaluation of forest size classes provide the means to evaluate successional change of forests over time. The early successional stage is characterized by the seedling/sapling size class. As trees grow, they transition from smaller size classes into larger size classes. Mid-successional forests are associated primarily with the small and medium forest size classes, but in some cases forests in the large size class are also mid-successional, depending on tree ages and species. Late successional forests are associated mainly with the large and very large forest size class.

Wildfire

Fire is a primary ecological process that has created, maintained, and renewed vegetation on the HLC NF. Table 42 briefly describes the effects of fire on the vegetation of the HLC NF based on fire regimes(Hann et al., 2008)(Hann et al., 2008).

Table 42. Fire severity effects on vegetation of the HLC NF (adapted from Hann et al., 2008)

Fire Regime	Severity, Frequency, and Vegetation Type	Fire effects on vegetation of the HLC NF
I	Low severity, 0-35 years, ponderosa pine and dry-site Douglas-fir	Open forest, woodland, shrub and savanna structures are maintained by frequent non-lethal fire. This regime also includes mixed severity fire that creates a mosaic of age classes. Low severity fires result in minimal overstory mortality (<25% of dominant overstory) and small patch size. The forests in this regime were often dominated by ponderosa pine or Douglas-fir; fire maintained these species and promoted open, often uneven-aged, structures. These species reforest gaps created by fire through the survival of fire-resistant seed bearing trees. These fires also maintained open, dry forest savannas and a shifting distribution of dry limber pine/juniper ecotone communities.
II	Stand-replacing, 0-35 years, Drier grasslands and cool-site sagebrush	Shrub or grasslands are maintained or cycled by frequent fire; fire typically removes nonsprouting shrubs, tops of sprouting shrubs and most tree regeneration. These fires are important in vegetation communities such as big mountain sagebrush.
III	Nonlethal and mixed severity, 35-100+ years, Interior dry-site shrub communities; moist-site Douglas-fir and lodgepole pine	A mosaic of ages, early to mid-seral forest stages, and shrub and herb dominated patches is maintained by infrequent fire. Mixed severity fires kill a moderate amount of the overstory, burning with a mosaic of severities but replacing <75% of the overstory. Highly variable patch sizes are created, with an irregular pattern with an abundant amount of edge. Fire tolerant species often survived fire, with large, old trees becoming prominent overstory components. These fires also resulted in unburned patches that could develop climax conditions dominated by shade tolerant species.
IV	Stand-replacing, high intensity, 35-100+ years, lodgepole pine	Large patches of similar aged forests are cycled by infrequent fire. Stand replacing fires kill most trees (>75%) over a large area. Lodgepole pine regenerates large areas by storing serotinous cones that open under intense heat. Mature lodgepole pine stands on the HLC NF generally exhibit a high degree of serotiny. Fire return intervals are generally long; however, shorter intervals also occur and forests may re-burn after dead trees have fallen. Lodgepole pine produces open cones at a young age to re-seed re-burned or understocked patches. Serotiny in fire-prone ecosystems is typically expressed from 30-60 years of age to ensure that seed is available after the next stand-replacing event.
V	Stand replacing, high intensity, 200+ years, boreal forest and high elevation conifer forest	Variable size patches of shrub and herb dominated structures, or early to mid to late seral forest occur depending on the biophysical environment and are cycled by rare fire events. These forests often have complex structures influenced by small gap disturbances and understory regeneration. Fires may result in the regeneration of lodgepole pine but also provide suitable sites for the establishment of whitebark pine at the highest elevations. Many sites become dominated by subalpine fir at the later stages of succession.

For much of the last century, wildfire area burned diminished relative to the historic condition. This was due to fire exclusion, forest management, and climate (Hessburg & Agee, 2003; Hessburg, Agee, &

Franklin, 2005; Westerling, Hidalgo, Cayan, & Swetnam, 2006). Roads, railroads, grazing, urbanization, agriculture, and rural settlement all influenced fire exclusion (Hessburg et al., 2005). Since 1940 most GAs on the HLC NF had a fraction of their area burn in any given decade. The consequences of this departure included:

- Fire in many dry forests shifted from low-intensity, high frequency to less frequent, moderate and high-severity, with increases in uncharacteristic large-scale stand-replacing fires (Lehmkuhl et al., 2007). Fires of higher intensity can kill fire-resistant seed bearing trees, thus disrupting the ability of these forests to regenerate.
- In higher elevation moist forests, changes to the natural regime were less pronounced. However, at the landscape scale, fire suppression in lodgepole pine may induce mosaic homogeneity in forests that previously contained a heterogeneous mix of age classes (Barrett, 1993; U.S. Department of Agriculture, Forest Service, Northern Region, 1990). In these areas fire suppression had the effect of decreasing acreage burned in normal fire seasons and reducing the variability in landscape patterns.
- Mixed severity fire regimes experienced changes described for both low and high severity regimes. Fire exclusion reduced stand- and landscape diversity in subalpine forests so that vegetation aged more uniformly and become less diverse, resulting in stand replacing fires that regenerate extensive areas that were mosaics historically (Barrett, Arno, & Menakis, 1997).
- Fire regimes in nonforested areas changed in large part due to conifer encroachment that has resulted from fire exclusion, grazing, and climate (Heyerdahl, Miller, & Parsons, 2006). The mosaic of sagebrush-grasslands with stable islands of Douglas-fir savanna that dominated by the past have been replaced by Douglas-fir forest in some areas (ibid).

On the HLC NF, increasingly large fires have been occurring since 1980. The increase may be due to: 1) fuel buildup in low severity regimes; 2) the influence of a warm/dry climate on vegetation, fire behavior, and effectiveness of suppression; and 3) fire policies that have allowed natural fires to burn in some areas. The increase in acres burned is consistent with the Regional climate shift (Marlon et al., 2012), and a trend of acres burned occurring throughout the West. Several GAs have had recent periods within the NRV for acres burned (Elkhorns, Rocky Mountain Range, and Upper Blackfoot).

Forest insects and diseases

There are many insects and diseases that affect forest vegetation. Most are native and usually exist at low population levels. Some insects can cause dramatic effects; but, more often, changes occur gradually. Insects and diseases that currently have the most notable impacts on the HLC NF are discussed here.

Bark beetles

The two primary bark beetles native to the HLC NF are the mountain pine beetle and the Douglas-fir beetle. Beetle populations may be favored by warm temperatures due to increased survival of beetles and increased stress of host species. Future bark beetle-caused mortality will depend not only on the spatial distribution of host trees, but also the ability of beetle populations to adapt to changing conditions. Beetle outbreaks can lead to changes in fire behavior (Jenkins, Hebertson, Page, & Jorgensen, 2008); Hansen et al 2015). The changes to fire behavior vary in post-outbreak stands depending upon when they occur; the net result is a substantial change in species composition and a highly altered fuels complex.

The NRV analysis compared the average acres infested per decade with recent acres infested from 2000-2009. Mountain pine beetle infestation was well above the natural range, while Douglas-fir beetle was at the lower end. Insect events are expected to be cyclic in nature with a wide range of variability. Severe bark beetle activity was at the high end of the natural range during warm and dry periods.

Mountain pine beetle hazard ratings are indicators of potential future beetle activity. Hazard represents the likelihood of an outbreak occurring in a specific time period and is a function of forest conditions.

Elevation, age, size and proportion/density of host pine species are factors used in the hazard rating; separate ratings are generated for lodgepole pine versus ponderosa pine (Randall & Bush, 2010). Although whitebark pine and limber pine may also be affected, no hazard rating is available.

Relatively few areas have hazard to mountain pine beetle in ponderosa pine because of the limited extent of this species. However, where ponderosa pine is present and hazards exists, most are at a moderate level, primarily in the warm dry broad potential vegetation group. Moderate and high hazard areas exist on the greatest proportions of the Big Belts, Little Belts, and Snowies GAs. Of particular interest are the ponderosa pine forests in the Snowies, which were largely untouched by the recent outbreak. Ponderosa pine forests on most other areas were impacted by the outbreak, and are at a lower hazard today as a result. The infestation was patchy in ponderosa pine, and scattered individuals and groups of susceptible trees survived.

Lodgepole pine forests are extensive on the HLC NF, and most have moderate to high hazard, particularly in the cool moist broad potential vegetation group. This is in part due to lodgepole on the east side of the forest sustaining light infestation during the recent outbreak. However, many areas especially on the west side of the forest were impacted by the outbreak and have a lower hazard today because many host trees were killed. The areas that sustained high mortality in the recent outbreak, such as the Divide, Big Belts, and Upper Blackfoot, now have small percentages of moderate or high hazard. It will be decades before these forests develop susceptible conditions. Conversely, GAs that still support extensive areas of mature pine, such as the Castles, Highwoods, and Little Belts have more moderate to high hazard.

In the short term, large-scale mountain pine beetle outbreaks are likely to be limited until lodgepole pine forests re-establish and mature. Some GAs, however, do contain potential for mountain pine beetle outbreaks in the short term, most notably the Snowies, Castles, Highwoods, and Little Belts.

The hazard, or likelihood of a Douglas-fir beetle infestation developing, is based on the average diameter of Douglas-fir trees, stand basal area, and percent composition of Douglas-fir (Randall & Bush, 2010). Where susceptible Douglas-fir are available, the hazard is primarily low and moderate. This may indicate a limited potential for a large scale outbreak; however, localized outbreaks are possible especially where disturbances cause elevated risk, and may impact high value stands such as old growth. The Highwoods GA in particular has a high proportion of its area at high hazard. Some amount of moderate to high hazard is present in most GAs based on the extent of mature Douglas-fir. This along with warm/dry climate and the stress caused by western spruce budworm give Douglas-fir beetle the potential to impact forests.

Western spruce budworm

Western spruce budworm is a native defoliator that historically has caused widespread damage on dry forests east of the Continental Divide. Defoliation has been widespread on the HLC NF over the last decade due to warm, dry climate and the availability of dense, layered forests of host species. In several areas, defoliation caused extensive mortality of mature trees, which is not typical of this insect. This was partly a result of the ongoing below-average precipitation and above-average temperatures (Kegley & Sturdevant, 2006). Budworm activity has varied in recent years due to wet springs and summers, but overall infestation remains at elevated levels at the writing of this report. The NRV analysis showed that acres infested from 2000-2009 were well above the NRV.

The hazard rating for defoliators is based upon basal area, percent composition of susceptible species, and trees per acre; high hazard stands are those in which a large amount of Douglas-fir and true fir defoliation is expected once an outbreak occurs (Randall & Bush, 2010). About three-quarters of the plan area contains hosts susceptible, and on these sites there is a fairly even distribution of high, moderate, and low hazard conditions. Due to the widespread distribution of Douglas-fir and dense stand conditions, defoliator hazard is prevalent on all GAs. The Crazies and Highwoods GAs contains the least hazard.

Root disease

Root diseases are caused by fungi that spread from the roots of diseased trees. The most common root pathogens known to occur on the HLC NF include armillaria root disease and schweinitzii root and butt rot. Douglas-fir and subalpine fir are the most susceptible species. At high infection levels, or over time, root diseases can kill trees. Other stressors such as bark beetles, secondary beetles, drought, or windthrow often contribute to mortality. In most cases root diseases kill trees gradually. Once established on a site, root disease can be essentially permanent, living for decades in roots and stumps (Hagle, 2006). To the best of our knowledge, the current level of root disease is within the NRV. Root disease is not especially prevalent on the HLC NF due to the relatively dry environment east of the Continental Divide. It is most commonly found within the cool moist broad potential vegetation group.

White pine blister rust

White pine blister rust is a non-native disease that entered the U.S. at the turn of the 20th century. Its primary host species on the HLC NF are whitebark pine and limber pine. As blister rust has moved into fragile, high-elevation ecosystems, successional pathways have been altered, hastening the conversion to climax species such as subalpine fir. Blister rust infections are expressed by cankers that progress from girdling branches to the boles of trees, killing them over time. The interaction of warming climates, mountain pine beetle, fire exclusion, and blister rust has resulted in a bleak outlook for whitebark pine in particular. Because it is non-native, all levels of blister rust infection are outside the NRV. There is no known method for eradicating the disease. A small percentage of host trees display one or more resistance traits that enable them to avoid or survive infection; encouraging regeneration from these seed sources provides hope for perpetuation of the species. White pine blister rust is generally present wherever five-needled pines are found on the HLC NF.

Vegetation treatments

In addition to natural ecosystem processes, human interventions change vegetation. Two broad categories of vegetation treatment are evaluated: timber harvest (which includes even-aged regeneration harvest, uneven-aged harvest, and intermediate harvest) prescribed fire and fuel reduction. Table 43 shows the acres of treatments conducted by decade since 1980, during the life of the current forest plans.

Table 43. Acres of vegetation treatments by decade, 1980-2017[4]

Decade	Harvest[1]	Prescribed Fire[2]	Fuel Reduction[3]
1980-1989	23,525	32,211	44,387
1990-1999	30,775	51,460	95,418
2000-2009	10,680	51,826	52,473
2010-2017	9,564	23,964	65,010

1. Harvest activities include even-aged, uneven-aged, and intermediate treatments.
2. Includes overlap of burning in harvested stands. Prescribed fire activities include broadcast burning, jackpot burning, site preparation burning, and underburning.
3. Fuel reduction treatments include burning of piled material, chipping of fuels, compacting/crushing of fuels, fuel break, miscellaneous treatment of natural fuels, piling of fuels, rearrangement of fuels, and thinning for hazardous fuels reduction.
4. Source: FACTS database, acres completed by fiscal year, up to April of 2017.

Salvage harvest

The term *salvage* indicates that trees being removed were killed by natural disturbance, most commonly wildfire or insects, and that one purpose of the treatment is to capture their economic value. Salvage typically only occurs on lands suitable for timber production. Salvage is not modeled as a vegetation treatment as part of the potential forest management solution, because it is unpredictable and would not contribute to estimated timber outputs as defined in the planning directives. In practice, the term salvage is only used when the treatment is intermediate in nature; that is, a fully stocked stand remains in place after the cutting. In the case of stand-replacing disturbance, salvage results in an even-aged regeneration silvicultural system, and is termed as such (i.e., clearcut, seed tree, or shelterwood harvest). Acres of “salvage”, both intermediate salvage and regeneration harvest, are included in the acres of harvest listed in Table 43. Salvage has occurred on approximately 2% of the wildfire acres burned since 1986.

Vegetation composition

The coarse filter for vegetation composition is portrayed by two indicators: cover types (forested and nonforested) and tree species distribution. Desired conditions are enumerated in the draft revised forest plan (alternatives B/C, D, and E). These desired conditions would not necessarily apply to alternative A, but are included in the analysis for all alternatives to provide for a consistent comparison.

Cover types are groupings of dominance types which are used to simplify analysis for the broad scale. There are eight coniferous cover types on the HLC NF and four nonforested cover types, which are described in detail in appendix D of the draft revised forest plan. Due to data limitations, all nonforested cover types are lumped together in the quantitative analysis. The western larch mixed conifer cover type is only present in the Upper Blackfoot GA (in negligible amounts) and is excluded from forestwide estimates. The cover types on the HLC NF include:

- Grass
- Dry shrub
- Riparian grass/shrub
- Mesic shrub
- Ponderosa pine
- Dry Douglas-fir
- Mixed mesic conifer
- Western larch mixed conifer
- Lodgepole pine
- Aspen/hardwood
- Spruce/fit
- Whitebark pine

Tree species presence indicates the proportion of an area where there is at least one live tree per acre of a given species. This measure gives an indication of how widely distributed the species is, although it is not necessarily dominant or even common in all the places it occurs. There are 11 native tree species found on the HLC NF: Rocky mountain juniper, limber pine, ponderosa pine, Douglas-fir, lodgepole pine, western larch, aspen, cottonwood, Engelmann spruce, subalpine fir, and whitebark pine.

Aspen, ponderosa pine, and whitebark pine cover types as well as individual species tend to be below the desired range, while Douglas-fir tends to be above the desired range. The warm dry broad potential vegetation group is the most departed from desired conditions for composition. The following sections provide a summary of the ecological role of each tree species and non-forested vegetation type on the HLC NF. Xeric ecotones and savannas, areas which straddle the concept of forested and nonforested PVTs, are also addressed.

Rocky mountain juniper

Rocky mountain juniper is a common component of xeric ecotones and dry forests. It is an important component of wildlife habitat. It also contributes to fire risk by functioning as a ladder fuel under forest canopies and can encroach into nonforested plant communities, where it would be killed by fire periodically under natural disturbance regimes. Although juniper dominance types are included in the ponderosa pine cover type, they are uncommon. While the NRV analysis estimated that juniper abundance is generally within the natural range, maintenance at the low end of the range is appropriate because this species tends to decline during the warm/dry periods, in favor of nonforested species promoted by fire. This species is essentially absent from the Crazies and Highwoods GAs, and in the other areas is present on small proportions of the landscape. Juniper is most prevalent in the Big Belts, and is notably above the NRV in that GA.

Limber pine

Limber pine is a relatively long-lived five-needled pine which grows primarily east of the Continental Divide. It is a key species on xeric ecotones and rocky areas as well as in alpine communities, and on the HLC NF its presence is often correlated to limestone substrates. On the HLC NF, it grows in association with whitebark pine in some places. Lower treeline limber pine woodlands serve as ecotones between sage/grass and forest/woodlands biomes; their expansion and contraction is due to relationships between vegetation, climate, and wildfire. On more mesic sites, mixed to high severity fires probably occurred much like the fire histories of whitebark pine; however, lower treeline limber pine woodlands are thought to have a more frequent disturbance regime. Limber pine is most prevalent in the warm dry broad potential vegetation group. Forestwide the distribution is within the desired range, but it is below the desired range in the warm dry broad potential vegetation group. By GA, it is generally at the low end or below the desired range except for the Snowies and Little Belts. Limber pine is present in all GAs, but does not feature prominently in the Elkhorns, Divide, or Highwoods. It is particularly abundant in the Little Belts and Snowies.

Aspen and Cottonwood

Persistent hardwood-dominated plant communities are rare but important on the HLC NF. Aspen is more common than cottonwood, which is confined to riparian areas with fluctuating water tables and is more common on the private lands outside of the forest boundary. It is desirable to maintain and promote cottonwood where it exists. Aspen may occur as a persistent community in riparian areas or as a transitional community in upland areas. These communities often dominate in the early stages of forest succession immediately after disturbance. Aspen historically relied on fire or disease to remove the overstory, kill encroaching conifers, and stimulate suckers from the existing clone root system (Shepperd, 1990).

Forestwide, the NRV analysis indicates that the aspen/hardwood cover type is generally within its natural range for abundance, although it is at the low end or slightly below its natural range in some GAs. The modeling also showed that at the forestwide scale, and in the warm dry and cool moist broad potential vegetation groups, aspen species distribution is below its natural abundance. At the GA level, aspen is below the desired condition in most GAs except the Divide, particularly in the Big Belts. The Divide and Rocky Mountain Range contain more aspen than the other GAs. The desired condition ranges reflect a desired trend of maintaining and increasing aspen. The highest levels of aspen correlated with past warm/dry climate periods.

Ponderosa pine

Ponderosa pine is a long-lived, windfirm early successional tree that most often occurs in the warm dry broad potential vegetation group. This species often grows in association with Douglas-fir, limber pine and/or juniper. On the driest sites, it may grow at very open densities and be present in the ecotone between forested and nonforested vegetation. As the most drought and fire tolerant species on the HLC NF, ponderosa pine is capable of surviving low to moderate severity fire even at a young age, and can regenerate on bare soils with high temperatures. As a large tree, it provides important wildlife nesting/feeding habitat, both when live and dead. Compared to associate species such as Douglas-fir, it is less vulnerable to root disease and other pathogens. It is shade intolerant and without disturbance to open the forest canopy, it is gradually replaced by Douglas-fir on most sites.

Ponderosa pine does not occur or is very limited in several GAs including the Rocky Mountain Range, Highwoods, and Crazies. The Little Snowies mountain range within the Snowies GA supports a ponderosa pine dominated community which is unique from other areas on the forest. Ponderosa pine also features prominently in the northern part of the Elkhorns and southern part of the Divide GAs. Ponderosa pine communities are also present in the Upper Blackfoot, Little Belts, and Big Belts GAs. The distribution and structure of ponderosa pine has been affected by fire exclusion and mountain pine beetle particularly in the Elkhorns and Divide GAs.

The NRV analysis indicates that the ponderosa cover type and species distribution is well below its natural range across most landscapes, except the Snowies. In GAs that have little to no existing ponderosa pine, the species could only be promoted through planting.

Douglas-fir

Douglas-fir is one of the most common species on the HLC NF due to the wide range of site and forest conditions under which it is able to compete. It is of high economic value for wood products. It is fairly tolerant of drought, moderately tolerant of shade, and capable of establishing and persisting in the dense forest conditions. Older, larger Douglas-fir are tolerant of fire. Trees can live for many centuries and grow to large diameters which provide wildlife habitat. Douglas-fir is one of the most susceptible conifer species to damage from insect and diseases.

Forestwide, the NRV analysis showed that Douglas-fir dominated cover types (dry Douglas-fir and mixed mesic conifer) are at the high end or above their natural ranges of abundance, as is the species distribution; the desired condition ranges indicate a desired decrease especially on the cool moist broad potential vegetation group. This trend holds true for many, but not all GAs; the Big Belts and Highwoods are below or at the lower bound of the desired range. Douglas-fir may be promoted with future drought on moist sites where it tolerates drought better than lodgepole pine, spruce, or subalpine fir, but conversely may retract on the dry sites where it competes with ponderosa pine. Douglas-fir abundance was at the lowest end of its NRV during warm and dry climate periods; therefore, in the future a presence at the low end of the range may be appropriate.

Western larch

On the HLC NF, western larch is only found in the Upper Blackfoot GA at the eastern end of its natural distribution. It grows primarily on the cool moist broad PVT. Western larch is of high value for its contribution to species diversity, forest structure, and ecosystem resilience. It has high resistance to many forest insects and pathogens. It is well adapted to surviving and regenerating under mixed and high severity fire regimes. It is very intolerant of shade. Western larch may live for several centuries and grow to very large diameter which provide wildlife habitat, both when live and dead. In the Upper Blackfoot GA, western larch is currently present on about 1% of the area. It is desirable to maintain and promote this species within its natural range as a rare but important component of diversity.

Lodgepole pine

Lodgepole pine is one of the most common tree species on the HLC NF, capable of growing under a wide range of conditions. It is shade intolerant and short lived compared to other conifers. Lodgepole is thin-barked and easily killed by fire, and it is also subject to mountain pine beetle once it reaches maturity. In fire-prone ecosystems such as the HLC NF, lodgepole pine has adapted by producing open cones at a very young age to re-seed re-burned or understocked patches, and then producing serotinous cones by the middle stages of development to ensure that seed is available after the next stand-replacing event. Nearly pure lodgepole stands are common across the landscape.

Forestwide, the NRV analysis indicated that the abundance of the lodgepole pine cover type is generally within or slightly below the natural range across the landscape, and specifically below the desired range in the cool moist broad potential vegetation group. This trend does not hold true for all GAs; in the

Crazies GA the lodgepole pine cover type is well below the natural range of abundance, whereas the Divide and Highwoods are above the range. Tree species distribution of lodgepole shows that it is a major component of most landscapes. In some GAs lodgepole pine is more extensive than it was historically (most notably the Castles, Divide, and Highwoods).

Subalpine fir and Engelmann spruce

Subalpine fir is common on high elevation moist sites across the HLC NF. Engelmann spruce is more limited, confined to riparian areas and moist sites. They fulfill similar ecological roles and often coexist. Both are very shade tolerant, and commonly most abundant in mid and understory canopy layers. These species are intolerant of drought and fire, with shallow roots, thin bark, and crowns that extend to the ground. Though they may regenerate into opening created by fire, they have slow growth rates. Their shade tolerance allows them to persist indefinitely and eventually, over time, they will dominate the site unless there is a stand-replacing disturbance. Spruce/fir forests provide valuable wildlife habitat, such as snowshoe hare and lynx habitat. They are also important components of riparian areas and other areas that are protected from disturbance. Forests dominated by subalpine fir and spruce tend to support high severity fires, due to the low fire tolerance, high tree densities, multiple canopy layers, and greater litter depths and fuel loads. These forests are susceptible to damage from insects and diseases as well.

The current amount of subalpine fir/spruce correlates to lack of fire and advancing succession. Maintenance of this cover type is desired within lynx habitat, generally on the cool moist broad potential vegetation group. In the cold broad potential vegetation group, however, the amount of subalpine fir and spruce represents a tradeoff with whitebark pine. The NRV analysis indicated that it the spruce/fir cover type is above its natural range of abundance in most GAs.

Whitebark pine

Whitebark pine is a candidate species for listing under the Threatened and ESA (see the Plants at Risk section). It is a five-needled pine that is a key ecosystem component at the highest forested elevations in cold, windy, snowy, and moist climatic zones (Arno & Hoff, 1989) that are difficult areas for plants and animals to inhabit. It usually occurs in association with subalpine fir, spruce, and sometimes lodgepole pine and limber pine on the HLC NF. As the most fire resistant and long lived species in these forests, it plays an important role in the stability of high elevation ecosystems and the quality of wildlife habitat. Its tolerance to cold, superior hardiness on harsh microsites, unique method of seed dispersal, and resistance to lower intensity fires allows it to compete successfully in the upper subalpine zone. On productive upper subalpine sites, whitebark is a seral species that is eventually replaced by more shade tolerant species; but in harsh upper subalpine forests and at treeline it can dominate as climax vegetation (Keane et al., 2012).

Whitebark pine primarily occurs on the cold broad potential vegetation group. Whitebark pine is present on all GAs except the Highwoods. Whitebark pine presence is below desired conditions. Whitebark pine tended to be at the higher end of its NRV during the warm/dry modeled climate periods. Future climates and disturbances may promote the whitebark pine cover type on the coldest, driest sites where it is hardier than other species, but the success of whitebark pine will also depend on interactions with white pine blister rust and restoration efforts.

Nonforested Vegetation

Persistent nonforested plant communities are widespread on many of the GAs on the HLC NF. These communities are maintained by site conditions that preclude establishment of trees, or by frequent disturbances such as fire. The most common communities found on the HLC NF are grasslands and shrublands, but wetlands, riparian areas, and alpine communities are also present. In some places, grass/forb/shrub communities occur as a transitional type in the earliest stages of forest succession.

The island mountain ranges of the HLC NF are separated by prairies; the degree to which prairie communities extend onto NFS lands varies by GA. On private valley-bottom lands adjacent to the forest, the trend has been to convert native grasslands to crop lands, rangelands for grazing, and developed lands, leading to the disruption of processes, such as fire, that played a role in maintaining them. Connectivity of grassland/herbaceous ecosystems has also been affected by development at these at lower elevations.

Nonforested vegetation communities have shifted in extent, composition, and structure, but are less explicitly represented and modeled with available data than forested types. Nonforested cover types have declined relative to the historical condition, including declines in acres of fescue, bunchgrass, sagebrush, and native forb cover types, largely attributable to agricultural development but also encroachment of woodland types such as juniper and exotic weeds (USDA 2003b). Grazing and associated reduction in fire frequency (due to the loss of fine fuels) are the primary causes of woodland expansion although climate change is also suggested as a contributing factor (Hessburg & Agee, 2003). Fire exclusion and drought have allowed conifers and/or sagebrush to invade grasslands, and altered the mosaic of conifer savannah and sagebrush steppe (Barrett 1997; (Heyerdahl et al., 2006). Invasive plants also are a primary threat to grass/forb/shrub communities. Historical and current grazing practices have contributed to shifts to nonnative species in these types, to an unquantified degree. For example, rough fescue is highly palatable throughout the grazing season. This type has been replaced by native oatgrass under moderate or heavy grazing pressure in some areas; and long-term heavy grazing on moister sites has resulted shifts to a nonnative Kentucky bluegrass/timothy/smooth brome type. High elevation grassland/herbaceous types are less likely to be substantially altered from historic conditions because factors such as grazing, agricultural development, and invasive plants are less common due to inaccessibility.

The desired condition ranges indicate the need to maintain or increase the abundance of nonforested cover types collectively on most GAs. This increase would primarily occur in the grassland or shrubland types, although the maintenance of healthy riparian, wetland, and alpine areas is also important. The desired condition includes maintaining the dominance of nonforested plant communities on nonforested potential vegetation groups, as well as on some forest potential vegetation groups - primarily the driest sites found in the warm dry broad potential vegetation group. Such areas would have been maintained in a nonforested condition, or one with very sparse tree cover by frequent fire. Increased conifer expansion in some of these areas is considered to be encroachment. In several GAs (Rocky Mountain Range and Upper Blackfoot), nonforested types are slightly above the NRV and desired condition; this is primarily due to areas that have not yet reforested after recent wildfire.

Xeric and Mesic Grasslands

Slope and moisture regimes divide grasslands into two general types in the plan area. The grasslands on the more moist north and east facing slopes, or at higher elevations, are generally dominated by Idaho fescue and rough fescue. The grasslands on drier sites (e.g., lower elevation and/or southwest facing slopes) are dominated by Idaho fescue and bluebunch wheatgrass. Grasslands range in size from small patches to large open parks located on montane to foothill zones. Grasslands are typified by colder winters, shorter summers, and younger soils derived from alluvial materials. They are dominated by cool-season perennial bunchgrasses and forbs, with sparse shrub and/or tree representation. Various shrub and tree species may occur with low cover (typically less than 10%).

The desired condition of xeric grassland communities is to have high diversity of tall and medium height, cool and warm season grasses (for example, bluebunch wheatgrass, green/Columbia/western needlegrass), and short grasses (e.g., Sandberg bluegrass). There should a variety of forbs in varying amounts, and the diversity of plant species present allows for drought tolerance. Individual species can vary greatly in the amount of production depending on growing conditions. Vegetation typically should have strong and robust root systems that allow production to increase considerably with favorable growing conditions. This plant community provides for soil stability and a properly functioning hydrologic cycle. Plant litter is a common component and is available for soil building and moisture retention. Plant litter is well distributed with little movement off-site and natural plant mortality is typically low. Bare ground is present because of the warm dry nature of these sites but at low amounts.

The desired condition of mesic grassland plant communities it to have greater amounts of mesic forbs, denser cover, and more species richness. The functional plant groups are characterized by long lived, moderately deep rooted cool and warm season grass species (for example, rough fescue, Idaho fescue, blue gramma, tufted hairgrass, etc.) with a wide variety of mesic forbs present in varying amounts. Shrubs may be present with minor cover and introduced species are rare. Bare ground should typically be low (less than 3%) across most sites with litter being a common component and available for soil building and moisture retention. Plant litter movement is expected to be limited with plant litter being properly distributed and rarely moving off-site.

Mesic and Xeric Shrubland/Woodlands

Mesic shrublands are often associated with coniferous forests and occur either as large landscape patches on moister sites or in smaller patches within grasslands. Mesic shrubland plant communities are more moist and productive than xeric sites. The desired condition is for species such as mountain big sagebrush and mesic deciduous shrubs (i.e., snowberry, ninebark, serviceberry) to be the dominant over story species with graminoid species and mesic forbs typically dominating the understory. Canopy cover may vary, but should typically be moderate to high, and may result in lower cover of understory species.

Xeric shrubland plant communities occur on drier sites, and the desired condition is to support shrub species such as Wyoming big sagebrush, basin big sagebrush, low sagebrush and black sagebrush. Overstory species vary by location and site type. The understory should typically be dominated by graminoid species such as needle-and-thread, Sandberg bluegrass and bluebunch wheatgrass. Canopy cover varies, but should typically low to moderate. Bare ground is present in higher amounts relative to mesic shrubland sites. Xeric woodlands are typically hot and dry or are steep, with shallow, skeletal soil. The dominant overstory species varies but includes Rocky Mountain juniper and mountain mahogany. Mountain mahogany is a specific site type which occurs in much lower amounts than juniper and is restricted to steep rocky soils and rock outcrops.

The shrub species below are of particular importance in shrublands and woodlands:

- Mountain big sagebrush (*Artemisia tridentata subsp. vaseyana*) dominates much of the shrub-steppe plant community across the HLC NF. This shrub is sensitive to encroachment by conifers (Grove, Wambolt, & Frisina, 2005; Gruell, Brown, & Bushey, 1986).
- Curl-leaf mountain mahogany (*Cercocarpus ledifolius*) generally occurs on limestone or sandstone stony slopes, cliffs, and rock outcrops from valleys to montane zones across the HLC NF. It provides an important food and cover source for a variety of wildlife year-round. With more frequent high severity fires, often related to increased fine fuel loads from exotic annual grasses, populations are declining in many areas throughout its range (Hanson et al 1999).
- Antelope bitterbrush (*Purshia tridentata*) infrequently occurs on stony or sandy soil of grasslands, shrub-steppe, and open ponderosa-pine forest from valley to montane zones across the HLC NF. As a shade intolerant, nitrogen-fixing shrub, bitterbrush is an early colonizer. It competes with nonnative, invasive grasses such as cheatgrass, which are spreading rapidly. This invasion has increased fine fuel loads, causing more frequent high severity fires during which bitterbrush (a weak sprouter) is often killed.

Riparian/Wetland Vegetation

Riparian systems occur along creeks and rivers and occupy floodplains, streambanks, islands in rivers, narrow bands in steep channels, and backwater channels. Riparian vegetation should be dominated by species that tolerate periodic flooding and an associated seasonally high water table. In wide valley bottoms, the vegetation typically should be a mosaic of all lifeforms with patterns reflecting the meander patterns of the stream/river. Key tree species include aspen, cottonwood, Engelmann spruce and subalpine fir; on drier sites, Douglas fir, and Rocky Mountain juniper may be present. Dominant shrubs may include mountain alder, various species of willows, river birch, dogwood, hawthorn, chokecherry, rose, silver buffaloberry, Rocky Mountain maple and/or snowberry. A wide variety of herbaceous species including, grasses, sedges, rushes, spikerushes, bulrushes, and forbs should be present in the understory. Threats to the riparian system include heavy grazing, invasive species, drought, recreation and climate change.

Wetlands are characterized by dominant vegetation adapted to saturated soil conditions. The vegetation complex should be represented by a mosaic of herbaceous and woody plant communities that provide excellent erosion control. Low willow species, bog birch and bog blueberry are often the representative woody species in a wetland system. Herbaceous species may be dominated by cattails, sedges, rushes, spikerushes or bulrushes. Bryophytes, including sphagnum, are often well represented in fens. Threats to wetlands include alteration of the original hydrology or hydric soils (i.e. diversion, draining, development, road construction, heavy grazing, etc), invasive species, and climate change.

Willows (*Salix spp*) are of particular interest in riparian and wetland plant communities because of their habitat value, limited extent, and pressures exerted by factors such as grazing and fire exclusion. Most species are shade-intolerant and those that occur along streams in narrow steep valleys will likely not persist if conifers overtop them. Browsing pressure by native and domestic ungulates can lead to loss of vigor and eventually death. Most willows germinate successfully in bare, moist, mineral substrate, i.e., stream bars. There are two main categories of willows: tall willows (up to 20 to 30 feet tall) which occur along streams in broad valley bottoms at low to mid elevations; and low willows (up to 4 feet tall) which occur in higher elevation valleys, usually associated with subalpine forests.

Alpine and rocky habitats

Alpine ecosystems occupy harsh high elevation sites, resulting in short stature and relatively slow growth for both shrubs and herbaceous species. Wetland communities are present in snowloaded depressions. Alpine ecosystems are mostly treeless, although some conifers may be present, often with a krummholz growth form. Vegetation cover should typically be low to moderate. The plant communities are dominated by a number of shrubs, forbs and graminoids.

Rocky habitats are often associated with the alpine PVT, including rock outcrops and scree. Vegetation is sparse or largely lacking. Bryophytes and lichens often occur in crevices and flourish on open rock surfaces. Rock outcrop and scree habitats may also be found at lower elevations. Rocky habitats are often fragile systems.

Xeric Ecotones and Savannas

On the HLC NF, the xeric ecotone represents the transition from nonforested xeric grass and shrub communities to dry forest communities. Scattered trees and shrubs including limber pine, ponderosa pine, Douglas-fir, Rocky Mountain juniper, sagebrush, mountain mahogany, and bitterbrush may be common. Herbaceous cover may be low due to limited soil development and dry conditions. Xeric ecotones overlap forested and nonforested PVTs. The plant communities found may shift between grass, shrub, and conifers based on climate and disturbances (mainly fire).

Savannas are a particular forest structure within xeric ecotones. Savannas are defined as communities found on either nonforested or the warm dry broad potential vegetation group which contain very open tree cover (5 to 10% canopy cover), and a dominance of grasses and/or shrubs. Historically, frequent fire would have maintained the dominance of grasses and shrubs while promoting the development of very large, widely scattered trees while limiting the establishment of small conifers. However, fire exclusion has resulted in the shift of some of these areas to more dense forests with a decrease in grass and shrub vigor. As this occurs, the large trees of the savanna become vulnerable to uncharacteristically severe wildfire or insect infestations.

It is desirable to promote the open character of forest savannahs and a dominance of grass and shrub communities in most xeric ecotones, particularly given expected future warm and dry climate conditions.

The desired extent of these plant communities is encompassed within the desired range of nonforested cover types.

Forest size class

Tree size is an indicator of the structure and age of forests across the landscape. Forest size classes are defined based on the predominant tree diameter in the stand (basal area weighted average diameter). The five size classes defined for this analysis are listed below, and are further described in appendix D of the draft revised forest plan.

- Seedling/sapling – 0 to 5 inches diameter at breast height
- Small – 5 to 8.9 inches diameter at breast height
- Medium – 9 to 14.9 inches diameter at breast height
- Large – 15 to 19.9 inches diameter at breast height
- Very large – 20 + inches diameter at breast height

The primary desired shift in size class is an increase in the large size class and a decrease in the small size class. Substantial proportions of the forest should be in the mid-successional stages of development (small to medium size classes). Many forest stands will never achieve a very large or very large size class, due to growing conditions and/or disturbances. Most GAs follow a similar trend as the forestwide ranges for the proportion of existing and desired size classes. Some, such as the Castles, have a higher proportion of the seedling/sapling tree class. Others, such as the Upper Blackfoot, have a more balanced proportion of all size classes. The large and very large tree classes are the least common classes on all GAs and are most prevalent in the Crazies, Castles, Divide, Big Belts, and Little Belts. The desired trend of size class across broad potential vegetation groups is summarized as follows:

- *Seedling/sapling:* Most GAs contain existing proportions of the seedling/sapling size class within or at the higher end of the NRV and desired condition because of recent fires and the mountain pine beetle outbreak. The most notable exception is the Highwoods, which contains essentially no seedling/sapling forests. The pattern and abundance of the seedling/sapling class is linked to stand-replacing fire regimes, and is most abundant in the cool moist broad potential vegetation group. Fire exclusion may have caused decreases in seedling/sapling forests.
- *Small:* Forestwide and in all GAs, the small tree size class is well above the NRV and desired condition, especially in the Big Belts, Castles, Divide, Little Belts, and Snowies GAs. Some of these GAs were impacted by the mountain pine beetle outbreak, which killed larger trees. High stand densities resulting from fire exclusion also contribute to the amount of the small size class.
- *Medium:* For most GAs, the existing proportion of the medium tree size class is within the NRV and desired condition. The exceptions are the Big Belts, Highwoods, and Little Belts, where the medium tree size class is more abundant than desired. Many of these forests were established following large fires and harvest at the turn of the last century. Not all of these will progress into the large size classes, such as lodgepole pine forests or densely stocked stands.
- *Large:* The large tree size class is underrepresented forestwide and in all GAs as compared to the NRV and desired condition. The disparity is especially notable in the Highwoods and Snowies, and in the warm dry broad potential vegetation group. Insect outbreaks recently killed many large trees. A lack of low-intensity disturbances has also caused a decrease in the large and very large size classes by perpetuating high densities that inhibit tree growth.
- *Very large:* Forestwide and in most GAs, the very large tree size class is rare and less abundant than in the NRV and desired condition, especially in the Snowies and Upper Blackfoot GAs. Several GAs, however, are either within or near the desired range, including the Castles and Crazies.

Large/very large tree concentrations and trees per acre

Large and very large diameter live trees, particularly long-lived fire tolerant ponderosa pine and Douglas-fir, are valuable whether they occur at low or high densities. These trees can survive low to moderate fire, contributing to the recovery of the forest after disturbance, promoting resilience, and providing long-term structural diversity. Where present in sufficient numbers they contribute to late successional forest and, in some cases, old growth. They can be of high economic value for wood products as well. They provide important wildlife habitat, both as live trees and when they die as snags and downed wood. Large trees develop where frequent disturbance maintains low density, and/or on productive sites which provide ample moisture and nutrients for individual tree growth.

The large and very large forest size classes reflect areas where large and very large trees occur in abundance. However, because forest size class is based on the basal area weighted average diameter of trees across the stand, it does not provide the full picture of the amount or distribution of all large and very large live trees. Large and very large trees may occur in forests dominated by smaller trees and therefore classified into smaller size classes. To address this, two additional indicators are considered:

- large and very large tree concentrations
- trees per acre of large and very large trees per acre across on the landscape

Large and very large tree concentrations are identified in places where large tree components are not necessarily dominant but do occur at certain minimum densities. These minimum densities are defined to reflect quantities meaningful for wildlife habitat and possible old growth. They are often referred to as subclasses of size class because they may occur in any of the five size classes. The criteria for large and very large tree concentrations on the HLC NF are displayed appendix D of the draft revised forest plan.

Figures found in appendix B display the existing and desired conditions for large and very large live tree concentrations. While the proportion of very large tree concentrations across the landscape are slightly lower than desired, the large tree concentrations are much more so, especially in the warm dry and cold broad PVTs. There are more acres with large and very large live tree concentrations present (14% and 7% respectively) than there are acres in the large and very large forest size classes (5% and 2% respectively). This is because large and very large trees are scattered irregularly across the landscape, including in stands dominated by smaller trees.

The final indicator for large and very large trees is the average trees per acre. These trees may be present as scattered individuals that are not captured in either the size class or concentration criteria. The large and very large trees on the HLC NF are most likely to be ponderosa pine or Douglas-fir, with some Engelmann spruce, subalpine fir, and whitebark pine. Figures found in appendix B display the current condition and desired large and very large trees per acre. The warm dry potential vegetation group contains the most very large trees, while the cool moist group contains the most large trees.

Forest density and vertical structure

Forest density is a measure of the area occupied by trees. The density of trees can influence tree growth and vigor; susceptibility to drought, insects and diseases, wildfires, and windthrow; and the rate of forest succession as well as other attributes such as vertical structure. These factors in turn affect whether the stand is suitable habitat for certain wildlife species. For this analysis, tree canopy cover is used as the measure of density. *Canopy cover* is the percentage of ground covered by a vertical projection of the outermost perimeter of the tree crowns, considering trees of all heights. The density classes used for the analysis are described in appendix D of the draft revised forest plan, and include the following:

- Nonforested – less than 10% canopy cover
- Low to medium – 10-39.9% canopy cover
- Medium high – 40-59.9% canopy cover

- High – 60% canopy cover

Vertical structure is categorized as single-storied (one canopy layer), two-storied (two canopy layers), or multistoried (three or more canopy layers). As with density, vertical structure is driven by succession, individual species traits, and disturbances. Some cover types, such as spruce/fir, naturally develop a continuous canopy made up of multiple layers of shade tolerant species. Other types, such as lodgepole pine, tend to grow in dense, single-storied stands. Desired conditions for forest density classes are enumerated in the draft revised forest plan, and vertical structures are addressed through narrative description.

The desired conditions indicate shifts toward decreasing forest density in general, depending on broad PVT. The NRV analysis indicated that the low/medium canopy cover class was common forestwide, especially on the warm dry broad potential vegetation group. Fire exclusion has resulted in higher canopy densities in dry cover types which would otherwise have been maintained at more open densities by frequent low intensity fire. Many forests on the cool moist sites also had low/medium density, which were likely forests in their early and mid-successional stages or older forests where disturbances removed trees and opened up the canopy. In all types, the shift toward higher densities reflects the impacts of fire exclusion and the increased abundance of shade tolerant species. Single-storied forests are more common than they were historically, while multi-storied forests are less common, especially in the warm dry and cold broad PVTs.

Most GAs follow the same trend as the forestwide averages. Some areas, such as the Big Belts and Upper Blackfoot, contain a fairly even proportion of classes. Others, such as the Castles and Snowies, have a high level of homogeneity in density class, dominated by the high tree cover class.

Landscape pattern: early successional forest openings

The spatial pattern of vegetation can affect ecological processes, including wildlife and plant habitat and dispersal; disturbance risk, spread and size; reforestation; watershed health; carbon storage; wildlife habitat quality; and aesthetic values. Connectivity can be affected by natural factors such as topography, soils, variation in precipitation, and wildfire but also by human developments and activities. It is also one of the most complex attributes of ecosystems to quantify. The goal of assessing connectivity and pattern is to better understand the mosaic of conditions that make up a resilient landscape.

Heterogeneity is the quality of consisting of dissimilar elements, as with mixed habitats or cover types occurring on a landscape (Turner, Gardner, & O'Neill, 2001). The ecological, social, and economic values that forests provide are heavily influenced by spatial patterns on the landscape (Turner, Donato, & Romme, 2012). Connectivity and pattern also influence the genetic flow of plant material, which has implications for the adaptability of vegetation. Seed dispersal strategies will depend on spatial heterogeneity and the suitability of future site conditions. Generally a resilient landscape is made up of a mosaic of age classes, composition, and successional stages because this ensures that not all areas are equally susceptible to the same drivers, such as wildfire and insects, at the same time.

It is impossible to effectively model and analyze all of the possible metrics of landscape pattern, or to capture all of those that would be meaningful for the variety of wildlife species in the plan area. The abundance, average, and range of sizes of *early successional forest patches* (transitional and seedling/sapling size classes) have been identified as the key ecosystem characteristics to represent landscape pattern because this condition is quantifiable, represents likely patterns of older forests, and is meaningful for many species. Openings in the forest are created after a stand-replacing disturbance, and are the most distinct and easily detectable structural conditions in a forested landscape because they are dominated by grass, forbs, shrubs, and short trees. They are meaningful to many wildlife species because of their distinctive composition and openness which affects the growth and survival of plants that wildlife depend on, and strong contrast to adjacent mid or late successional forest (e.g.“edge”). They also represent the initiation point in forest development, the foundation upon which rests the pattern of the future forest.

The NRV represents the desired condition. The existing condition of patch sizes is within this range, forestwide and in each broad potential vegetation group. Fragmentation and small patch size may be an issue in some areas, at smaller scales. Early successional patches in the warm dry and cold broad potential vegetation groups are smaller than in cool moist, due to a more frequent low severity disturbance regime which causes a complex mosaic of within-stand structures including small patches and canopy openings. Patches in the cool moist broad potential vegetation group tend to be larger, due to a preponderance of lodgepole pine and infrequent, high severity disturbances. The largest patch sizes are correlated with warm/dry climate periods.

Benefits to people

Terrestrial vegetation contribute directly to several multiple uses and key ecosystem services identified for the HLC NF, including timber products, forest products, and wood for fuel. The vegetation on the landscape also provides the ecological basis for other more intrinsic services, such as water quality and quantity, clean air, outdoor recreation, scenery, fish and wildlife, carbon sequestration, flood control, and erosion control.

3.8.6 Environmental consequences

The following sections describe expected trends for terrestrial vegetation indicators over a 50-year period. See appendix B for charts and detailed modeling results.

Effects common to all alternatives

Warm and dry climate, vegetative succession, wildfires, and insect and disease activity would be the primary shapers of vegetation under all alternatives. While planned treatments could vary by alternative and alter the probability and/or effects of some drivers, these processes will remain dominant. Recent studies have indicated that climate and drought coupled with natural disturbances have the potential to impact ecosystems much more so than human interventions, but that management within that context may be important to reduce the potential for forest decline and/or ease transitions into new, more resilient states (Cohen et al., 2016; Golladay et al., 2016; Millar & Stephenson, 2015) Halofsky & Peterson 2016).

Under all alternatives, vegetation characteristics will influence, and be influenced by, spatial heterogeneity of landscapes and interrelated drivers such as wildfires, climate, and insects. Fire suppression will continue to alter successional processes, although vegetation treatments may mitigate this influence somewhat. Fire exclusion would favor shade-tolerant species, small to medium size classes, and denser forests. Conversely, large fires will influence vegetation in a variety of ways such as reducing density, returning sites to an early successional stage, promoting large tree growth, and/or favoring fire tolerant species depending on the severity of fire. Warmer, drier climates will influence species distributions and successional processes in complex and uncertain ways. For example, species better adapted to warm, dry conditions such as ponderosa pine may gain a competitive advantage. Drought may inhibit tree growth in some areas.

Spatial heterogeneity will play particularly important roles for the production of wildlife habitat, with thresholds in habitat quality, habitat connectivity, and/or patch size apparent for many species (Turner et al., 2012).

The terrestrial vegetation indicators modeled into the future vary by alternative; however, this variance is very subtle at the broad scale. This is because all alternatives were modeled with a similar climate regime and similar levels of natural disturbance are projected. Natural disturbance regimes are the primary influences on vegetation across the vast majority of the HLC NF, due to the extent of areas where little active management occurs (such as wilderness, RWAs, IRAs, and primitive recreation settings). Vegetation management actions such as timber harvest projected by the Spectrum model were applied in the SIMPPLLE model. While these treatments undoubtedly result in modified vegetation characteristics where they occur, the overall level of treatment is not substantially different across alternatives, and impacts of treatments are generally outweighed by other influences when the key indicators are summarized at the broad scale.

Climate change

Climate is integrated into the SIMPPLLE model and a major driver of vegetation change and effects of the alternatives over time. There is a great deal of uncertainty surrounding climate change and its potential effect on vegetation conditions. However, best available science was used to guide both the integration of future climate conditions into the SIMPPLLE model, and the evaluation of the vegetation change related to direct and indirect effects of climate change. Whether it is invasive species (e.g., white pine blister rust), drought, uncharacteristic wildfires, elevated native insects and disease levels, unusually high forest densities, or some other agent or combination of agents that serves to stress trees and forest ecosystems; recent research suggests that climate change will likely exacerbate those stressors and “stress complexes” will continue to manifest themselves (Halofsky and Peterson 2016).

Vegetation Composition

Vegetation composition is expected to change through time as depicted in the following sections for forested cover types, tree species presence, and nonforested cover types. For all types, the expected trends are similar across all alternatives, and negligible when viewed at the forestwide scale.

The expected trend of some species would move towards the desired condition, including increases in tree species presence and cover types associated with limber pine and ponderosa pine, and decreases in tree species presence and cover types associated with Douglas-fir. Conversely, other results indicate a trend away from the desired condition, including reductions in the extent and dominance of lodgepole pine and increases in spruce and subalpine fir. Several key species, including aspen and whitebark pine, remain relatively static.

Rocky mountain juniper

Areas dominated by Rocky mountain juniper are rare, and are included in the ponderosa pine cover type; this type is expected to increase through time as discussed in the ponderosa pine section. As an individual tree species, the presence of juniper is projected to increase forestwide. The increase occurs on the warm dry PVT; the extent of juniper on the cool moist and cold broad potential types is relatively rare and remains static. Although it is an important component of the ecosystem and provides structure for wildlife habitat, juniper expansion can lead to the decline of grass and shrublands and result in altered fire regimes in both nonforested and forested vegetation communities.

Rocky mountain juniper is found in greatest abundance in the Big Belts GA, and in the future is expected to decline and move towards the desired condition for this GA. It is also expected to decline in the Rocky Mountain Range GA. Low to moderate increases in most other GAs would be within the desired ranges. There is no Rocky Mountain juniper known to occur in the Highwoods GA.

Limber pine

Areas dominated by limber pine are included in the ponderosa pine cover type; this type is expected to increase through time as discussed in the ponderosa pine section. As an individual tree species, the presence of limber pine is expected to increase slightly by the end of the model period forestwide. The increases occur in the warm dry broad PVT, with the amount in the cool moist and cold broad PVTs remaining static. By GA, the expected distribution of limber pine is generally expected to increase (trending towards or exceeding the desired ranges), with the exception of the Little Belts, Snowies, and Upper Blackfoot GAs, where it may decline.

Limber pine is subject to multiple threats. While the isolated locations and climate conditions of limber pine woodlands may have provided them some protection in the past, these lower treeline woodlands are just as, or more, susceptible to white pine blister rust infections and mountain pine beetle (Means, 2011). The natural fire regime, and the alteration thereof, is an important influence on the abundance and health of limber pine. The decline in health and mortality of this species has been observed throughout central and eastern Montana due to disease, winter damage, drought, and competition from other conifers (USDA 2003a). While it tended to increase historically during warm/dry periods, some sources indicate that limber pine expanded in some areas due to fire exclusion, and may be less viable on the driest sites in drought conditions (Halofsky et al., in press). Limber pine's position on the lower treeline and foothills in semi-arid climate systems is predicted to be particularly vulnerable to climate change (Means, 2011).

Aspen and cottonwood

Forestwide, the aspen/hardwood cover type is predicted to increase very slightly with all alternatives. The starting condition in SIMPPLLE is slightly below the actual condition estimated with plots. The projected increase would trend toward, but still remain below the desired range by the end of the modeling period. The slight increases occur in both the warm dry and cool moist broad PVTs.

Although it is known to occur, the presence of cottonwood is not well-represented by data or modeling. The presence of aspen is expected to increase slightly over time forestwide. The increase in extent would occur primarily in the warm dry broad PVT. Conditions would trend toward, but still below, the desired range forestwide and in the cool moist broad PVT, but possibly approach the lower bound of the desired range for the warm dry PVT.

Increases in the extent of aspen are expected to be particularly pronounced in the Big Belts and Highwoods GAs, with more moderate increases in the Elkhorns, Little Belts, Snowies, and Upper Blackfoot. Decreases may occur in the Castles, Divide, and Rocky Mountain Range.

Aspen is less common than it was historically because of encroachment and overtopping by conifers, overgrazing by cattle and large native herbivores, and the absence of fire (Shepperd, Bartos, & Mata, 2001); Kaye et al. 2005). The recent mountain pine beetle outbreak has reduced competition to aspen in some stands. Similarly, wildfires could stimulate new suckering to increase the vigor and extent of aspen, although other factors such as insects, disease, animal herbivory and genetics also play a role in long term success (Shepperd et al., 2001). The influence of a warming climate might be to increase the extent and severity of disturbances which could reduce the cover of conifers. However, dry conditions may also render some sites unsuitable for aspen. Cottonwood has also likely been reduced from historic conditions, and may suffer further in drought conditions (Halofsky et al., in press-b).

Ponderosa pine

The ponderosa pine cover type would primarily include areas dominated by ponderosa pine, but also limber pine, or some rare cases, Rocky Mountain juniper. This cover type is expected to steadily increase through time under all alternatives, with an abundance in 50 years that is trending towards but still below the desired range. The increases occur forestwide, as well as in the warm dry and cool moist broad PVTs, likely due to the expected warm climate conditions that favor ponderosa and limber pine over competitors such as Douglas-fir.

As an individual species, the presence of ponderosa pine is expected to increase forestwide as well, primarily starting in decade 3. This increase occurs primarily in the warm dry broad PVT, with the extent of ponderosa pine on cool moist types remaining static. The extent of ponderosa levels off and remains below the desired range at the end of the 50-year modeling period.

By GA, ponderosa pine presence is also expected to increase except in the Snowies, although this is in part an artifact of the variance in the existing conditions measured by plots versus what the SIMPPLLE model mapped as a starting condition. In all other GAs, the increases in ponderosa pine trend towards the desired ranges.

Ponderosa pine decline relative to the NRV has been due to a combination of factors, including fire exclusion and early harvesting. Stand structure has changed from open park-like stands to densely stocked areas undergoing stand conversion to more shade-tolerant species such as Douglas-fir (Gruell, Schmidt, Arno, & Reich, 1982; Pollet & Omi, 2002; Smith & Arno, 1999). High density also increases tree stress and decreases resistance to insect attack (Thomas E. Kolb, Holmberg, Wager, & Stone, 1998). Warm and dry climates along with natural disturbances and vegetation treatments may promote ponderosa pine where it can outcompete less drought-tolerant species.

Douglas-fir

There are two cover types dominated by Douglas-fir: dry Douglas-fir and mixed mesic conifer. Forestwide, both are expected to decrease through time with all alternatives. The decreases in dry Douglas-fir occur on the warm dry broad PVT at a rate and magnitude that generally mirrors the increases in the ponderosa pine cover type. The decreases in mixed mesic conifer occur primarily on the cool moist broad potential type, with moderate decreases on the warm dry type. The starting condition of SIMPPLLE for both types is above the actual existing condition, and the expected trend would likely result in conditions approaching or moving within the upper end of the desired range by decade 5.

Desired conditions for the Douglas-fir dominated cover types were developed for several GAs, because the NRV indicated slightly different trends than the forestwide ranges. In the Highwoods GA, the amount of the dry Douglas-fir cover type is predicted to increase and move into the desired range for this landscape. In the Rocky Mountain Range GA, the dry Douglas-fir type is predicted to increase slightly and move toward the upper end of the desired range, while the mixed mesic conifer cover type is predicted to increase and move above the desired range. Refer to appendix B.

The presence of Douglas-fir is also expected to decrease slightly forestwide. This decrease is more subtle than the decrease in the cover types (where Douglas-fir dominates) because Douglas-fir would remain a minor component within other cover types such as ponderosa pine, lodgepole pine, or spruce/fir. The decrease in Douglas-fir presence occurs primarily in the warm dry broad PVT, with its extent remaining fairly static on cool moist and cold types.

By GA, Douglas-fir is expected to decrease in the Castles, Crazies, Divide, Little Belts, and Snowies to a degree that moves toward or even exceeds the desired ranges. Increases are expected in the Big Belts, Elkhorns, Highwoods, and Rocky Mountain Range; this trend moves these GAs toward the desired ranges as well. Little to no change in the extent of Douglas-fir is expected in the Upper Blackfoot GA.

Relative to the NRV, fire exclusion has favored the expansion of Douglas-fir particularly on dry forest sites. The higher stand densities that have resulted also increase tree stress, which contributes to greater susceptibility of Douglas-fir to insects and diseases. Where dense Douglas-fir has filled in dry forest canopies, forest resilience is reduced and conditions support higher severity fires due to the higher tree densities, multiple canopy layers, greater fuels from tree mortality, and loss of the more fire resistant tree species. The future modeling indicates the potential that warm and dry climate conditions along with natural disturbances and management may decrease the abundance of Douglas-fir, although it would remain a common component on the landscape.

Western larch

Western larch is limited by its natural distribution range to the Upper Blackfoot GA. The western larch cover type is not represented by the existing condition or modeling, although it could occur in rare amounts. Modeling predicts that with all alternatives, the presence of western larch is anticipated to remain static. It is likely that the static condition would be within the desired range of conditions in the Upper Blackfoot GA.

Across its range, western larch is less abundant than it was historically due to fire exclusion and vegetation succession that favors more shade tolerant species such as subalpine fir and spruce. Because this species is so rare on the HLC NF, it is not well represented by modeling. The desired ranges call for maintenance or increase of this species within its natural distribution area.

Lodgepole pine

Forestwide, the lodgepole pine cover type is predicted to decrease slightly in abundance under all alternatives, which may trend slightly below the desired range. The highest magnitude of decrease would occur in the warm dry broad PVT; this decrease would actually trend toward the desired condition for that PVT and could be attributable to warm, dry climate conditions that promote other cover types like ponderosa pine. The expected trends on the cool moist broad PVT is cyclic and shows variation by alternative; the abundance of the lodgepole pine cover type would at times approach the desired range, but then decrease and move away from the range at other periods. The abundance of this cover type is also cyclic on cold PVTs, but remains above the desired range.

Desired conditions for the lodgepole pine cover type were developed for several GAs, because the NRV indicated slightly different trends than the forestwide ranges. In the Crazies and Divide GAs, the model indicates that the lodgepole pine cover type would increase in abundance and approach, but remain below, the desired condition. In the Highwoods, the model suggests that the abundance of this cover type would decrease and approach, but remain above, the desired condition. In the Snowies, the model suggests that increase in the lodgepole pine cover type would move this GA within its desired range. In the Rocky Mountain Range, slight reductions in this cover type would maintain a condition below the desired range.

The presence of lodgepole pine shows a similar trend to the cover type forestwide. The sustained decline may trend below the desired range forestwide and on the cool moist broad PVT, but would likely remain within or approach the desired condition for the warm dry and cold types. Unlike the fluctuating nature of the cover type abundance, the expected decline in lodgepole pine presence is gradual and sustained across all broad PVTs. The presence of lodgepole pine is expected to increase in the Big Belts, Elkhorns, and Snowies, while decreasing on all other GAs.

The modeling indicates that on the HLC NF the future may bring slight decreases in lodgepole pine depending on the other species associates present; but overall it will remain a major component.

Subalpine fir and Engelmann spruce

The spruce/fir cover type is anticipated to increase slightly under all alternatives, and trend away from the desired condition range. Desired conditions for the spruce cover type were developed for several GAs, because the NRV indicated slightly different trends than the forestwide ranges. In the Elkhorns GA, the model predicts a reduction in this cover type that moves its abundance within the desired range. Conversely, in the Divide GA, little change occurs in the abundance of this type and it remains above the desired range.

Individually, the presence of subalpine fir and Engelmann spruce is expected to remain fairly static, remaining above the desired extent. The fact that the cover type increases would indicate that spruce and fir become dominant over other species in areas where they are already present in minor amounts. This may be due to fire exclusion that allows these species to become dominant over competitors, and is likely related to a decline in lodgepole pine.

By GA, Engelmann spruce presence is predicted to increase most substantially in the Crazies GA, with more moderate increases in the Big Belts, Castles, Highwoods, Rocky Mountain Range, and Upper Blackfoot. Decreases are expected in the Elkhorns, Little Belts, and Snowies which move towards or achieve the desired ranges. Subalpine fir presence increases in the Castles, Highwoods, Little Belts, Rocky Mountain Range, and Snowies, but decreases in the Divide and Elkhorns while remaining fairly static in other GAs. The presence of subalpine fir remains above the desired ranges for all GAs except for the Snowies.

Based on available literature, the spruce/fir cover type would be expected to be maintained on the wettest sites but possibly decline overall given expected warm climates and fire activity. Both Engelmann spruce and subalpine fir were at the low end of their ranges during warm/dry climate periods in the NRV. However, the future modeling for the HLC NF indicates that forestwide and in some GAs, these types would be maintained or actually increase in the next 50 years.

Whitebark pine

The whitebark pine cover type is predicted to remain fairly static, and below the desired range, for the next 5 decades forestwide. While wildfire and vegetation treatments may promote it in some areas, it will also continue to face threats from mountain pine beetle, blister rust, and climate changes. The presence of whitebark pine is similarly expected to remain fairly static, with slight decreases and increases at the forestwide scale. These minor changes occur primarily in the cool moist broad PVT.

By GA, the presence of whitebark pine is expected to decrease in the Big Belts, Castles, Divide, Elkhorns, and Little Belts, while increases may be seen in the Rocky Mountain Range, Snowies, and Upper Blackfoot with little change in the Crazies. None is known to occur in the Highwoods. Most GAs remain within but are trending below the desired ranges.

Whitebark pine is less abundant than it was historically due to a number of factors including fire exclusion, mountain pine beetle, climate shifts, and white pine blister rust. Though whitebark pine still occurs, mature seed-bearing trees are scarce. The percentage of whitebark that are resistant to blister rust may increase slowly through the process of natural selection (Tomback, Arno, & Keane, 2001). The loss of whitebark has altered the structure, composition and pattern of high-elevation ecosystems, and threatened their long-term stability and integrity. On the HLC NF, the SIMPPLLE model predicts that with expected climate, disturbance, and vegetation management the abundance of whitebark pine may remain relatively static over the next 5 decades, although key losses may occur in some GAs.

Nonforested Vegetation, Forest Savannas, and Xeric ecotones

Nonforest cover types include all non-forested plant communities, including some open forest savannas where grasses and shrubs dominate, as well as recently disturbed areas where forest cover has not re-established. The existing abundance of nonforested cover types is approximately 14% forestwide, while the abundance of the nonforest/none density class is 22%, indicating that at least roughly 8% of the forest is in a very open forested condition. Additional savannas may occur in areas with a nonforested cover type as well, to an unknown degree. This condition is related to the concept of xeric ecotones, which can fluctuate between forest and nonforest cover depending on disturbance and climate regimes. In short, the expected trend of forest savannas is embedded within nonforested cover types and nonforested density classes.

At the forestwide scale, nonforested cover types are predicted to increase from decades 1 to 3 and then slightly decrease, but remain slightly above the existing condition. The starting condition for SIMPPLLE is below the actual condition estimated with plots, and the expected trend would likely result in conditions within but trending toward the lower bound of the desired range for most future decades at the forestwide scale, as well as in in the warm dry and cold broad PVTs. Conditions would be at the mid to upper end of the desired range in the cool moist broad PVT.

By GA, nonforested cover types are expected to decrease notably in the Highwoods and Rocky Mountain Range, with more moderate decreases in the Snowies, Crazies, and Upper Blackfoot – these decreases are generally consistent with desired conditions but move below the desired ranges in some cases. The decrease in nonforest cover types may occur as both a result of desirable reforestation of disturbed areas, as well as the loss of historic grass and shrubland communities to conifer encroachment. In no GA does the model predict that the abundance of nonforested cover types increase substantially.

At the broad scale, the expected effects of future warm, dry climate and drought include the maintenance or expansion of nonforested communities (particularly xeric types) as sites become too dry or frequently disturbed to support forest cover. At the local scale, modeling indicates that such a trend would not be substantially realized in the next 50 years, although the results are complicated by our inability to tease apart the relationship between the reforestation of disturbed forested sites, versus the expansion or loss of true nonforested plant communities. Further, other factors such as fire suppression play a role.

Xeric ecotones are among the most sensitive ecosystems to climate change (Means, 2011). Lower treeline woodlands are often thought to be "invading" desirable sagebrush and grass types due to fire suppression and grazing; however, ecotones also naturally move elevationally based on the dynamics of vegetation, climate and fire (ibid). Studies done near the HLC NF found that areas of mosaic sagebrush-grasslands with stable islands of Douglas-fir savannah have become dominated by Douglas-fir (Heyerdahl et al., 2006). Drivers of this trend include fire exclusion which would have killed encroaching trees when they were of a small size; grazing which reduced fine fuel loads and further influenced fire exclusion; and summer droughts that enhanced sagebrush which functioned as nurse plants for establishing conifers (ibid). Threats to the xeric ecotone include loss of tree species to disease, insects, and fire as well as shifts in warming and/or drying patterns as a result of climate change.

Forest size class

Forest size class is expected to change through time. Appendix B contains model output charts. For all types, the expected trends are similar across all alternatives, and negligible when viewed at the forestwide scale. The size class outputs from the SIMPPLLE model are not defined in the same way as the size classes in the R1 Classification System reflected in by plot data. The size classes from the SIMPPLLE outputs are therefore adjusted to be more analogous to how size class is represented on plots; refer to the planning record for more information on this process.

At the forestwide scale, the expected trend of size class distribution would generally move towards the desired condition, including increases in the large tree size class and decreases in the small and medium classes. These shifts may result in enhanced resilience to disturbance, structural diversity, and providing the array of successional stages for wildlife habitat as indicated by the NRV. The forestwide trends and conclusions do not apply to every PVT or every GA.

Seedling/sapling size class

Forestwide, SIMPPLLE modeling predicts that the seedling/sapling forest size class will fluctuate through time but remain overall relatively similar to the existing condition. The expected future trend forestwide is within the desired range of conditions, and is similar for all alternatives.

The trend varies by broad PVT, however. In the warm dry type, this size class trends fairly steadily upward and moves above the desired range. In cool moist broad PVTs, this size class is more cyclic but generally decreases overall by the end of the 50 year modeling period; these fluctuations appear to move to the lower end or just below the desired range. Cold types show similar fluctuations as the forestwide scale, which results in conditions that remain above the desired range for abundance of this size class.

Desired conditions for the seedling/sapling size class were developed for the Highwoods specifically, because the NRV indicated slightly different trends than the forestwide ranges. The modeling indicated that the seedling/sapling class would increase and move within the desired range for this GA under all alternatives. Alternative D resulted in the highest amount of seedling/sapling forests in this GA, while the other alternatives were similar.

Small tree size class

The small tree size class is predicted to decline forestwide to a similar degree under all alternatives over the 50 year modeling period. This trend would move towards but remain slightly above the desired range.

The trend of the small tree size class would be similar for all broad PVTs. The decreases in this class in the warm dry broad PVT would remain above the desired range; this decrease would correspond to desired increases in the larger size classes that are emphasized on these low severity, high frequency fire regimes. In the cool moist broad PVT, the decreases in this class are more subtle and achieve the desired range. The small tree size class is natural more prominent on these types due to the preponderance of lodgepole pine. On the cold broad PVT, the decrease in this class is relatively pronounced and also achieves the desired range; this shift is relatable to increases in the medium size class.

Medium tree size class

Forestwide, the expected trend of the medium tree size class is somewhat cyclic but overall declining with all alternatives. The expected trend would likely move this size class within and then below the desired range within the 50 year analysis period.

A decline in the medium tree size class was identified as most desirable on the warm dry broad PVT, where this class represented a mid-seral "bulge" that developed in large part due to fire exclusion, and corresponds to desired increases in larger size classes. As shown in appendix B, on the warm dry broad PVT the model predicts a fairly sustained and dramatic decline which would achieve the desired range. It is this trend that most substantially influences the decline noted at the forestwide scale, and is probably due to natural forest succession as well as disturbances or management that reduce tree densities to promote larger tree growth and/or remove smaller trees to increase the average tree size. In the cool moist broad PVT, the expected trend is more cyclic and results in an overall similar abundance of this type, generally within the desired range. In the cold types, the trend is also cyclic but slightly increasing, and above the desired range.

Desired conditions for the medium size class were developed for the Castles and Highwoods GAs specifically, because the NRV indicated slightly different trends than the forestwide ranges. The modeling indicated that the medium class would increase and move slightly above the desired range for the Castles GA. In the Highwoods GA, small to moderate increases are expected which perpetuate a condition above the desired range. The Highwoods in particular has a preponderance of this size class due to its disturbance history, and the model does not predict that disturbances or management would diversify the age class distribution to a great degree in the next 50 years under any alternative.

Large and very large tree size class

Forestwide, the model predicts an increasing trend in the large tree size class over time to a similar degree under all alternatives, which likely achieves the desired condition by the end of the 50 year analysis period. These increases correspond to the reductions in the smaller size classes as described above, attributable to natural succession as well as disturbances or management that reduce stand densities and/or remove smaller trees. The large tree size class, however, remains relatively rare and static over time, below the desired range.

All broad PVTs have predicted increases in the large tree size class over time, relatively steady and to a similar degree as the forestwide trend. This results in conditions that trend toward but remain somewhat below the desired range in warm dry, achieve the desired range in cool moist, and trend toward but remain fairly far below the desired range in the cold type. The expected trend for the very large tree sizes class is fairly static in all broad PVTs, similar to the forestwide depiction. This is within the desired range for the cold types, as this size class is naturally extremely rare, but is below the desired range for the warm dry and cool moist types.

Desired conditions for the very large class was developed for the Crazies GA, because the NRV indicated that increases were not desired as with the forestwide ranges. The modeling indicated that the very large class would have a fairly static condition, remaining within the desired range.

Large/very large tree concentrations and trees per acre

Forestwide, the expected trend of large and very large tree concentrations follows the same increasing trend as large and very large size classes, but the abundance is predicted to increase and achieve the desired range by the end of the analysis period. Very large tree concentrations remain fairly static and rare. The number of very large live trees is expected to increase through time under all alternatives.

In some areas (especially dry forest types), the presence of these components in stands of smaller size classes may indicate that fire exclusion allowed small trees to establish. Such areas provide short-term restoration opportunities for increasing the large and very large size class because removing some or all of the small trees would meet the desired condition without the need to wait for young trees to grow larger.

Forest density and vertical structure

For all PVTs, the expected trends of forest density and vertical structure are similar across all alternatives, and negligible when viewed at the forestwide scale. The expected trend of density class distribution would generally move towards the desired condition, including increases in the low/medium class and decreases in the high class. The expected trends are expected to be positive relative to forest resilience because, in general, the denser the forest the greater the likelihood that fuel characteristics could support a fast moving intense crown fire due to greater fuel quantities and the vertical and horizontal continuity of fuels. In addition, as density increases, trees lose their ability to withstand attacks by insects, pathogens, and parasites. Lower densities also support enhanced individual tree growth, and therefore the expected shifts likely contribute to the increases in the large tree size classes and concentrations. The forestwide trends and conclusions do not apply to every PVT or every GA; these variances are described in the sections below.

Low/Medium density

Forestwide, the model projects that the low/medium density class (10-39.9% canopy cover) would increase over time to a similar degree with all alternatives, and be within or at the upper range of the desired condition. This class steadily decreases in the warm dry type, to be at the low end or just below the desired range at the end of the analysis period; this decrease may contribute to the increases in the low/medium density class as dry forests are opened up by natural processes or management. Conversely, this class increases on cool moist types, which over time achieves the desired range; most forest types on these sites would naturally grow in this density condition at least in the later stages of stand development. This condition fluctuates on the cold broad PVT, remaining within the desired range.

Medium/High density

Medium/high density forests (40-59.9% canopy cover) are projected to fluctuate over time but remain at a similar abundance overall at the forestwide scale, and generally within the desired range. This class steadily decreases in the warm dry type, to be at the low end or just below the desired range at the end of the analysis period; this decrease may contribute to the increases in the low/medium density class as dry forests are opened up by natural processes or management. Conversely, this class increases on cool moist types, which over time achieves the desired range; most forest types on these sites would naturally grow in this density condition at least in the later stages of stand development. This condition fluctuates on the cold broad PVT, remaining within the desired range.

High density

Forestwide, the high density class (>60% canopy cover) decreases over time. This class moves into the desired range and possibly below it by the end of the modeling period. The decreases in the high density class likely correspond to the increases in the low/medium class across all broad PVTs, as well as the increases in the medium/high class in the cool moist broad PVT.

All broad PVTs include similar reductions of this density class. The trends in the warm dry and cool moist types would achieve and possibly move below the desired ranges by the end of the modeling period, whereas the decline would still be trending toward desired conditions in the cold type. Drought conditions and expected future disturbances are likely the main drivers of this reduction. The reductions of the high density class could result in higher forest resiliency to disturbances in many cases, and result in promoting large trees and shade-intolerant species. Conversely, in some cases shifts to lower densities could equate to the loss of habitats of interest (such as dense spruce/fir for lynx habitat).

Vertical structure

Vertical structure classes do not have desired conditions specified, as they are inherent within the mix of species composition, size classes, and density classes. This attribute is one of the most uncertain in terms of model classification, but is of interest for some specific conditions, and therefore results are described relative to the NRV.

The single storied vertical structure class includes seedling forests. It often, but not always, occurs in stands in the higher density classes. This structure is predicted to decline through time forestwide, to likely move into the upper end of the NRV. This will remain a common structure on the landscape, and the reductions are likely due to a diversification of structures that accompanies reduction in tree density and/or species composition. The abundance fluctuates a bit but remains relatively near the existing condition, and well above the natural range, in the warm dry type. This condition steadily decreases in the cool moist type to be within the natural range, and may indicate a diversification of structures and be related to the decrease in the lodgepole pine cover type. This class is predicted to decrease but is also somewhat cyclic in the cold PVT.

Two-storied vertical structures are relatively uncommon and the model predicts an increase over time, to remain above the NRV. This condition can develop in stands where the overstory canopy is opened up via a disturbance and a new age class of trees becomes established. These stands often progress into a multi-storied condition over time. The trend within the warm dry broad PVT is an overall decrease, to be within the NRV. In the cool moist and cold types, this class increases for the first few decades and then declines to again be within or just above the NRV.

Multistoried are predicted to increase forestwide through time, to approach or be within the NRV. This trend may be related to the increasing trends in certain cover types, such as spruce/fir, which commonly develop this structure; and/or where reduced densities allow additional canopy layers to become established. The increase in these structures is relatively small in the warm dry broad PVT, trending towards but below the NRV. The increases in this condition in the cool moist broad PVT are predicted to move above the NRV and may be tied to the increases in the spruce/fir forests which is also above the NRV. The increases in this condition in the cold broad PVT appear to be within the NRV.

Landscape pattern: early successional forest openings

The size of early successional forest openings is expected to change through time. The effects analysis was conducted allowing patches to be considered openings for as long as they remained in the seedling/sapling size class condition. The expected trends are similar across all alternatives, and negligible when viewed at the forestwide scale. Forestwide and in each broad PVT, the average size of early successional forest patches is projected to decrease through time. This trend remains within the desired range (and NRV) in all cases, but at the end of the projection in 50 years the average size within the cool moist broad PVT is at the lower bound of the range. If the trend continues, patch sizes may be smaller than the desired range within this PVT.

The area weighted mean patch size also generally declines over time, although some periods of increase are projected (decade 2 for forestwide and the warm/dry broad PVTs, and decade 3 for cold broad PVTs). At the forestwide scale and in the cool moist broad PVT, this decreasing trend remains within, but near the lower bound, of the desired ranges. For the warm dry broad PVT, the trend remains more squarely within the desired range. In the cold broad PVT, the existing condition is above the desired range, and the expected downward trend over time moves this metric within the desired range.

The primary cause of decreasing patch size of early successional forests is likely the growth and recovery of young forests that have been created by disturbance recently, coupled with projected future disturbances affecting the landscape in a finer grained mosaic. Timber harvest and prescribed burning also create early successional forest patches, but at the forestwide scale the extent of these activities would be minor and not likely to affect mean patch size to a large degree. The decrease in patch size is not likely due to landscape fragmentation associated with development or road building, because the pattern of NFS lands is expected to be maintained (not converted to other ownerships or uses), and little new permanent road building is anticipated.

The estimated patch sizes through time remain in the middle of the NRV for cold and warm dry broad PVTs; the average patch sizes in these types tend to be smaller and the tree species found there generally utilize reforestation strategies following disturbance that are dependent upon seed dispersal from surviving trees. Conversely, the patch size reductions estimated in the cool moist broad PVTs approaches the lower bound of the NRV. Lodgepole pine forests which are commonly found on this type are adapted to reforesting large openings following disturbances utilizing serotinous cones; a finer grained mosaic of patch sizes could provide for the maintenance of shade tolerant species such as spruce and fir in some areas.

Effects from forest plan components associated with:

Access and infrastructure

In all alternatives, limits related to road access on existing roads as well as construction of new roads (both permanent and temporary) could have an impact on the ability to conduct vegetation treatments that require road access, particularly mechanical treatments, across portions of the forest. Limited access to conduct desired vegetation treatments would affect the ability to achieve desired vegetation conditions in some areas. All alternatives are similar in terms of road access and infrastructure.

Livestock grazing

In all alternatives, livestock grazing would occur on portions of the HLC NF. Plan components would enable grazing activities to complement terrestrial vegetation management, such as reducing fine fuels to lower fire risk. While grazing and trampling from livestock can damage native plants and tree seedlings and saplings, plan components are in place that would ensure that grazing is managed to promote sustainable and vigorous native plant communities. Further, components are in place that would ensure that grazing does not adversely impact the regeneration of forests, or re-seeding of nonforested areas with desirable native vegetation. Plan components would also ensure that grazing is managed in a manner that would not lower site productivity (through damages such as compaction), and limits the spread of invasive plant species into native plant communities.

Air quality

The consequences to terrestrial vegetation from air quality related forest plan direction are the same for all alternatives. All alternatives have direction to meet air quality standards established by federal and state agencies and meet the requirements of state implementation plans and smoke management plans. The direction limits how much can be burned and when and where it can occur. The costs of conducting prescribed fires increases as a result of the burning regulations, which affect how much is burned. The ability to implement the vegetation treatments that would occur as a result of the alternatives is dependent upon prescribed burning as well as using natural, unplanned ignitions to meet resource objectives. Therefore, to the extent that air quality regulations may become more stringent in regards to the quantity and timing of smoke emissions, there could be limitations to conducting prescribed burning.

Mining and mineral extraction

Mining undergoes site-specific environmental analysis to determine effects and required mitigation, and effects to vegetation from mining is determined at the project level. Generally, the impacts to terrestrial vegetation from mineral extraction on the forest are localized, and insignificant at the forestwide scale.

Grizzly bear management

Under all alternatives, grizzly bear management would be guided by the Draft Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy ((U.S. Department of Agriculture, Forest Service, 2013c). Management direction from the Conservation Strategy would be amended to the existing plans for alternative A; or incorporated into all action alternatives. Refer to appendix I of the draft revised forest plan for the grizzly bear plan components.

Management for grizzly bears may affect terrestrial vegetation as a result of components that limit the miles of road access and duration of project activities such as timber harvest and prescribed fire. These restrictions would apply mainly to the primary conservation area and to Zone 1. On the HLC NF, the primary conservation area occurs only on portions of the Upper Blackfoot and Rocky Mountain Range GAs, and Zone 1 occurs only on a portion of the Upper Blackfoot GA.

Habitat management for grizzly bears would have a relatively small influence on future timber harvest. Further, it would not have an impact on reforestation or prescribed burning associated with harvest, because specific exceptions apply to allow access for these activities. Some specific project design elements would be applied to all vegetation management, such as reducing the risk of human-bear conflicts and retaining cover along a portion of grass/forb/shrub openings, riparian wildlife habitat, or wetlands. These design elements would not preclude achievement of desired conditions for terrestrial vegetation. Overall, the extent to which timber harvest and prescribed fire may be used to achieve desired terrestrial vegetation conditions is not greatly diminished by habitat management for grizzly bears.

Effects common to all action alternatives (B, C, D, and E)

All action alternatives contain revised forest plan components for vegetation composition, structure, and pattern. The revised forest plan would include quantitative desired conditions, and terrestrial vegetation would be managed to be consistent with the NRV and resilient to disturbance, with consideration for climate change vulnerabilities and adaptation options based on the best available science for the HLC NF (Halofsky et al., in press-b). The components in the revised forest plan that would guide management of terrestrial vegetation are summarized in Table 44.

Table 44. Summary of plan components relevant to terrestrial vegetation – revised forest plan

Plan Component(s)	Summary of expected effects
FW-VEGT-DC	The desired vegetation conditions for all broad potential vegetation groups summarize function, composition, structure, and pattern; states that vegetation should support at-risk species; and addresses connectivity and climate change. This guidance would ensure that all projects and activities share a vision of desired vegetation.
FW-VEGT-OBJ-01	This component specifies a minimum desired level of vegetation management to help move conditions toward the desired condition, and would ensure that active management occurs on the landscape.
FW-VEGT-GDL-01, 02, 03, 04	This suite of guidelines would provide for maintenance and/or re-establishment of desirable vegetation for both non-forested and forested plant communities after management or disturbances.

Plan Component(s)	Summary of expected effects
FW-VEGF-DC	This suite of components enumerates the quantitative desired conditions for forested vegetation composition, structure, pattern, and function. The effects would be similar as described for FW-VEGT-DC-01.
FW-VEGF-GDL-01	This standard prescribes minimum retention of large and very large live trees for vegetation management projects, and would ensure that these activities contribute towards the desired condition.
FW-VEGF-DC-07, 08, 09; and GDL-02, 04, 05, and 06	These components are specific to old growth, snags, and coarse woody debris. These components are complementary to the other desired conditions for forested vegetation, and provide specific guidance and limits on vegetation management.
FW-VEGNF-DC	These components enumerate desired conditions for nonforested plant communities. The effects are similar as described for FW-VEGT-DC-01.
FW-VEGNF-GDL-01	This guideline would refine where treatments in nonforested plant communities occur.
FW-PRISK-DC-02 and OBJ-01	This objective and guideline would ensure that restoration treatments occur for whitebark pine, and that key whitebark pine areas would exist to support the long term recovery of this species.
Invasive plants	The plan components for invasive plants would promote the health of native terrestrial vegetation, most especially nonforested plant communities.
Recreation Opportunities; Recreation Special Uses; Land Use	Plan components would guide vegetation conditions and management in developed recreation and special use areas. Managing these small areas for purposes such as public safety would not substantially add to or subtract from movement toward the desired conditions for vegetation.
Designated wilderness, RWAs, WSAs, RNAs, and IRAs	Plan components would ensure that vegetation change occurs primarily through natural processes. IRAs would be managed in a manner consistent with the 2001 Roadless Area Conservation Rule, which includes limitations on vegetation management.
Eligible WSRs, Nationally Designated Trails	The components include limitations for vegetation management. Managing these site specific areas for specific purposes would not substantially add to or subtract from movement toward the desired conditions for vegetation.
Carbon Storage and Sequestration	The desired condition would complement vegetation plan components by calling for resilient forests.
GA direction (Chapter 3)	These plan components provide more detail and/or describe the land allocations where forestwide components apply. These complement the vegetation effects described for forestwide components at the GA scale.

Alternative A, no action

The existing forest plans (1986) do not quantify desired vegetation conditions; rather, there are qualitative descriptions. Because the existing plans were developed over 30 years ago under a different planning rule and paradigm, a comparison to the revised plans is difficult. The plan content in the existing forest plans relevant to terrestrial vegetation is summarized in Table 45.

Table 45. Summary of plan components related to terrestrial vegetation – existing forest plans

Section	Summary of expected effects
HNF – Desired Future Condition	The desired condition is not consistent with those developed for the revised forest plan based on best available science.
HNF – Forestwide Standards – Big Game	The standards would require the maintenance or development of stand densities that may or may not be consistent with the desired vegetation conditions, depending on the landscape and vegetation type.
HNF – Forestwide Standards – Range	The plan components for grazing would promote the health of native vegetation, especially nonforested communities and riparian areas.
HNF – Forestwide Standards – Noxious Weeds	The plan components for noxious weeds would promote the health of native terrestrial vegetation, most especially nonforested plant communities.

Section	Summary of expected effects
HNF – Forestwide Standards – Revegetation	These standards prescribe seeding disturbed areas, and would ensure the re-establishment of native vegetation following natural disturbance or management.
HNF – Forestwide Standards – Timber and Firewood	The suite of timber standards are similar in intent as those in the revised plan. The maximum opening size limit is smaller, which would limit the achievement of desired forest pattern in some cases.
HNF – Forestwide Standards – Watershed	Guidance relative to vegetation removal and watershed cumulative effects would limit vegetation management in some areas.
HNF – Forestwide standards – Protection	Components would emphasize silvicultural treatments for insects and disease. Components for wildfire and prescribed fire would contribute to movement towards vegetation desired conditions.
HNF – Forestwide Standards – Riparian	Components provide guidance related to vegetative cover in riparian areas, with specifics for livestock grazing, and would contribute to desired vegetation conditions in riparian areas.
HNF and LCNF – Management Area Direction	The existing plan mapped management areas, including proposed wilderness areas, each with a unique management emphasis, and enumerated management standards for recreation, visuals, wildlife and fisheries, range, timber, water and soils, minerals, lands, facilities, protection, and riparian resources. This guidance would influence the types and magnitude of treatments allowed to achieve desired conditions.
LCNF – Forestwide Objectives and Desired Future Condition	The objectives and desired future condition do not describe the condition of vegetation over time. The plan would not necessarily guide the forest toward conditions similar to those described in this analysis.
LCNF – Forestwide standard C-1, Wildlife Habitat Management	Components specific to forage and winter range would maintain the health of nonforested vegetation in elk winter range specifically.
LCNF – Forestwide standard D-2	The plan components for noxious weeds would promote the health of native vegetation, especially nonforested plant communities.
LCNF – Forestwide standard D-1, D-3, D-4	Guidance related to grazing management would protect riparian areas (including vegetation), soils, and water quality.
LCNF – Forestwide standards E-1, E-2, E-3, E-4	These standards for timber, firewood, and reforestation, and are similar in intent to many revised forest plan components. Maximum opening sizes are not addressed.
LCNF – Forestwide standard F-3, Soil, Water, and Air	The guidance would generally protect watershed, soil, and air values. Prompt revegetation would occur.
LCNF – Forestwide standard P-1, Protection	This standard would guide the Forest toward harvesting stands at high risk to mountain pine beetle and other insects and diseases, and to utilize prescribed fire to achieve management goals.

Effects that vary by alternative

Ecosystem processes: projected wildfire and hazard to stand replacing fire

Wildfires are expected to have one of the most substantial influence on vegetation in the future. The expected acres of wildfire are generated by SIMPPLLE based on assumptions for fire suppression, future climate (warm/dry), vegetation conditions, and projected vegetation treatments. The differences in alternatives are a result of different land allocations, such as lands suitable for timber production, which influence the amount and type of vegetation management that is projected to occur. These differences resulted in only subtle variation in projected wildfire acres across the alternatives.

Though our best understanding of how fire behaves and its effects on vegetation were used to inform the model, there is an inherent degree of uncertainty. We cannot predict with high accuracy where and when fires will occur. There is a high degree of variation, spatially and temporally, in the amount and location of fire. The average wildfire acres shown in appendix B do not imply an “even flow” of acres burned over time. The estimated mean levels of fire activity are below the NRV for low severity fires, and at the low end within the NRV for mixed severity and stand replacing fires.

The hazard of stand replacing fire was also estimated with Spectrum. In all alternatives the model projects that the hazard of stand replacing fire in forested stands would be reduced over time. While this decrease is greatest with alternatives A and E, all alternatives would result in a reduction of hazard to stand replacing fire. This metric shows only the hazard of stand replacing fire, based on stand characteristics – it does not indicate fire risk or expected fire acres burned which depend upon many other factors such as ignition sources, weather, fire suppression efforts, and topography.

Ecosystem processes: projected insect and disease activity and hazard ratings

Insects and disease will also play a role in vegetation change over the next five decades. The amount of insect and disease disturbance is closely tied to the abundance of the host species, vegetative succession, and warmer climates.

The estimated mean levels of Douglas-fir beetle are within the NRV. Mountain pine beetle would also generally be within its NRV, except on cold broad PVTs where the model predicts infestations above the historic amount. This indicates continued impacts to whitebark pine from this insect. The projected levels of western spruce budworm are above the NRV on cool moist and cold broad PVTs, but are declining through time and within the natural range for warm dry PVTs.

Hazard to bark beetles (mountain pine beetle and Douglas-fir beetle) and defoliators (primarily western spruce budworm) was also estimated. In all alternatives, the hazard to bark beetles is expected to increase over time; this partly reflects the re-growth of pine forests that were killed in the recent mountain pine beetle outbreak. It is also likely a function of the anticipated increases in large trees and large forest size classes. Alternatives A, B/C, and D are generally similar with respect to bark beetle hazard, while alternative E has a higher hazard from decades 3 to 5.

Similarly, the amount of the forest at high hazard to defoliators would decrease through time under all alternatives, to a relatively similar degree although alternative E would result in slightly more acres of high hazard as compared to the other alternatives. This trend is likely due to vegetation management and wildfires that result in a reduction or removal of forests with dense understories of susceptible hosts.

Effects from forest plan components associated with:

Timber management

Timber harvest is one of the tools available to change vegetation for purposes of maintaining or moving towards desired vegetation conditions. Forest plan direction guiding timber harvest is provided in all alternatives. The Spectrum model was used to generate the best solution for applying future timber harvest to move towards desired conditions while considering resource constraints and management guidance for each alternative. The acres influenced by timber harvest are a relatively small proportion compared to natural disturbance processes such as wildfire.

Alternative E has the most land determined to be suitable for timber production, while alternative D contains the least. These are lands where harvest would be used to the greatest extent, although the alternatives also include lands that are unsuitable for timber production where harvest can occur for other purposes. However, the difference between alternatives in terms of timber suitability is minor. Alternative E treats the fewest acres in the early decades, although it generates the most timber volume by virtue of where and how the harvest is conducted. Alternatives A, B/C, and D would harvest similar amounts.

In the first decade, all alternatives would treat more of the landscape with even-aged regeneration harvest than with other types of harvest (intermediate or uneven-aged systems). This proportion changes over time, with more intermediate and uneven-aged harvests occurring in decades 2 through 4. The proportion of even-aged regeneration harvest increases again in decade 5. These trends are based on the model finding the optimum solution to move the landscape towards desired conditions. Even-aged regeneration harvest are likely driven by the desired condition to alter species composition (most notably, the desired condition to increase the ponderosa pine cover type); whereas other types of harvest may be more related to altering forest structures (most notably, the desired condition to increase large size classes).

In alternatives A, B/C, and D the Spectrum model generally selected warm dry forests for harvest treatment to best meet the desired conditions as defined by cover type, density class, and size class distributions, while alternative E selected to treat cool moist forests as well (lodgepole pine and spruce/fir) in order to achieve more timber volume production. Generally speaking, alternatives A, B/C, and D would generally do more to move warm dry forests toward more open densities and ponderosa pine dominance than alternative E.

Average patch sizes are projected to decrease over time, which specifically in the cool moist broad PVT may result in average patch sizes that trend below the NRV and desired condition. The revised forest plan (alternatives B/C, D, and E) include standards for maximum even-aged harvest openings based on the NRV. For the warm dry and cold types, the standard is 40 acres, which is consistent with both the existing and desired condition ranges as well as the broad-scale average patch size projected through time. For the cool moist type, the standard is 125 acres, which is larger than the current and projected average size but aligned with the NRV. Therefore, to the extent that timber harvest affects the landscape, larger patch sizes may be promoted to offset the reduction in patch size to the limited degree possible under FS control. Patch size was not a variable included in the desired conditions for timber modeling (Spectrum), but would be a consideration during implementation of the plan. Alternative A would result in a maximum opening size of 40 acres for all PVTs (with exceptions as provided by law).

Regeneration harvest would alter forest size class, primarily resulting in seedling/sapling forests. Reforestation (planting or natural regeneration) would occur in these stands, and can be used to achieve desired conversions in composition. Other harvests include intermediate treatments, or thinning. These treatments primarily reduce tree density, but may also increase size class (when smaller trees are removed) and can change forest composition. Uneven-aged harvest tends to maintain or increase the shade tolerant tree species as compared to shade intolerant species, because of the small openings and denser forest canopy conditions, but can also be used to promote uneven-aged stands of intolerant species such as ponderosa pine. The projected harvest acres and subsequent vegetation changes produced by the Spectrum model are incorporated into the SIMPPLLE model, and therefore their influence on the indicators for terrestrial vegetation are reflected in the results described in this section.

Salvage harvest - Under any alternative, salvage harvest may occur in burned areas or those infested with insects or disease, removing some of the dead trees for their economic value; the potential for this activity is not modeled. In practice the term salvage is technically only applied as an intermediate harvest; as described in the affected environment section. However, the term “salvage” is used here more broadly to indicate any post-disturbance harvesting. The majority of the HLC NF is in designated wilderness, RWAs, or IRAs where salvage would be prohibited or limited and natural disturbances would be predominant, including fire that creates abundant burned forest conditions. Salvage would most commonly occur in lands suitable for timber production. The impacts of salvage would generally be consistent with a “green” harvest in terms of trees removed and reforestation, because the full suite of plan components that guide timber harvest would apply. Salvage cutting following fire is a controversial management approach. The ecological effects of post-fire logging are influenced by various combinations and intensities of the fire itself and management activities that affect (1) ground disturbance by equipment and road use; (2) number of living and dead trees and their spatial pattern following harvest; (3) postharvest fuel treatment; and (4) in some cases, grass seeding and placement of various structures and materials to mitigate the effects of fire and logging (Peterson et al., 2009). Post-fire harvest may fit into an effective restoration strategy if management pathways for attaining desired combinations of species, forest structure, and ecological functions are specified (ibid).

Fire and fuels management

Fire and fuels management provide tools to help achieve vegetation desired conditions, and therefore generally result in positive impacts to terrestrial vegetation.

Prescribed fire can be the only feasible management option in landscapes where mechanical treatments are not allowed or are infeasible. The objectives for fuel reduction are usually complementary to other desired vegetation conditions, especially related to forest resiliency. Plan components that allow for prescribed fire and other fuel reduction activities exist in all alternatives. Management direction for the action alternatives emphasizes and provides greater flexibility in the use of prescribed and natural, unplanned ignitions to improve vegetative conditions. The revised plan components are designed to recognize the natural role of fire on the landscape and its importance in shaping the ecosystem, while also protecting values at risk.

The Spectrum model was used to generate the best solution for applying future prescribed fire to move towards desired conditions while considering resource constraints and management guidance for each alternative. These treatments were only applied in forested lands, because that is the focus of Spectrum modeling. In reality, additional prescribed burning in nonforested vegetation types would also occur. In the model, prescribed burning treatments were applied both as maintenance treatments within harvested stands, as well as stand-alone prescriptions. The model projects that alternatives A, B/C, and D would apply similar levels of prescribed burning, with the greatest treatment acres occurring in decades 1 and 5. Alternative E would apply the least amount of fire to the forested landscape. Alternative E differs in this way because it emphasizes timber production in addition to achievement of desired conditions.

In lands within the WUI and near communities, there would likely be a continued emphasis on fire suppression, although the action alternatives would allow for managing wildland fires on all areas when appropriate. Although both prescribed fire and other fuels treatments may occur across the landscape to achieve desired conditions, in these areas in particular, it is likely that mechanical treatment methods would be needed to reduce hazardous fuels and create conditions conducive to more safe and effective suppression efforts. To achieve desired fuel conditions, there may be areas where forest conditions are created and maintained over the long term at lower densities, i.e., very open and park-like conditions. This would be consistent with the natural disturbance regime found on many sites, such as in the warm dry potential vegetation group. However, in cases where cool moist forest types are found in the WUI the site specific conditions could be more open than what would occur under natural disturbance regimes. This effect is common to all alternatives.

ROS settings

Recreation opportunity settings are defined for the action alternatives but do not apply to the no-action alternative. The array of ROS settings vary by each action alternative and influence both the potential access and type of vegetation treatments that can occur, particularly timber harvest. Alternative D is most limiting to harvest in this regard, as it includes the most primitive and semi-primitive nonmotorized settings. Alternative E is the least limiting, as it includes the most semi-primitive motorized and roaded natural settings, which are compatible with timber harvest and lands suitable for timber production.

Scenery

Under all alternatives, plan components associated with scenery may affect terrestrial vegetation through their influence on allowable vegetation treatments that could help move vegetation towards desired conditions. The magnitude and type of vegetation treatment (particularly timber harvest) in areas with higher scenic values may be limited. Effects to scenery are typically localized and would be determined in project-level analysis; in some landscapes scenery plan components may align perfectly with terrestrial vegetation desired conditions, while in other landscapes these components may inhibit or delay achievement of desired vegetation conditions. However, because both vegetation and scenery objectives emphasize retaining or mimicking conditions that are consistent with natural processes, at the broad scale plan components related to scenery and visual quality would not likely preclude the achievement of desired conditions for terrestrial vegetation.

Alternative A uses visual quality objectives to define scenery management, whereas the action alternatives utilize SIOs. SIOs offer greater flexibility and recognition of natural disturbance regimes and vegetation conditions. Alternative D is most potentially limiting to vegetation management activities, as it has the most high and very high SIOs as a result of having the most RWAs and primitive recreation opportunities. Alternative E is the least limiting.

General wildlife management

Wildlife plan components under all alternatives would influence terrestrial vegetation. In the existing forest plans, many of these elements are blended into management area guidance, and some complement terrestrial vegetation desired conditions. For the most part, plan components for wildlife under the action alternatives are complementary to those of terrestrial vegetation. By design, the desired vegetation would benefit and provide for the wildlife habitat conditions that support the full suite of native species. This is the coarse-filter approach to providing ecological integrity.

Elk (and other ungulates) management

Under all alternatives, terrestrial vegetation may be influenced by the management of elk and other ungulates through components that limit the location, access, timing and/or duration of vegetation management, and in some cases require certain vegetation conditions (such as hiding and thermal cover). These plan components vary by alternative as well as by GA. The potential influences of these components cannot be quantified with Spectrum or SIMPPLLE, and are therefore addressed qualitatively.

Plan components related to elk are detailed and specific to alternative A. The requirements for the maintenance of certain vegetation conditions, such as hiding or thermal cover as defined by tree canopy density, would not necessarily be consistent with desired vegetation conditions depending on the vegetation type and location. In some areas the standards may not be achievable given disturbances and climate. The effect of these plan components would be to limit vegetation management and preclude the achievement of desired conditions in some areas. Other components, such as open road densities and elk security standards, may limit the potential feasibility of some vegetation projects.

Under the action alternatives, plan components related to disturbance to ungulates (specifically on winter range) would also influence the potential timing and duration of vegetation management activities. Hiding and thermal cover would also be considerations for determining desired vegetation conditions at the project scale. Elk security requirements may limit the potential for vegetation treatments and achievement of desired vegetation conditions, and are found in alternatives B and E but not C or D. For all of these aspects of elk management, the potential constraints to management or influence on vegetation conditions would be based on the best available science to provide for the needs of elk, determined on a project-specific basis. In contrast to alternative A, the required conditions are not quantified in the revised plan and flexibility is provided to increase the potential that conditions necessary for elk would be consistent desired vegetation conditions.

The Elkhorns GA has unique plan components under all alternatives, based on its designation as a wildlife management unit. These components are similar across all alternatives, and would result in any vegetation management activities that occur being designed to benefit desired wildlife and vegetation conditions, hazardous fuel reduction, or protection of values at risk. This would not preclude, and in fact should complement, the achievement of desired conditions as defined for terrestrial vegetation, especially nonforested plant communities.

Canada lynx management

All alternatives would incorporate the NRLMD (USDA, 2007a), which would influence vegetation management and how desired conditions are applied in potential lynx habitat (roughly 44% of the HLC

NF). Refer to appendix H of the revised forest plan for the lynx plan components. Although the management direction applies to mapped occupied lynx habitat, the guidance should be considered on all mapped habitat on the Forest, including habitat that is currently considered unoccupied. Occupied lynx habitat was identified in the 2006 Amended Canada Lynx Conservation Agreement by the USFS and U.S. Fish & Wildlife Service, and currently includes only the Upper Blackfoot and Rocky Mountain Range GAs. However, because the guidance should be considered on all lands, and there is potential for occupied habitat to change, lynx management direction is applied and analyzed across the entire HLC NF for forest planning purposes.

Several of the objectives of the lynx direction complement the terrestrial vegetation plan components, by describing a desired condition to management vegetation to approximate natural succession and disturbance processes (#1), and provide a mosaic of habitat conditions through time (#2). Further, objective #4 specifically points to the opportunity to utilize vegetation management to promote the development of desirable habitat characteristics.

Several standards and guidelines may potentially impact the management of terrestrial vegetation (VEG-S1, S2, S5, and S6). These standards include an exemption for fuel reduction treatments within the WUI, and exceptions to these standards may also occur for pre-commercial thinning to benefit other resources. The acres affected for S1, S2, S5, and S6 cumulatively must occur on no more than 6% of mapped lynx habitat. The number of acres that may be treated in the WUI by exemption and/or pre-commercially thinned by exception are determined in consultation between the FS and the U.S. Fish & Wildlife Service; maximum acres that may be affected are defined for the Helena and Lewis and Clark portions of the HLC NF separately as part of an Incidental Take Statement. Treatments that are conducted under the exemptions and exceptions are monitored. To date, over the 10 years since the adoption of the final lynx direction, the exemption/exceptions have been applied to less than 3,000 acres of mapped occupied habitat across the HLC NF, which represents a small percentage of the allowable threshold.

The limitations of the lynx management direction were incorporated into the Spectrum model, and therefore their influence is incorporated into the results displayed in this section. The effects tied to each standard individually are assessed in the following subsections.

NRLMD Standard VEG-S1 and S2

Standards VEG S1 and S2 would potentially limit the amount of regeneration harvest that may occur. Standard VEG S1 requires that if more than 30% of the lynx habitat in a lynx analysis unit (LAU) is currently in a stand initiation structural stage that does not yet provide hare habitat during winter, no additional habitat may be regenerated by vegetation management. Standard VEG S2 requires that timber management shall not regenerate more than 15% of lynx habitat on NFS lands in a LAU in a ten-year period. These standards may limit potential vegetation treatments in some areas where seedling/sapling forests are abundant, particularly after a stand replacing disturbance. However, in those instances it is likely that the desired vegetation conditions would be consistent with not creating additional regenerating forest patches. Therefore, these standards should be complementary, or at least not preclude, the potential future achievement of terrestrial vegetation desired conditions.

NRLMD Standard VEG-S5

Standard VEG S5 does not allow pre-commercial thinning that reduces snowshoe hare habitat in seedling/sapling size stands except in very limited situations. In addition to the exemption/exceptions allowed in the WUI previously described, other exceptions are provided for pre-commercial thinning within 200’ of administrative buildings (#1); thinning for research studies or genetic tests (#2); thinning associated with aspen (#4); or whitebark restoration (#6). Finally, an additional exception (#3) is provided to allow for thinning based on new information that is peer reviewed and accepted at the Regional level; however this analysis and documentation does not yet exist.

This standard may reduce the effectiveness of achieving desired vegetation conditions across portions of the forest. Although dense forests may be desired in some stands, in many others pre-commercial thinning can be used to trend forests towards desired composition, densities, size classes, and improved resilience over time, especially in lands suitable for timber production. Early thinning can be more cost effective at achieving these goals than waiting until the trees are larger and more difficult to dispose of. Table 46 provides a depiction of the magnitude of the effect of standard VEG S5 on potential pre-commercial thinning opportunities.

Table 46. Seedling/sapling forests in potential lynx habitat (both occupied and unoccupied), in lands suitable for timber production

	Acres Within the WUI	Acres Outside the WUI	Total Acres
Alternative A	12,611	15,502	28,113
Alternative B/C	9,977	12,312	22,289
Alternative D	10,102	12,002	22,104
Alternative E	10,452	12,564	23,016

The proportion of the lands suitable for timber production in a seedling/sapling size class, within potential lynx habitat and outside WUI represent lands where pre-commercial thinning would most commonly be desired, and conversely that action would be delayed by lynx management direction. Precommercial thinning could not occur until the stands no longer provide habitat for snowshoe hare, i.e. after the trees self-prune and no longer include green limbs that touch the snow surface in the winter. Hand thinning is generally most feasible and cost-effective when the trees in the stand are small, and therefore delaying treatment may render the action infeasible, and the opportunity to improve stand growth and quality could be foregone in some areas. The amount of acres in this condition is highest in alternative A, and slightly less in alternatives B/C and E. Such areas that still provide snowshoe hare habitat could only be pre-commercially thinned if exception #3 can be met in the future through new peer-reviewed written documentation.

Pre-commercial thinning would not be feasible or needed in all of these young stands, depending on the site specific existing and desired conditions, nor would current or anticipated budget levels support thinning all these acres.

NRLMD Standard VEG-S6

Except for the exemption for fuels treatments in the WUI (as described above), standard VEG S6 does not allow vegetation management that reduces winter snowshoe hare habitat in mature multi-story forests. This habitat condition most commonly develops on the cool moist and cold broad PVTs. Other exceptions are provided for treatments within 200’ of administrative buildings, dwellings, outbuildings, recreation sites, and special use permits including ski areas (#1); treatments for research studies or genetic tests (#2); or for incidental removal during salvage harvest (#3). VEG S6 also notes that timber harvest could be used to create openings to improve hare habitat in stands with poorly developed understories.

Mature multi-storied hare habitat is fairly uncommon, currently comprising less than 2% of the potential lynx habitat area across the HLC NF. This amount will fluctuate over time as the condition is removed by disturbance and develops in other stands. Under all alternatives, the SIMPPLLE model predicts the amount of multistory habitat to increase for the first few decades (to nearly 10% of the potential lynx habitat area forestwide) and then decrease again to about 7% of the potential lynx habitat area forestwide by decade 5. Therefore, this standard is likely to be more limiting in the future than in the current condition, with any alternative.

Adhering to VEG S6 would result in harvest and prescribed fire treatments rarely being feasible in multi-story mature forests in potential lynx habitat, due to the likely damage to understory trees. This limitation would limit vegetation management to the greatest extent in potential lynx habitat outside of the WUI, which represents roughly 38% of the HLC NF in all alternatives. Much of this area is located in IRAs, RWAs, or designated wilderness areas where the only vegetation treatments that could occur would be prescribed fire.

VEG S6 would potentially reduce or delay the ability to achieve desired vegetation conditions in some areas, such as where increasing the abundance and resilience of whitebark pine is desired. The inability to apply vegetation management in whitebark pine forests where fire exclusion has allowed spruce/fir canopy layers to develop would result in foregoing some whitebark restoration opportunities; refer also to the Plants at Risk section. In addition, achieving resiliency through management in other stands by promoting early seral species (such as lodgepole pine) or more open tree canopies would not occur in mature multi-storied stands.

Mature multi-story hare habitat is likely to be susceptible to high severity fire as well as to damage and mortality from western spruce budworm, bark beetles, and other agents. Therefore, vegetation management to promote the development of future mature multi-storied hare habitat, as allowed in VEG S6, may be warranted in some areas. This guidance would influence the types of prescriptions selected in some projects (i.e., selecting uneven-aged management to promote the development of spruce/fir multi-storied stands, rather than another vegetation treatment that would promote other structures or species).

At the broad scale the promotion of mature multi-storied forest is an important piece of the desired vegetation mosaic. VEG S6 would not necessarily preclude a trend towards other terrestrial vegetation desired conditions, in large part because vegetation treatments are predicted to influence a relatively minor proportion of the landscape. Still, this standard may have some impact on the potential to achieve specific desired conditions related to lodgepole pine and whitebark pine forests. The vegetation modeling included parameters that did not allow timber harvest or prescribed fire within existing mature multi-storied stands in potential lynx habitat. While this condition currently represents only about 20% of the forests on the cool moist and cold broad PVTs, the amount is predicted to increase over time. The model also predicted a decrease in the lodgepole pine cover type and a fairly static trend for whitebark pine, along with increases in spruce/fir on the cool moist and cold broad PVTs. Therefore, VEG S6 may become increasingly limiting in the future and represent some tradeoffs with the potential to achieve other desired conditions through active management.

Under any alternative, the achievement of desired vegetation conditions and lynx habitat would require integration of the full suite of desired conditions for a given landscape, and appropriately assigning vegetation management in time and space.

Watershed and conservation watershed network management

Watershed plan components exist for all alternatives, but are more specific in the action alternatives (B, C, D, and E) than in alternative A. One way that watershed plan components would influence terrestrial vegetation is through their influence on potential timber harvest; refer to the Timber section. Watershed plan components may also either limit or encourage other forms of vegetation management, such as prescribed fire and tree planting, to maintain the appropriate level and types of vegetation cover that reduce erosion potential as well as the risk of catastrophic fire effects. These components are built on the concepts of the NRV, and therefore would generally either complement or at least not preclude the achievement of the vegetation desired conditions as described in this section. The management direction found in the action alternatives recognize more flexibility in potential scenarios related to vegetation and natural disturbances than the no-action alternative.

Soils

Under all alternatives, plan components related to soils would generally benefit terrestrial vegetation by ensuring that soil productivity is maintained in the long term. Standards and guidelines related to soils may limit vegetation management activities, such as timber harvest and prescribed fire, by restricting activities or conditions that may be detrimental to soils. The action alternatives provide greater specificity in the standards and guides for soils than alternative A, particularly with respect to allowable detrimental disturbance and post-treatment ground cover requirements.

Aquatic habitat and riparian areas

Measures to protect aquatic habitat and riparian areas would apply under all alternatives near streams, water bodies, and wetlands. RMZs are defined differently depending on the alternative, as described in the RMZ section. Plan components would limit and guide the type, amount and location of vegetation treatments that have the potential to impact riparian resources, as well as requiring retention of trees and other forest components, as discussed in the Timber section.

RMZs are narrow, linear features on the landscape that help provide for wildlife habitat connectivity, late successional forest features, and refugia for seed sources; therefore, plan components that encourage the retention of these features would generally complement terrestrial vegetation desired conditions. All action alternatives recognize that vegetation treatments, including prescribed fire, within RMZs may be beneficial and needed to achieve desired conditions and provides direction to increase efficiency and flexibility for managing in certain areas within RMZ, as determined through site-specific analysis. Though vegetation treatments in RMZs are not prohibited in the existing forest plan, alternative A does not provide as clear direction and flexibility, and thus could be more limiting on the ability to trend forest towards desired conditions.

West of the Continental Divide, alternative A is very similar to the action alternatives with respect to the sizes and management direction applied to riparian areas, although guidance for vegetation management in the outer RMZs is more flexible with the action alternatives. East of the Continental Divide (the majority of the HLC NF), the action alternatives would establish larger RMZs than alternative A.

Recommended wilderness areas

The alternatives vary in the quantity and location of RWAs, ranging from none in alternative E, to 16 areas in alternative D. Within these areas, all action alternatives would have the same level of ability to achieve desired vegetation conditions within RWAs through the use of vegetation treatments. All have forest plan direction that allow restoration activities to occur as long as the ecological and social characteristics that provide the basis for wilderness recommendation are maintained and protected. Anticipated vegetation treatment activities would largely be associated with the restoration of high elevation ecosystems, and whitebark pine forest communities in particular. There may be other treatments occurring to achieve restoration objectives outlined in the plan components. The most likely treatment would be prescribed burning (planned ignition), in some cases followed by limited planting of conifer seedlings. Objectives would include restoration of desired forest structure and compositions, and to restore desired landscape patterns.

Future wilderness designation of RWAs could be anticipated. Designation as wilderness would likely result in reduced flexibility and options for vegetation management to achieve desired conditions. Use of prescribed fire is typically restricted within designated wilderness areas, and the ability to use unplanned ignitions (wildfire) as a tool would be limited within some of the RWAs. This is because of the small size and/or in locations of the areas and most wildfires would likely have to be aggressively suppressed to protect identified values (i.e., private lands). Reduced ability to use prescribed fire treatments may limit ability to achieve desired vegetation conditions across portions of the landscape.

Cumulative Effects

The effects that past activities have had on all of the components of forest vegetation are reflected in the current condition of the forest vegetation. In addition, the section above that discusses consequences to vegetation from forest plan components associated with other resource programs or topic is a form of cumulative effects analysis.

Changing human populations

Additional stressors that may increase in the future are increasing population levels, both locally and nationally, with resulting increasing demands and pressures on public lands. Locally, at present populations are increasing in the counties on the west side of the plan area, but are declining or stable in other areas. These changes may lead to increased demands for commercial and non-commercial forest products, elevated importance of public lands in providing for habitat needs of wildlife species, and changing societal desires related to the mix of uses public lands should provide.

Management of adjacent lands

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some GAs contain inholdings of such lands, while others are more unfragmented in terms of ownership. The GAs which are island mountain ranges are surrounded by private lands.

Harvesting or conversion of forests on adjacent lands would affect vegetation conditions at the landscape level, changing forest composition and structures. State law applies to all harvest activities regardless of ownership; therefore, basic resource protections would be consistent. However, harvest practices on other lands would not necessarily be conducted to meet the same desired conditions as those outlined in the HLC NF Draft Plan. Forest pattern (patch sizes, shapes) would potentially be affected by treatments on non-NFS lands immediately adjacent to NFS lands. Forest conditions on adjacent lands may influence pattern, extent or intensity of natural disturbances within forests on NFS lands, for example fuel conditions/fire hazard or potential spread of insect/pathogen populations. Forest conditions on NFS lands will be important for their contribution to maintaining desired biodiversity at the broad landscape scale.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF draft plan are summarized in Table 47, for those plans applicable to terrestrial vegetation.

Table 47. Summary of cumulative effects to terrestrial vegetation from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All plans address terrestrial vegetation. Generally speaking, management of vegetation is consistent across all NFs due to law, regulation, and policy. The cumulative effect would be that the management of vegetation would be generally complementary. This includes specific adjacent landscapes that cross Forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
Montana Statewide Forest Resource Strategy (2010)	This plan guides forest management on state lands. It includes many concepts that are complementary to draft plan components, for example promoting forest resilience, providing wildlife habitat, and reducing hazardous fuels. While specific desired conditions are not stated in the same terms as the HLC NF, it is likely that some elements such as increasing large trees, early seral species, and open forests would be similar. State forest lands may be actively managed to a greater degree than NFS lands, and would likely contribute to achievement of desired vegetation conditions across the landscape.

Resource plan	Description and Summary of effects
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components related to resilient terrestrial vegetation, and would therefore be complementary to the plan components for the HLC NF.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the terrestrial vegetation characteristics in this area are therefore similar to the wilderness areas in the adjacent Rocky Mountain Range GA and would likely complement these conditions.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily non-forested, and calls for managing for fire-resilient vegetation as well as restoration of native vegetation including mountain mahogany specifically. This plan would be generally complementary to the HLC NF most especially in promoting the health of native vegetation.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Terrestrial vegetation is a component of these parks, although not always the primary feature. Specific vegetation conditions would not necessarily contribute to the desired conditions as described for the HLC NF.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy (above). The vegetation conditions described would be complementary to the conditions being managed for with the HLC NF plan.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	This plan is relevant to an area that lies adjacent to NFS lands in the Divide GA, in proximity to the City of Helena. The plan emphases forest management and wildfire mitigation. This would be complementary to management on some HLC NF lands, specifically the South Hills Special Recreation area (alternatives B, C, and D).

Conclusions

Broadly, the suite of desired conditions are characterized by increases in large trees and large forest size classes; more open forest densities and vigorous nonforested plant communities; and increasing early-seral shade tolerant species as compared to the existing condition while maintaining the full range of biodiversity on the landscape. These conditions are consistent with the modeled NRV and most likely to be resilient in the future given expected drivers such as climate change, drought, vegetation succession, wildfire, insects and disease, and the demands of people.

To an extent, all alternatives would help move the forest toward some desired conditions by allowing for active management and having similar types and extent of expected natural disturbances. The action alternatives provide more plan components specifically designed to ensure achievement of these conditions, than the no-action alternative. Expected trends for terrestrial vegetation show little to no variance across alternatives, due to the limited scope and impact of vegetation management treatments at that scale which are masked by the effects of natural disturbances. Table 48 summarizes the comparison of alternatives for the vegetation characteristics.

In all alternatives, the hazard to stand replacing fire decreases over time. The expected future hazard to bark beetles increases based on forest re-growth and increases in large trees. Alternative E has the highest hazard to bark beetles over time as compared to the other alternatives. The expected future hazard to defoliators decreases through time, likely due to decreases in forest density and/or susceptible hosts.

Table 48. Comparison of alternatives for terrestrial vegetation indicators

Key ecosystem characteristic	Relative contribution to desired condition			Discussion
	Highest		Lowest	
Role of wildfire	ABCDE			The expected acres burned by wildfire are similar for all alternatives, and within the NRV.
Role of insects and diseases	ABCD	E		Expected levels of insect infestation are within the NRV for all alternatives. Hazard to bark beetles increases as forests impacted by the recent outbreak regrow, and the large size class increases. Alternative E results in the highest hazard to bark beetles. Hazard to western spruce budworm decreases.
Vegetation composition and tree species presence		BCDE	A	Ponderosa pine would increase while Douglas-fir decreases, trending toward or within desired ranges. Limber pine, whitebark pine, and aspen remain stable. Lodgepole pine decreases while spruce and subalpine fir increase, trending away from their desired ranges.
Forest size	BCDE	A		The modeling predicts increases in the large tree size class, with decreases in the small and medium classes at most scales; these trends move towards or maintain desired ranges.
Large and very large trees	BCDE	A		Large tree concentrations are expected to increase. The very large tree size class and concentrations would remain rare. Trees per acre of large and very large trees would increase.
Forest density and vertical structure	BCDE	A		Increase in the low/medium forest density class is anticipated, along with decreases in the high density class, which trends towards or meets the desired condition range. The abundance of single-storied forests is expected to decline with increases in multistoried forests, trending towards desired conditions.
Landscape pattern: early successional forest		BCDE	A	Patch sizes of early successional forests are expected to decrease. This is within the desired range forestwide and in the warm dry and cold broad potential vegetation groups. However, this trend moves to the lower bound of the desired range for cool moist types.
Overall movement toward desired conditions of terrestrial vegetation	BCDE	A		All alternatives have the potential to move towards desired vegetation conditions to a similar degree based on modeling. Alternative A is ranked below the action alternatives because it does not include plan components that explicitly include desired conditions based on the NRV.

3.9 Old Growth

3.9.1 Introduction

Old growth is a structural condition that may develop during the late successional stage of forest development. Old growth is of particular value to many wildlife species, is an important component of biological diversity, and provides functions such as carbon storage. It also contains biological legacies and seed sources that contribute to landscape resilience. The concept of old growth involves not only the age of a forest but also characteristics such as large trees, size and spacing variation, large dead standing and fallen trees, broken and deformed tops, bole and root rot, multiple canopy layers, canopy gaps and understory patchiness, cessation in height growth of oldest trees, near zero net productivity, and biochemistry of secondary metabolic products in old trees (Johnson, Miyanishi, & Weir, 1995). This late-stage state of succession is not static and as old growth dies it is replaced by younger forests that age. The proportion and distribution of old growth across the landscape changes naturally over time.

The indicator and measure for the existing condition of old growth is the estimated abundance (acres or percent of the area) of this condition on the landscape. However, old growth cannot be explicitly modeled into the future with current analysis tools. Therefore, other attributes which have some correlation to old growth are used to compare the effects of the alternatives through time. These attributes are:

- Abundance of large and very large tree concentrations, estimated by the SIMPPLLE model; and
- Abundance of old forest as estimated by the Spectrum model.

The abundance, location, condition, and potential management of old growth were raised as issues during the scoping period for the revised forest plan.

3.9.2 Regulatory framework

USDA FS Position Statement on National Forest Old-Growth Values 1989 (Green et al., 1992) recognizes the many values associated with old growth forests, such as biological diversity, wildlife and fisheries habitat, recreation, aesthetics, soil productivity, water quality, and industrial raw material. Old growth on the NFs will be managed to provide the foregoing values for present and future generations. Decisions on managing existing old growth forest to provide these values will be made in the development and implementation of forest plans. These plans shall also provide for a succession of young forests into old growth forests in light of their depletion due to natural events or harvest.

3.9.3 Assumptions

Ecosystems are dynamic, and natural processes such as succession result in a proportion of mid to late successional forests becoming old growth over time.

Old growth is not static; stands are killed by insects, disease, windthrow, and wildfire, and are replaced by younger stands as they age.

With expected warm and dry climate, old growth will be subject to increased disturbances and therefore represents important areas for the retention of biological legacies, seed sources, late successional forest habitat features, and carbon storage.

For the action alternatives, the strategies described in appendix C of the revised forest plan would be followed.

3.9.4 Best available scientific information used

Though all old growth is late successional forest, not all late successional forest is old growth. Old growth, as currently defined, must contain specific attributes. The HLC NF has adopted definitions of old growth developed by the Regional Old Growth Task Force and documented by Green and others (1992) as the BASI. This work contains measurable criteria to consistently define old growth. These criteria were developed based on a national definition that old growth forests are ecosystems distinguished by old trees and related structural attributes (Green et al., 1992). The old growth definitions are specific to forest type and habitat type group. Key attributes of old growth include age, numbers and diameter of the old tree component within the stand, and the overall stand density. Minimum thresholds have been established for these attributes. Associated characteristics are also defined for each old growth type such as probabilities of downed woody material, number of canopy layers, and number of snags over 9 inches diameter at breast height.

For this analysis, old growth is estimated with Forest Inventory Analysis (FIA) and FIA intensified grid plots using an algorithm based on the definitions found in Green et al (1992). Please refer to appendix B for a more detailed description of these datasets.

Incomplete and unavailable information

The criteria specified in Green et al (1992) are the best available information that can be applied to plot data to provide estimates of old growth for the purposes of broad-scale analysis. However, the authors state, "because of the great variation in old growth stand structures, no set of numbers can be relied upon to correctly classify every stand…do not accept or reject a stand as old growth based on the numbers alone; use the numbers as a guide." Therefore, as the forest plan is implemented, the determination of old growth patches at the project level may not match estimates made using plot data alone.

There is no forestwide map of old growth. Because the plots used to estimate old growth at the broad scale are designed to represent areas on a grid basis, polygons (or stands) of old growth cannot be delineated. Field inventories are necessary to accurately identify old growth stands. However, it is infeasible to maintain a stand examination inventory that covers every acre in a large analysis area. This type of inventory may occur at the project level, where site specific identification of old growth may be necessary. Some of the old growth on the Forest has been mapped during project level analysis, but much has not.

There is no quantitative estimate of the NRV of the abundance and distribution of old growth. It is difficult if not impossible to determine quantitatively the natural range in variation of old growth as currently defined across the landscape because the specific stand characteristics required to classify as old growth cannot be estimated with the model used (SIMPPLLE).

The data used for analysis represents the latest available, which includes FIA plots with the most recent measurements in 2011; and FIA intensified grid plots the most recent measurements in 2016. The effects of more recent disturbances, including the fires of 2017, are not portrayed by this data. However, the analysis of alternatives includes the potential for future fire and therefore the relative comparisons at the programmatic scale remain valid.

3.9.5 Affected environment

Currently about 11% of the HLC NF is estimated to be old growth (roughly 315,000 acres). Figure 6 shows the abundance of old growth at the forestwide scale and by broad PVT (see the Terrestrial Vegetation section for a description of these groups).

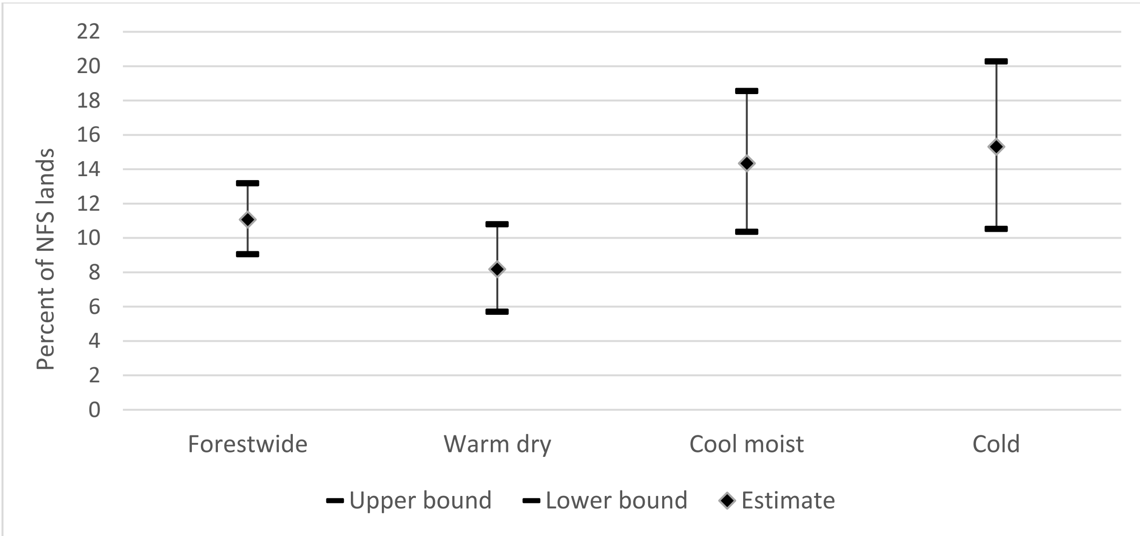


Figure 6. Old growth forestwide and by R1 broad PVT

Topography can influence the probability of old growth development; areas protected from wildfire (such as riparian areas or sites near rock features) may support vegetation legacy components which are more likely to be retained in the event of a disturbance. Even so, in fire prone landscapes the historic amount of old growth was probably not very high. In high elevation forests, the majority of the landscape would not have been very old at a given time due to fire cycles (Johnson et al., 1995).

From an early successional seedling stage, on sites typical of the HLC NF, it would take at least 150 years for a forest to become old growth, depending on the type. Periodic fire is a major disturbance process that influences old growth development. The likelihood of a particular forest stand to experience wildfire within 100 to 150 years would be high across many parts of the forest. Therefore, long-lived, early successional, fire tolerant tree species play a critical role in the successional process and development of old growth. These trees have a chance of surviving moderate and even high severity fires, and/or have adaptations that enable them to regenerate and grow rapidly post-fire. These species include ponderosa pine, Douglas-fir, and whitebark pine. Individual trees of these species can persist on some sites well into the late successional stages. They become the large diameter, old trees that are key features of the old growth forest condition. Old growth dominated by shade tolerant trees such as Engelmann spruce also occur particularly in riparian areas or other sites protected from disturbance by topographical features.

The existing old growth across the HLC NF represents an array of cover types, with those dominated by Douglas-fir (dry Douglas-fir and mixed mesic conifer) being the most common. Lodgepole pine dominated old growth is the next most abundant. Lodgepole pine is not as often thought of as old growth, as it would normally be replaced by fire or insects prior to reaching the required age. However, some stands do withstand low intensity fire and support large, old trees. Many plots used to estimate old growth forestwide have not been re-measured since the mountain pine beetle outbreak. Therefore, the amount of lodgepole pine and ponderosa pine old growth may be less. The lodgepole old growth remains vulnerable to mortality from insects and fire, more so than the other cover types, and losses may be inevitable in the near future.

The mosaic of structures available on some GAs to provide a stable quantity of old growth is limited because factors such as climate, fire history, and human intervention have resulted in homogeneity. For example, the Highwoods is dominated by young tree classes because the entire GA burned at the beginning the previous century. In the short term few older forests exist to become old growth. However, in the long term, a high proportion of forests could become old growth all at once (barring disturbance).

Conversely, GAs with a greater heterogeneity in age class, species composition, and structure, such as the Upper Blackfoot, may provide a more constant mix of old growth.

The abundance and distribution of old growth is influenced by the unique disturbance history of each GA. With the exception of the Highwoods, all of the GAs on the HLC NF contain old growth, with the means between 5 and 15% of the GA area. The Little Belts has a notably high proportion (17%). The Castles and Elkhorns also have relatively high estimates, but the lower bounds of the confidence intervals are not substantially different than other areas.

The total acres of old growth in the GAs is shown in Figure 7. Not surprisingly, the largest GAs (Rocky Mountain Range and Little Belts) support the most old growth acres. All other GAs have less than 25,000 acres of old growth each.

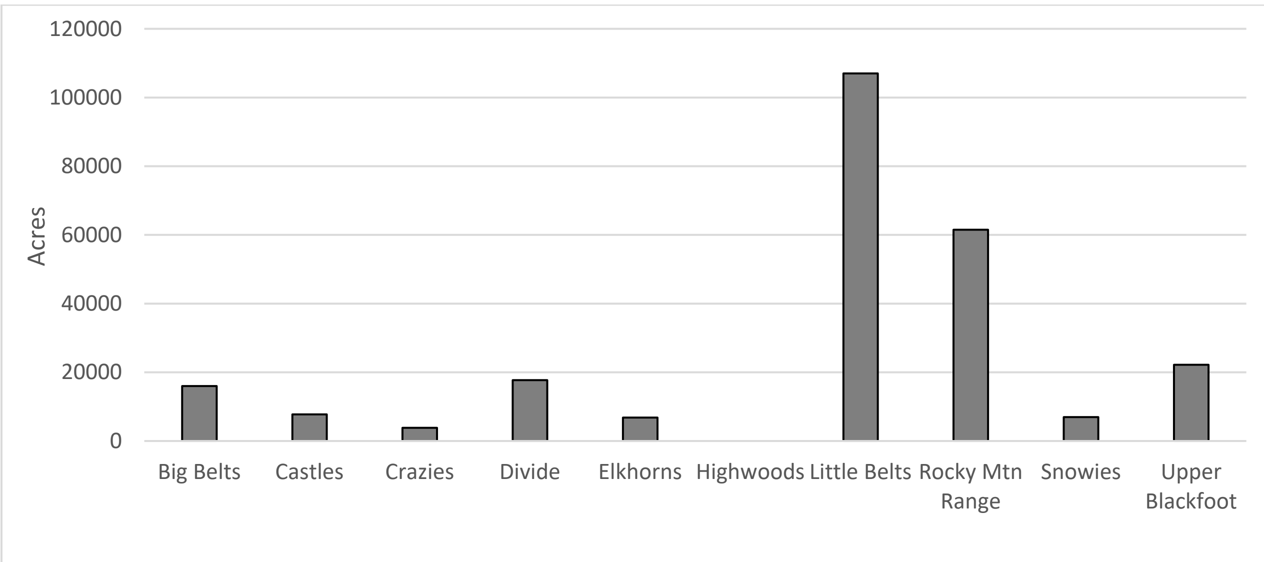


Figure 7. Estimated acres of old growth by GA[1]

1. Source: R1 Summary Database, F12_F15_Partial_IntGrid_4X_Hybrid_2016 and Hybrid 2011. Upper and lower bounds 90% confidence interval.

The abundance and distribution of old growth is influenced by the unique disturbance history of each GA. The recent mountain pine beetle outbreak has had an effect on pine-dominated old growth. The lack of old growth in some GAs, such as the Highwoods, is due to their small size and extensive fire history. Small island ranges such as these are susceptible to fires that spread from the surrounding prairie. In contrast, old growth in the Little Belts is abundant; this GA has experienced few wildfires recently. A substantial proportion of the old growth in this GA is the lodgepole pine type which may be susceptible to insect or fire mortality. The Upper Blackfoot, Divide, and Big Belts GAs are similar in old growth abundance. These GAs may have supported more old growth prior to recent large disturbances.

Old growth NRV and desired conditions

There is no means to determine a statistically sound, quantifiable estimate of NRV for old growth because the characteristics can be determined only through site specific inventory. However, other information provides historic context. Because old growth definitions are based in part on the presence of large trees, a partial correlation can be drawn with the presence of large and very large tree concentrations.

The NRV analysis estimated a mean of about 40% (range 35 to 43%) of the landscape had large tree concentrations, and 11% (range 9 to 14%) had very large tree concentrations. Not all of these areas would actually have been old growth. About 44% of the FIA plots that currently have large/very large tree concentrations on the HLC NF plan area also classify as old growth. If this proportion were applied to the NRV estimates for areas with large/very large tree concentrations, then it can be postulated that a natural range of old growth forestwide may have been 20-25%. This range would indicate that past amounts of old growth were likely higher than the existing condition. This conclusion is supported by the finding that the existing abundance of large and very large tree concentrations and size classes are lower than the NRV, especially in the warm dry broad PVT.

To the extent that desired conditions call for an increase in the large and very large size classes and tree concentrations, the old growth resource should increase as well on a proportion of those areas. This information was used to develop the desired condition for old growth as described in the draft revised forest plan. The desired conditions within old growth stands are based on the descriptions found in the BASI; these conditions are summarized in appendix B.

Another important feature of old-growth, particularly in regard to its importance to wildlife habitat and connectivity, is its spatial arrangement and patch size. Because there is no data to spatially map old-growth, the pattern is not quantified. However, the pattern of old growth is likely to vary as influenced by human and natural disturbances. Old growth that may have existed on non-NFS lands within the planning area has probably been removed over the past 100 to 120 years or so more through harvest or conversion of lands to other uses, such as agriculture. The average size of remaining old growth patches on all land ownerships are likely less than they were in the more recent past, particularly in areas where large patches were fragmented by harvest or development patterns.

Existing old growth is vulnerable to moderate or high severity fire, as well as insects and disease. Fire exclusion, particularly in low elevation warmer sites, has altered vegetation structure and composition in some old growth forests. Increasing tree densities, canopy layers, and proportions of Douglas-fir have increased tree stress and vulnerability to mortality from insects, disease, and fire. In addition, mountain pine beetle has recently affected many lodgepole pine old growth stands, and some ponderosa pine.

Benefits to People

Old growth is not specifically identified as a key ecosystem service of the HLC NF. However, this forest condition does provide benefits to people. Indirectly, these forests contribute to wildlife habitat and therefore contribute to the continued presence and possible wildlife interaction opportunities that people value. In some cases, these forests represent historic forest remnants that are valued by people, and where people enjoy hiking or other recreational activities, due to the large tree trees that provide shade and other aesthetic qualities. These forests also contribute to vegetative cover that helps provide for clean air, water, and other broad scale ecosystem services.

3.9.6 Environmental consequences

Effects common to all alternatives

All alternatives have forest plan direction for old growth that focuses on the maintenance of existing old growth across the landscape and managing for desired old growth amounts and patterns into the future.

In all alternatives, fire and other natural disturbances would continue to influence vegetation substantially more so than vegetation treatments, and would remain the main reason by far for loss of old growth. Similarly, succession would continue to be the primary means by which old growth is formed. This is in large part due to the expanses of land such as designated wilderness, RWAs, and IRAs where vegetation management is precluded or limited. Vegetation treatments that promote the long-term development of old growth (such as thinning in young stands to promote tree growth and resilience) are management tools that are available over a relatively small portion of the Forest in all alternatives. Old growth amounts and distribution would be dynamic and variable over time.

Predictions for warmer springs and warm, dry summers suggest that forests of the northern Rockies and the western U.S. will experience longer fire seasons, with larger and potentially more severe fires in the future. Therefore, existing old growth would be vulnerable to loss due to fire, as well as insects and disease, especially in wilderness and un-roaded areas. Fire exclusion and suppression in areas where a low or mixed severity historical fire regime occurred can alter vegetation structure and composition in old growth, and may make these stands more vulnerable to fire. Particularly on the warm dry broad PVT, increasing tree densities, canopy layers, and proportions of Douglas-fir have increased tree stress and vulnerability to mortality from insects, pathogens, and high intensity crown fires.

Old growth abundance

The expected effects to old growth abundance and distribution on the landscape cannot be quantitatively estimated with available modeling tools. Therefore, several proxy indicators are used. The expected trend in these characteristics is likely indicative of the trend of old growth. These values do not predict actual old growth conditions in the future, but are used to compare differences between alternatives. The results of the modeling for these indicators shows that it is likely that old growth may increase in abundance during the life of the plan, to a similar degree under all alternatives.

The SIMPPLLE model was used to estimate the abundance of large and very large tree concentrations, which show some correlation to areas that are most likely to be old growth. Figures in appendix B show the anticipated trend over time. All alternatives are nearly identical with respect to this metric. Forestwide, all alternatives appear to result in an increase in the abundance of this condition over time. This trend is most apparent in the warm dry broad PVT.

The SIMPPLLE model was also used to estimate the large and very large tree concentrations into the future for each GA. For most GAs, all alternatives are nearly identical, except in the Big Belts where alternative E indicates a slightly higher amount of large and very large tree concentrations as compared to the other alternatives. In all GAs, the modeling estimates an increase in these landscape components, with the exception of the Snowies. The slight loss of large/very large tree concentrations in the Snowies may occur based on susceptibility to disturbances such as bark beetles.

Another complementary source of information are the old forests that are tracked in the Spectrum model. Old forests are identified by age alone, and therefore would not necessarily always be old growth because other characteristics may be lacking. As shown in appendix B, all alternatives support an increasing trend in old forests through time, with the greatest acreage achieved with alternative A compared to the least achieved with alternative E. However, the magnitude of difference across alternatives is negligible.

Climate change

Climate is integrated into the SIMPPLLE model and a major driver of vegetation change and effects of the alternatives over time. There is a great deal of uncertainty surrounding climate change and its potential effect on vegetation, and therefore on old growth. Recent research suggests that climate change will likely exacerbate stressors and “stress complexes” will continue to manifest themselves (Halofsky and Peterson 2016). Increased disturbances may remove old growth from the landscape, and an increased focus on the resilience of old growth stands and development of old growth would likely be increasingly crucial to retain these habitat features on the landscape.

Effects from forest plan components associated with:

Vegetation management in old growth

All alternatives provide some flexibility to allow vegetation management within existing old growth stands. The degree to which this may occur, and how management would be guided, is compared across alternatives in subsequent sections.

Applying vegetation treatments in old growth is a controversial approach; however, some recent literature has concluded that carefully designed silvicultural treatments may be a valid approach in specific situations where needed to restore forest composition and structure so that fire can play its characteristic role (Noss, Franklin, Baker, Schoennagel, & Moyle, 2006; Salwasser, 2009)). Often it is the drier forest types that need treatment most, because fire exclusion has often created uncharacteristically high tree density and risk of high severity fire. These types of old growth would occur primarily in the warm dry PVT. Treatments to restore resilience could include reducing density with thinning in mid and understory tree layers, selective removal of overstory shade tolerant species, and retaining large, old fire-tolerant species such as ponderosa pine. These activities could reduce risk of high severity fire, provide for growth of smaller, younger trees into larger old overstory trees, and create gaps in canopy that allow establishment of new seedlings of fire-resistant species (Agee & Skinner, 2005; Fiedler, 2002; Franklin, Mitchell, & Palik, 2007; T. E. Kolb et al., 2007; Spies, Hemstrom, Youngblood, & Hummel, 2006).

A number of other studies also suggest that forest resilience can be improved through a variety of silvicultural treatments, while retaining diversity of plant and animal species (Fule, Crouse, Roccaforte, & Kalies, 2012; Lindh & Muir, 2004; Metlen & Fiedler, 2006; Ritchie, Wing, & Hamilton, 2008; Scott Lewis Stephens, 1998; S. L. Stephens & Moghaddas, 2005; Youngblood, Metlen, & Coe, 2006; Zhang, Ritchie, & Oliver, 2008). Further, treatments can maintain sufficient stand structure in old forests to provide habitat requirements for cavity nester species and a diversity of birds and small mammals, as well as maintain or improve understory plant diversity (Metlen & Fiedler, 2006; Steeger & Quesnel, 2003; Steventon, MacKenzie, & Mahon, 1998). Nevertheless, uncertainty associated with treatment of old growth for the purpose of improving forest conditions and resilience is also documented (Baker & Ehle, 2003; DellaSala et al., 2013).

Monitoring of treatments in old growth in the Region have indicated old growth characteristics can be maintained while achieving an increase in the proportion of desired fire-resistant species, an increase in average diameter of the stand, a decrease in stand density, maintaining or decreasing insect hazard ratings, and an overall reduction in fire hazard.

Fire and fuels management

Fire and fuels management plan components provide tools to help achieve vegetation desired conditions, and therefore generally result in positive impacts to old growth. It is possible that fires can destroy old growth, and many old growth stands are at risk to this disturbance based on their stand characteristics.

The degree to which wildfire has the potential to impact old growth would be similar for all alternatives. Prescribed fire is an important tool that can emulate natural disturbances and can be the only feasible management option in landscapes where mechanical treatments are not allowed or are infeasible. All alternatives provide plan components that allow a relatively high degree of flexibility in applying prescribed fire to the landscape. The plan components in the action alternatives in particular are designed to recognize the natural role of fire on the landscape and its importance in shaping the ecosystem. Old growth plan components in all action alternatives would ensure that prescribed fires are conducted in ways that do not remove existing old growth from the landscape.

Access and infrastructure

All alternatives are similar in terms of road access and infrastructure. In addition, all alternatives would apply access and road use limitations in areas identified as grizzly bear secure core, in the Rocky Mountain Range and Upper Blackfoot GAs. Where access is permitted along roads that are adjacent to or bisect old growth stands, some impacts to old growth could occur, primarily related to firewood cutting, which could remove old growth characteristics near the roadway. New road or temporary road construction could remove strips of old growth, if it occurs within old growth stands. Old growth that occurs in areas with limited access would not be subject to these impacts. However, limited access to conduct desired vegetation treatments would affect the ability to utilize vegetation treatments to enhance or promote future old growth.

Livestock grazing

Livestock grazing and old growth are not generally closely associated, as old growth stands would usually not provide the abundant forage, and where present in livestock allotments these forests are likely to provide only transitory range at best due to tree density. However, old growth and livestock uses may be juxtaposed in some areas, particularly riparian areas or in very dry, open old growth patches. Plan components in all alternatives for livestock grazing are designed to protect desired vegetation, with specific consideration given to riparian areas. Therefore, livestock grazing plan components would generally complement and not preclude movement towards the desired conditions for old growth.

Wildlife management

For the most part, under all alternatives the desired conditions and associated standards and guidelines for wildlife habitat would benefit old growth and vice versa. Plan components that may have the greatest influence on old growth are those that would influence terrestrial vegetation and vegetation management. These would generally include components related to big game, Canada lynx, and grizzly bear.

The direction for all of these species would result in limitations to the amount, type, and/or duration of vegetation management in specific areas, and/or would require the retention of a certain amount of mature or dense forests (such as components for hiding cover), as discussed in the Timber and Terrestrial Vegetation sections. To the extent that vegetation management is limited, the potential to retain existing old growth and allow natural old growth development to occur may be enhanced in some locations and vegetation types (such as spruce/fir). In other areas, limiting vegetation management may reduce the potential to increase forest resilience to maintain existing old growth, especially in dry forest types, and reduce the potential to treat younger stands in a manner that could help them develop old growth characteristics more rapidly.

With all alternatives, there are potential impacts in all alternatives resulting from forest plan standards associated with the NRLMD. The following standards have the greatest potential influence on old growth:

- Standard VEG S5 does not allow pre-commercial thinning projects that reduce snowshoe hare habitat in seedling/sapling size stands (outside the WUI) except in very limited situations. This may limit the amount of area where early thinning is done to promote the development of old growth.
- Standard VEG S6 does not allow vegetation management to reduce winter snowshoe hare habitat in “mature multi-story forests” (outside the WUI) except in very limited situations. This may complement the standard for retaining existing old growth, as some of these forests may also be old growth. However, it would also limit the potential to increase the resiliency of these stands with vegetation treatments.

Mining and mineral extraction

Mining undergoes site-specific analysis to determine effects and required mitigation. Effects to vegetation from mining is determined at the project level. Generally, the impacts to old growth from mineral extraction on the forest would be localized, and at the forestwide scale they would be minor.

Effects common to all action alternatives

All action alternatives include the same old growth desired conditions, guidelines, standards, and monitoring. Table 49 summarizes the expected effects of each plan component related to old growth.

Table 49. Summary of revised plan components for old growth

Plan component	Expected effects
FW-VEGF-DC, OBJ, and GDLs	As a coarse filter, the full suite of forested vegetation components provide for a natural diversity of forest conditions that should support the development of an appropriate array of old growth across the landscape. This direction would indirectly contribute to the development of old growth structures by providing for the appropriate array of species compositions, size classes, density classes, and other components on the landscape.
FW-VEGF-DC-07	This desired condition is specific to old growth. The component recognizes the dynamic nature of old growth forest over time, and the desire to increase resilience of old growth, and the size and shape of old growth patches. Qualitative descriptions of desired old growth conditions are provided, including species mixes and structures desired for old growth forest within the different broad potential vegetation groups. The effect of this desired condition is that management decisions would result in increasing the amount of old growth on the landscape.
FW-VEGF-GDL-04	This guideline would ensure that vegetation management activities would not modify the characteristics of old growth such that the stand would no longer meet the definition for old growth, unless specific exceptions apply. Therefore, no loss of old growth should occur under the action alternatives due to vegetation management activities. This component emphasizes several purposes for which treatment could occur in old growth, including promoting the resilience of old growth stands.
FW-VEGF-GDL-05	This guideline would ensure that vegetation management projects would promote the long-term development of future old growth, and recognizes that active management can help develop old growth. This management could include thinning in young stands to develop future species composition, size classes, and stand structures characteristic of late successional and old growth forests. It could also include treatment in small or medium forest size class stands to retain larger or more rapidly growing overstory trees, patches of younger trees, and other stand components and structures that could contribute to future old growth. The component also addresses actions near old growth that may help protect existing old growth from disturbances.
FW-VEGF-DC-05, 06; FW-VEGF-GDL-01	The desired conditions for large/very large live trees and concentrations complement the old growth plan components by providing for desired levels of large trees across the landscape. These are one important characteristic of old growth stands. The large/very large live tree guideline ensures that retention of these trees would occur within vegetation treatment units, which may help contribute to future old growth development.
FW-VEGF-DC-08, 09; FW-VEGF-GDL-02; 06	These plan components specify the desired conditions for snags and coarse woody debris, as well as provide guidance for minimum retention of these elements when vegetation treatments occur. This would contribute to future old growth development in some areas.

Alternative A, no action

Under the no-action alternative, the existing Forest Plan old growth standards would apply for the Helena and Lewis and Clark NFs respectively, as described in Table 50. The plans adopted the Green et al (1992) definition of old growth.

Table 50. Alternative A summary of forest plan standards for old growth (1986 plans)

Plan component	Expected effects
Helena NF forestwide standards II/20: An old growth stand is generally characterized by a high level of standing and down, dead and rotting woody material; two or more levels of tree canopies and a high degree of decadence indicated by heart rot, mistletoe, dead or broken tree tops, and moss. Five percent of each third order drainage should be managed for old growth. The priority for old growth in each drainage is: first, land below 6,000 feet in elevation; second, riparian zones and mesic drainage heads; and third, management areas emphasizing wildlife habitat. These areas will normally be managed on a 240	These plan components would result in a static amount of land being designated for management of old growth in each third order boundary or timber compartment. This does not necessarily reflect natural conditions; for example, in drainages or compartments dominated by nonforested plant communities this amount may be unachievable, and conversely in other landscapes the amount may be too low. The Helena NF plan does

Plan component	Expected effects
year rotation and will range from 10 acres to several hundred acres. Management areas other than T-1 through T-5 will be the primary source for old growth. However, if adequate old growth area cannot be achieved then the T management areas will be considered to meet old growth objectives.	not necessarily require that the stands selected actually are or are capable of becoming old growth, although the Forest has consistently chosen stands that are old growth or the "next best thing." It is unknown whether the quantity (5%) or scale (in every third order drainage or timber compartment) is representative of the natural range of conditions or necessary wildlife habitat amount and distribution. These plans would also result in only stands of a certain minimum size being selected for old growth (10 acres or 20 acres). These plans do not address a desire to increase the amount of old growth, nor do they reflect the varying capabilities of different landscapes and site capabilities. The amount of old growth prescribed does not have a clear tie to an understanding of the NRV or landscape resilience.
Lewis and Clark NF 2-16 Forest-wide management direction: Old growth forest inventory – there is currently no inventory of timber stands on the Forest which meet the old growth forest definition. These stands will be identified as a part of resource program and project level wildlife inventories and evaluations…2-44 Forest Wide management direction, management standard E-4 (9): A minimum of 5% of the commercial forest land within a timber compartment should be maintained in an old growth condition. A minimum stand size of 20 acres is recommended for old growth management. In management areas included in the regulated timber harvest base…a rotation of at least 200 years is recommended on the 5% of the commercial forest land to be maintained in an old growth condition. Appendix A: Silvicultural treatment recommendations for old growth.	

Effects that vary by alternative

Effects from forest plan components associated with:

Vegetation management

All alternatives include plan components that allow for vegetation management to occur within existing old growth stands, including timber harvest, prescribed fire, and other stand tending activities. In all alternatives, the majority of the HLC NF is in wilderness, RWAs, or IRAs, where harvest, including salvage would be prohibited or greatly limited, and natural disturbances would be predominant.

Alternative A requires that a certain proportion of the landscape be managed as old growth, and therefore old growth in excess of this amount could be removed from the landscape with vegetation management.

In contrast, the plan components in all action alternatives would ensure that timber harvest is conducted in a way that does not remove existing old growth from the landscape. Vegetation management would be limited to actions that do not result in the stand no longer qualifying as old growth, based on quantifiable characteristics. These characteristics are currently defined by Green and others (1992), although in the future newer science could be used if it becomes available. Because of these restrictions, no loss of old growth would occur under the action alternatives.

All action alternatives acknowledge the naturally dynamic nature of old growth over time, and that natural disturbances, such as fire, insects and disease, would impact it. Recognizing that old growth losses may be exacerbated by climate change, all action alternatives emphasize managing for resilience at the landscape and stand level. If fire or disturbance impacts an old growth patch, a more resilient forest may have the capability to restore previous composition and structure over time.

All alternatives would have a similar potential for vegetation management to be used in younger stands to promote future old growth, although only the action alternatives describe this in detail.

ROS settings and scenic integrity objectives

Alternative D is most limiting to vegetation treatments in this regard, as it includes the most primitive and semi-primitive nonmotorized settings. To a small extent, this could limit the amount of treatments that occur to promote the development of future old growth. Alternative E is the least limiting, as it includes the most semi-primitive motorized and roaded natural settings. In areas where vegetation treatment is precluded, natural processes would be the primary drivers of old growth impacts.

The effects from the various SIOs would have little impact on old growth, as the treatment limitations within old growth would generally meet all but the very high category. Effect to scenery is typically localized and would be determined in project-level analysis. Generally speaking, Alternative D has the most high and very high SIOs as a result of having the most RWAs and primitive recreation opportunities. This may to a small extent limit the amount of treatments that occur to promote the development of future old growth. Alternative E is the least limiting.

Watershed, soil, riparian, and aquatic habitat management

All alternatives contain direction that protects watershed integrity, soil productivity, riparian values, and aquatic habitat management. This direction limits and guides the type, amount, and location of vegetation treatment activities that have the potential to impact these resources, as well as the roads needed to access treatment areas. All action alternatives recognize that vegetation treatments, including prescribed fire, within RMZs may be beneficial and needed to achieve desired conditions. Alternative A does not provide as clear direction and flexibility as the action alternatives, and thus could be more limiting in the ability to trend forest towards desired conditions. In all alternatives, the limitations on treatments within RMZs would complement the old growth standards and guidelines for old growth stands that are found in these areas, by emphasizing retention of forest structure and downed wood.

Recommended wilderness areas

The alternatives vary in the quantity and location of RWAs, ranging from none in alternative E, to 16 areas in alternative D. Within these areas, all action alternatives would have the same level of ability to achieve desired vegetation conditions through the use of vegetation treatments. All have forest plan direction that allow restoration activities to occur, and the most likely treatment would be prescribed burning (planned ignition). Generally speaking, however, natural processes would be the primary driver of old growth impacts in these areas.

Cumulative Effects

Portions of the HLC NF adjoin other NFs, each having its own forest plan. All of the forest plans contain plan direction regarding old growth. In addition, The HLC NF is intermixed with lands of other ownerships, including private lands, other federal lands such as the BLM and Bureau of Reclamation, and state lands. Some GAs contain inholdings of such lands, while others are more unfragmented in terms of ownership. The GAs which are island mountain ranges in particular are typically surrounded by private lands. Harvesting or conversion of forests on adjacent private and state lands will affect vegetation conditions at the landscape level, changing forest composition and structures. Old growth forest or very large trees may be removed on non-NFS lands, increasing the importance of retention on NFS lands.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the draft plan are summarized in Table 51, for plans applicable to old growth.

Table 51. Summary of cumulative effects to old growth from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All of these forests have adopted the Green et al. 1992 definition for old growth. While specific old growth plan components vary, all plans address having old growth on the landscape. The cumulative effect would be that old growth is present across NFS lands at a scale broader than the HLC NF, and old growth management would be complementary. This includes specific adjacent

Resource plan	Description and Summary of effects
	landscapes that cross forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
Montana Statewide Forest Resource Strategy (2010)	This plan guides forest management on state lands. It includes many concepts that are complementary to the plan components for the HLC NF, for example promoting forest resilience, providing wildlife habitat, and reducing hazardous fuels. This plan does not call out old growth as a desired condition. It is possible that old growth would not be a focus on these lands, thereby increasing the importance of old growth found on NFS lands.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) and includes management goals for old forest. The existing plan for the Missoula area, the Garnet RMP, includes requirements to manage for a certain amount of old growth on non-commercial lands. This plan is under revision. The Lewistown area is managed with several plans (Judith-Valley-Phillips and Headwaters), and is also currently under revision. It is uncertain the degree to which old growth is specifically addressed in these plans, but it is likely that they would be complementary to that of the HLC NF.
National Park Service - Glacier National Park General Management Plan 1999	The management plan for Glacier National Park does not mention old growth explicitly, but calls for preserving natural vegetation, landscapes, and disturbance processes. Old growth is likely present in this area to a similar degree, and subject to similar ecosystem processes, as the wilderness areas in the adjacent Rocky Mountain Range GA and would likely complement this habitat condition found on NFS lands.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily nonforested, although the plan does call for managing for fire-resilient vegetation. The plan does not have provisions related to old growth, and it is not expected that any old growth would occur or be maintained on these lands. These lands would not contribute to a landscape abundance and distribution of old growth associated with the Elkhorns GA.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. It is unlikely that the vegetation in these areas would support old growth, and old growth management is not a focus of these plans. These lands would not contribute to a landscape abundance and distribution of old growth.
Montana's State Wildlife Action Plan	This plan describes old growth habitat where important for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy and should help ensure that old growth forest exists in some amount on state-owned lands and therefore would be complementary to the HLC NF forest plan.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI for that county. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Old growth that is found in the WUI, as defined by the counties, may be more likely to have treatments conducted to improve resiliency to fire. In addition, old growth may be more likely to be protected from wildfire as fire suppression is more aggressively applied in these areas.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	This plan is relevant to an area that lies adjacent to NFS lands in the Divide GA, in proximity to the City of Helena. The plan does not mention old growth, and emphases forest management and wildfire mitigation. While it is possible that old growth may occur, old growth would not necessarily be specifically maintained on these lands and should not be expected to contribute to the landscape abundance and distribution of old growth for the Divide GA.

Conclusions

Old growth takes hundreds of years to develop. A viable old growth strategy includes retention of existing old growth (to the extent practicable with natural disturbance regimes), as well as providing for an array of younger forests that may develop into old growth in the future.

The revised forest plan contains several plan components related specifically to old growth, including a desired condition as well guidelines designed to increase and enhance old growth on the landscape. All action alternatives are the same in terms of this guidance. These components would ensure management actions would not remove old growth, and that the development of future old growth would be promoted. The existing forest plans (no-action alternative) also contain standards related to old growth which do not specifically preclude the removal of some old growth, but provide for quantitative levels of old growth at specified scales (third order drainages or timber compartments).

The alternatives vary in terms of land allocations and expected vegetation treatments through time. While old growth cannot be explicitly modeled, several modeled attributes are used to provide indicators of the potential amounts of old growth through time. Under all alternatives, the amount of large and very large tree concentrations and old forests are expected to increase over time. A subset of these areas could be expected to be old growth, and therefore it is anticipated that old growth would at a minimum be maintained or increased as compared to existing levels under all alternatives.

The following conclusions were reached based on the old growth analysis:

- Old growth is an important habitat feature and component of vegetation diversity on the landscape. Old growth is likely less abundant today than it was historically.
- The desired condition is to maintain and increase the abundance and patch size of old growth, well-distributed across the landscape and representative of natural vegetation types.
- Existing plan components (alternative A) would provide for specific minimum amounts of old growth within certain boundaries (third order drainages or timber compartments). The minimum amounts and scale are not known to be consistent with the best available science.
- Revised plan components (alternatives B, C, D, and E) would provide for increasing the amount and patch size of old growth; ensure that vegetation management treatments would not remove old growth from the landscape; and ensures that vegetation management encourages the development of future old growth.
- In all alternatives, fire and other natural disturbances would continue to influence vegetation more so than vegetation treatments, and would remain the main reason for loss of old growth forest. Succession would continue to be the primary means by which old growth forest is formed. Old growth amounts and distribution would remain dynamic and variable over time.
- Based on modeling of future large/very large tree concentrations and old forests, all alternatives would likely result in an increase in the abundance of old growth forestwide, to a similar degree. By GA, expected trends are similar except in the Big Belts, where alternative E is modeled to result in slightly more large/very large tree concentrations; and in the Snowies, where all alternatives are expected to result in a slight decrease in these components.

3.10 Snags and Downed Wood

3.10.1 Introduction

Dead wood in the forest occurs as standing dead trees (snags) and as fallen trees or other woody material that lies on the ground (downed wood). These attributes have been identified as key ecosystem characteristics for the HLC NF plan revision.

Snags and dead wood contribute to biodiversity by providing habitat for wildlife feeding, reproduction and shelter, and play an important role in protecting the soil, enhancing soil development, and maintaining soil productivity over the long term. Although all dead wood has value, large snags and downed wood (or “coarse woody debris”) are of particular importance. Medium and larger-sized snags and downed wood greater than 3” in diameter are included in this programmatic analysis. Snags are created at broad scales, ranging from single-tree mortality to high-quantity pulses that result from wildfires or insect infestations. Recent disturbances on the HLC NF include the mountain pine beetle outbreak as well as large wildfires. Still, while smaller diameter snags are abundant, larger snags are relatively rare in part due to the growing conditions on the HLC NF.

The scale of the analysis and plan components related to snags and coarse woody debris is forestwide by snag analysis group or broad PVTs. Snag analysis groups are similar to broad PVTs, with the exception that lodgepole pine cover types are split out due to their unique ecological characteristics related to snags and downed wood.

The key indicators used in this analysis are:

- Snags per acre, by size class (medium, 10-14.9”, large 15-19.9”, and very large 20”+)
- Snag distribution (percent of area that has snags, by size class)
- Tons per acre coarse woody debris greater than 3” diameter

Snags and coarse woody debris, in terms of their importance to the ecosystem as well as concerns over plan components guiding their management, were raised as issues during scoping.

3.10.2 Regulatory framework

Please refer to the introductory regulatory framework section of this chapter (3.3).

3.10.3 Assumptions

A primary assumption used in the development of desired conditions for snags is that the best indication of the NRV is the abundance of snags found in wilderness and IRAs, where natural processes have by in large been allowed to occur (Bollenbacher, Bush, Hahn, & Lundberg, 2008).

Future climate will be warm and dry, and therefore increases in disturbances that create snags, such as wildfire and insect outbreaks, are expected to occur and possibly increase in frequency, extent, and/or severity across the landscape.

For the action alternatives, the suggested management approaches described in appendix C of the revised forest plan would generally be followed.

3.10.4 Best available scientific information used

The source of data for existing snags and woody debris are statistically based measurements collected on spatially balanced FIA plots. Refer appendix B for more information.

The work of Bollenbacher and others (2008) is the best available science for describing the conditions of snags in Region 1. This work provides snag quantity and distribution estimates for all NFs in eastern Montana by snag analysis groups and size classes. Updated data were queried in 2017 to augment this publication with the most current information available.

The data used for analysis represents the latest available. The effects of more recent disturbances, including the fires of 2017, are not portrayed by this data. However, the analysis of alternatives includes the potential for future fire and therefore the relative comparisons at the programmatic scale remain valid.

The best available science for coarse woody debris on the HLC NF is found in two publications. Brown et al (2003) was used to inform our understanding of the NRV and development of the desired conditions found in the revised forest plan, while Graham et al (1994) was used to inform the development of a guideline for coarse woody debris retention in vegetation management areas.

3.10.5 Affected environment

Snags

Snags are created over time by disturbances that kill trees (such as fire, insect, and disease), and as a by-product of succession, as trees die due to crowding out by the more dominant trees. Snag densities, sizes and distribution are influenced by the disturbance history and on pre-existing forest conditions. Snag longevity varies by factors such as tree size, species, cause of death, age of tree at death, rate of decay, and site conditions (L. J. Lyon, 1977; Mitchell & Preisler, 1998; Russell, Saab, Dudley, & Rotella, 2006; Michael J. Wisdom & Bate, 2008); Hansen et al 2015; USDA 2000).

A report on snag conditions in eastern Montana forests was completed by Bollenbacher and others (2008) using FIA data. Updated data tables were produced in 2017. Medium snags are the most prevalent; relatively few large or very large are present. Large snags tend to occur in the cool moist broad PVT. In areas dominated by lodgepole pine, early seral stands have the most snags due to a greater proportion of stand-replacing fires and species intolerance to fire. The warm dry broad PVT has a more even distribution of snags into later seral stages because of a more frequent, less severe fire regime. All broad PVTs show fewer mid-seral stage snags as snags transition to downed wood. Snags occur in a clumpy manner, and in all groups the larger the snag the less common it is.

Most of the existing large and very large snags on the HLC NF are Douglas-fir; this is the most common long-lived species. Less common large and very large snags are ponderosa pine, subalpine fir, whitebark pine, and Engelmann spruce. Ponderosa pine and Douglas-fir snags have the longest longevity due to their deep roots. Medium-sized snags are often lodgepole pine, which is the most common tree species on the HLC NF and one that does not tend to reach a large size. The lodgepole pine cover type has the highest density of snags largely due to the recent mountain pine beetle outbreak.

Snags are naturally unevenly distributed across the landscape. This variability applies at a temporal scale as well. Snag recruitment is dependent on the pattern and frequency of fire, insects and other disturbances. High snag densities, or “pulses”, are often the result of high severity wildfires or insect outbreaks which vary widely in time and space. Low densities of snags occur where low severity fires occur frequently, areas where fire has been excluded, and in areas with greater human access where snags can be removed through activities such as firewood cutting. Because of the naturally wide variation in snag conditions spatially and temporally, snags are analyzed at broad scales.

Desired conditions for snags are shown in appendix B, and are designed to reflect the conditions that would be expected to occur under natural disturbance regimes. Snags currently present in wilderness and roadless areas provide the basis for the desired condition because they reflect a more natural condition because human management is limited, although fire suppression has occurred.

Overall, existing mean snag quantities are within or just slightly higher than the desired ranges. Snag distribution of medium snags is higher than the desired condition, but within or close to the desired distribution for large and very large. Snag conditions at a forestwide scale are similar to what might occur under natural regimes, and are generally within the NRV. At smaller scales of analysis (such as project level), timber harvest and human access can have substantial impacts on snag density, distribution and longevity (Michael J. Wisdom & Bate, 2008). Presence of localized disturbances could also have substantial influence on snag conditions at smaller scales.

The existing condition of snags, both forestwide and for each GA, is shown in Figure 8 and Figure 9. Conditions at the GA scale vary due to the unique topography, site potential, and disturbance history of each area. All GAs have fewer average snags per acre, but more widely distributed snags, than the overall forestwide average; this is in part due to different datasets that represent each scale of analysis.

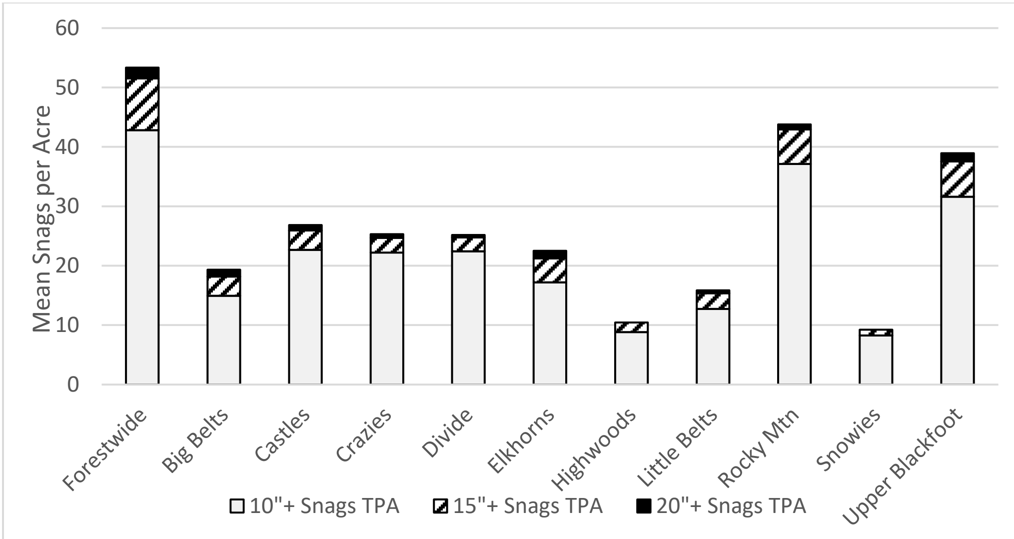


Figure 8. Snags per acre across all snag analysis groups, forestwide and by GA[1]

1. Source: R1 Summary Database: Hybrid 2011 (forestwide and Rocky Mountain Range GA); 4x 2016.

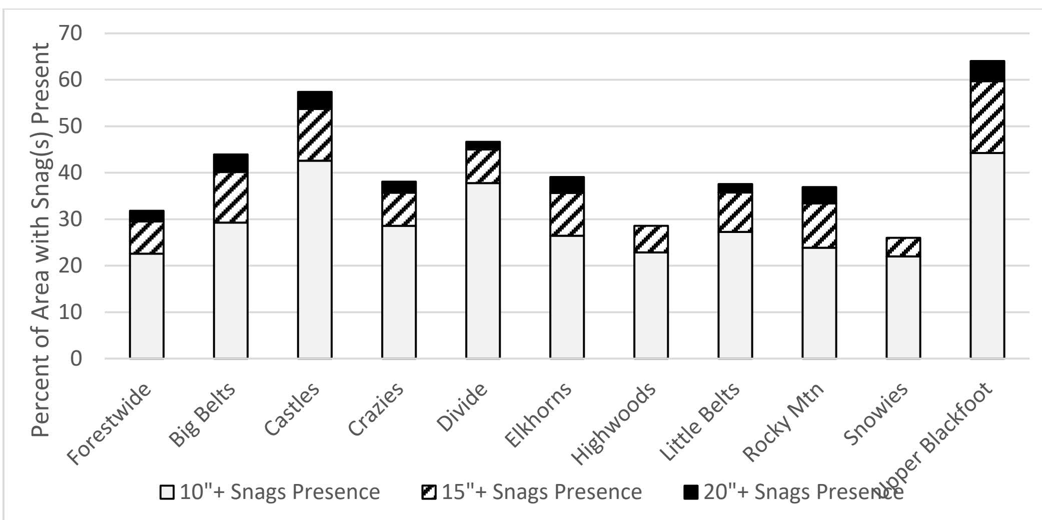


Figure 9. Snags distribution across all snag analysis groups, forestwide and by GA[1]

1. Source: R1 Summary Database: Hybrid 2011 (forestwide & Rocky Mountain Range GA); 4x 2016.

The Rocky Mountain Range and Upper Blackfoot GAs contain the most abundant snags per acre and snag distribution, due to their active recent disturbance history. GAs that have experienced little recent disturbance, such as the Highwoods and Snowies, contain fewer snags. The Big Belts, Castles, Elkhorns, and Upper Blackfoot contain the most very large snags, whereas these snags are essentially absent from the Highwoods and Snowies.

Quantitative desired conditions for snags were not developed for the GA scale for several reasons. First, there is a lack of data available to represent the NRV with confidence at that scale (i.e., fewer data points in roadless and wilderness areas). In addition, the appropriateness and application of GA-level desired conditions could be problematic in small GAs that may be subject to periodic disturbances that create a boom-and-bust situation for snags (i.e., the scale is too small to encompass the natural temporal variability of snag conditions). However, it may be appropriate to consider GA-level snag trends when designing projects (for example, focus on promoting large tree growth for future snag recruitment in the Highwoods and Snowies), as described in appendix C of the draft revised forest plan.

Downed wood

Downed wood is derived from snags, as well as from live trees or parts of trees, that fall to the ground. Recent fires and the mountain pine beetle have increased the amount of snags in many areas. As these snags fall, there will be a period of time when downed wood is elevated in these areas. Decomposition will reduce this component over time.

The desired condition for downed wood is to maintain amounts that contribute to forest structural diversity, soil ecological function, and habitat, focusing on coarse woody debris because larger downed wood is more valuable to ecosystem function than smaller debris. Appendix B displays the current and desired conditions for coarse woody debris across HLC NF. The desired conditions are based on the BASI (Brown et al., 2003). The ecosystem conditions described in the paper are relevant but are based on data west of the Continental Divide and therefore some adjustments using local data are needed.

The desired average tons/acre are not applicable to every forest stand, but rather as broad scale averages. There is no desired condition for nonforested potential vegetation groups, as there is generally no source of downed wood (i.e. trees) in those areas. At all scales, the current estimated amount of coarse woody debris is within the desired condition.

Conditions at the GA scale vary due to the unique topography, site potential, and disturbance history of each area as shown in Figure 10. In all cases the average tons/acre of coarse woody debris is less than 15 tons/acre. The Elkhorns and Upper Blackfoot GAs contain the most average coarse woody debris per acre. GAs that have experienced little recent disturbance, such as the Highwoods, have less coarse woody debris.

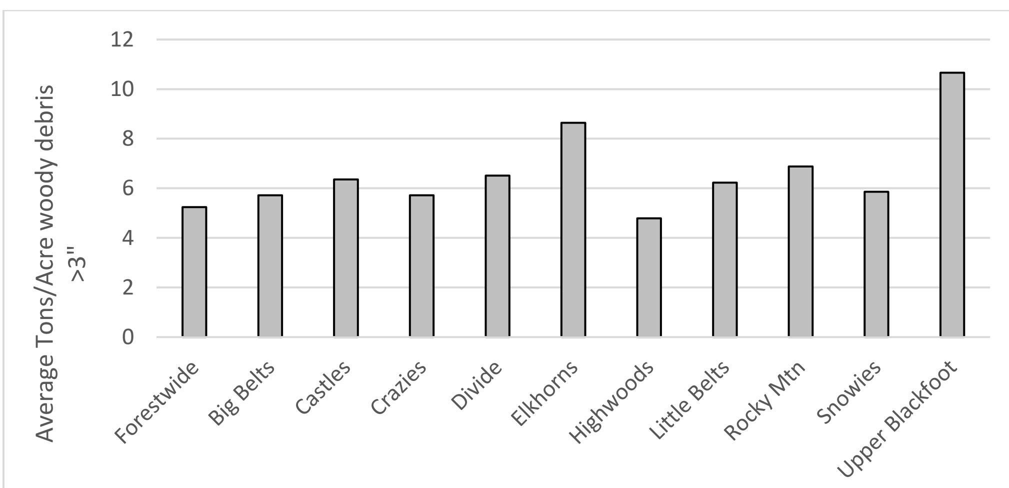


Figure 10. Coarse woody debris average tons/acre across, forestwide and by GA[1]

1. Source: R1 Summary Database: Hybrid 2011 (forestwide & Rocky Mountain Range GA); 4x 2016.

Benefits to people

Some snags provide a direct economic benefit to people when they are utilized with commercial timber sales and salvage projects, or when dead trees are removed as wood for fuel under firewood permits. Dead wood also indirectly provides benefits to people, such as, but not limited to: providing habitat (creating opportunities for wildlife viewing, fishing, and hunting); contributing to watershed function; and contributing to site productivity, which supports desired vegetation that may be used for timber products. In addition, plan components that describe the appropriate levels of dead wood are also of importance to fire risk and potential impacts of fires to values at risk, which include private property as well as other values that people have, such as a desire to recreate in green forests.

3.10.6 Environmental consequences

Effects common to all alternatives

Under all alternatives, snag and downed wood conditions would be dynamic, highly variable and unevenly distributed across time and space. Dead wood would be created by fire, insect, disease, and successional processes. Decomposition and fire are the primary ecological processes that remove dead wood from the ecosystem. In all alternatives, the majority of forest lands are in areas where human management is limited and natural ecological processes and disturbances would be the primary ecosystem drivers affecting snag and downed wood.

Natural disturbances such as wildfire are projected to occur at a similar degree in all alternatives because the impact of forest management has a relatively small influence. These disturbances influence the abundance, distribution, and condition of snags and coarse woody debris. The highest amounts of dead wood would be present where fire or insect/disease outbreaks occur. Snags would fall to the ground to become part of the downed wood component, where they decompose and eventually become part of the soil. Wildfires can have a wide range of effects, both creating snags (especially of smaller size classes) while causing some to fall and be consumed. Similarly, the effects to coarse woody debris can be variable, as fires may consume material on the forest floor, and also create snags and thus future downed wood. Meanwhile, insect infestations create snags, often of large size classes, and thus contribute to future large woody debris.

Recent fire and insect outbreaks on the HLC NF have created snag pulses, which are converting to downed woody material at the writing of this plan. Regardless of the selected alternative, in the short term medium snags, especially lodgepole pine, would be abundant. In the long term, this pulse of snags will be lost to natural attrition, and the material will accumulate on the forest floor as woody debris.

To some degree, fire exclusion would continue to affect the landscape under all alternatives, due in part to continued fire suppression activities. Fire exclusion can limit snag creation in areas that would otherwise have burned. Conversely, over the long term, fire exclusion can increase fuel loadings and stand densities that predispose areas to large stand-replacing events that create snag pulses. The creation of large and very large snags is dependent upon the development of large live trees. Large snags are not abundant because tree growth is moisture-limited on the HLC NF. Further, high stand densities that may develop due to fire suppression or other factors limits the potential for individual large tree growth. Homogenous landscapes yield snag pulses followed by periods with few snags. Because of pulse events, snags may not always be well-distributed spatially or temporally.

Lands where active vegetation management would occur (for example, lands suitable for timber production) cover a minority of the Forest under all alternatives. Many of the forests in areas suitable for timber production and within WUI areas would be managed to maintain vigorous trees and limit losses due to insects, disease and fire where possible. This would tend to result in less tree mortality, and a potentially lower density of snags and downed woody over time as compared to areas less influenced by human actions. On the other hand, active vegetation management provides the opportunity to manage for species and larger size classes that would contribute to larger snags and downed wood. Lower amounts of snags and downed wood would tend to occur in developed sites, areas where concern for fire hazard is elevated and in areas closer to communities and accessible to firewood cutting.

All alternatives have standards and guidelines that direct management of snags and downed wood in timber harvest units. These are designed to address the unequal distribution of snags and downed wood across the forest that may be the result of timber management, and supports the active role that is more likely to be needed to achieve desired conditions within actively managed landscapes.

Effects from plan components associated with:

Climate change

Climate change is anticipated to increase tree mortality on the landscape, either directly through drought and moisture stress on trees, or indirectly by increasing the frequency and severity of natural disturbances such as wildfire and insect outbreaks. Therefore, it will cumulatively impact both snags and downed wood, generally by creating more dead wood but also potentially reducing it in some areas, such as where fire burns repeatedly. Climate is integrated into the SIMPPLLE model and is a major driver of vegetation change and effects of the alternatives over time.

Access and infrastructure

In all alternatives, access on existing roads as well as construction of new roads (both permanent and temporary) could have an impact on the presence of snags and woody debris adjacent to roads, primarily as a function of firewood gathering. All alternatives are similar in terms of road access.

Mining and mineral extraction

Mining undergoes site-specific analysis to determine effects and required mitigation, and effects to vegetation from mining is determined at the project level. The impacts to snags and downed wood from mineral extraction on the forest would be localized, and at the forestwide scale they would be minor.

IRAs

IRAs do not vary by alternative, and timber harvest would be limited in these areas under the Roadless Area Conservation Rule (2001). RWAs, which vary by alternative, tend to overlap with IRAs, and no harvest would be allowed in those areas. Therefore, to the extent that RWAs vary by alternative, so too does the amount of IRAs where harvest could conceivably occur as shown in the Timber section. Prescribed fire may occur in IRAs, and would generally result in increases to the snag and downed wood components, although in some cases some dead wood could be consumed. Natural processes would dominate these areas under all alternatives. Given expected climate, more wildfire and insect activity are likely to occur in the future, and IRAs are likely to contain ample snags and downed wood regardless of whether prescribed fire or timber harvest occurs.

Wildlife management

Management for grizzly bears and lynx affects the amount of vegetation management that occurs on the landscape, as described in the timber and terrestrial vegetation sections. With regards to snags and downed wood, the influence of grizzly bear and lynx management guidance is related to the limitations placed on vegetation management that could reduce these components. For example, timber harvest would not occur in lynx multistory habitat, and these forest patches may provide ample snag and downed wood components. In general, under any alternative grizzly bear and lynx management would contribute to the retention of snags and downed wood on the landscape, because they would result in some limitations to vegetation management activities that could reduce snags or downed wood.

The NRLMD includes a guideline (Veg G11) specifies that denning habitat should be distributed in each LAU in the form of pockets of large amounts of large woody debris. This would apply in potential lynx habitat. This direction may result in project design features that retain concentrations of downed wood in some areas.

Effects common to all action alternatives

All action alternatives include the same snag and woody debris desired conditions, guidelines, standards, and monitoring. Table 52 summarizes the expected effects of these plan components.

Table 52. Summary of revised plan components for snags and coarse woody debris

Plan component	Intent and Expected effects
FW-VEGF-DC-05, 06; FW-VEGF-GDL-01	These desired conditions describe the desired levels of large and very large live trees and concentrations, which represent future large and very large snags and eventually woody debris. The guideline ensures retention of these trees during vegetation management. These components would ensure that future snags and downed wood are available in managed areas.
FW-VEGF-DC-07	This desired condition describes the structural components of old growth, including snags and woody debris. This component would help ensure that in these site-specific areas, snags and downed woody debris would be present and contribute to habitat.
FW-VEGF-DC-08; FW-VEGF-GDL-02	The Forestwide quantitative desired condition for snags describes appropriate numbers and distribution of snags. The guideline specifies the retention of snags during vegetation management. The desired condition would provide for adequate snags at the broad scale, which may be achieved with a combination of natural disturbances and management. The guideline would ensure that snags are retained in managed areas to contribute to the desired condition.
FW-VEGF-DC-09; FW-VEGF-GDL-06	The Forestwide quantitative desired condition for coarse woody debris describes its appropriate abundance and distribution. The guideline specifies woody debris retention during vegetation management. The desired condition would provide for adequate coarse wood at the broad scale, which may be achieved with a combination of natural disturbances and management. The guideline would ensure that sufficient coarse woody debris is retained in managed areas to contribute to the desired condition.
FW-VEGF-DC-11	This desired condition recognizes the role of insects and diseases in creating snags and downed wood to meet FW-VEGF-DC 08 and 09.
FW-POLL-DC-01	This desired condition addresses snags and coarse woody debris as components of pollinator habitat. It would complement FW-VEGF-DC-09.
FW-WTR-DC-12; FW-FAH-DC-02; FW-FAH-OBJ-01; FW-RMZ-GDL-01	These components address woody debris as important features for riparian and aquatic habitat and stream channels and would complement the quantitative desired condition FW-VEGF-DC-09.
FW-SOIL-DC-01; FW-SOIL-GDL-05	This desired condition and guideline reference woody material needed to provide nutrient cycling for soil productivity, and would complement the quantitative desired condition FW-VEGF-DC-09.

Alternative A, no action

Under the no-action alternative, the existing forest plan snag standards would apply for the HLC NFs respectively, as described in Table 53.

Table 53. Alternative A summary of forest plan standards for snags and coarse woody debris

Summary of plan standards	Expected effects
Helena NF Forestwide standard II/21: In summary, this standard requires minimum retention of an average level of snags across each third order drainage (2/acre). The primary areas where snags would be retained are those where timber management is not an emphasis. The standard specifies minimum snags or replacement trees by size class that should be left in cutting units if the average cannot be met otherwise, with the	The standard would result in retaining a minimum average number of snags per acre across each third order drainage; snags would not necessarily be left within treatment units. Not all of the Forest is delineated as a third order drainage, and therefore this standard would not necessarily be applied to all NFS lands. This plan component does not recognize the variability in snag distribution (clumpiness) nor the unique qualities and disturbance regimes of PVTs (or snag groups). It is not

Summary of plan standards	Expected effects
exception of units that are pure lodgepole pine. The plan does not include any quantitative guidance for coarse woody debris.	consistent with best available science for the natural condition of snags on the landscape. The management of coarse woody debris would be guided by other law, regulation, or policy.
Lewis & Clark NF Forestwide standard C-4: In summary, this standard includes both snags and down trees as wildlife trees, defining hard versus soft. All soft trees are to be retained. Recommended sizes and numbers of hard snags to retain across varying scales are specified by vegetation type and wildlife species. The desired distribution of these trees is described as is leaving live deformed trees for snag recruitment. *Standard E-1* also mentions informing the public on the importance of snags.	The standard would result in retention of minimum numbers of hard snags in the sizes and vegetation types described, which are not necessarily consistent with the best available science. The management of coarse woody debris would be further guided by other law, regulation, or policy.

Effects that vary by alternative

Snags can be created through management actions such as prescribed burning, and reduced by management practices such as timber harvest. The increases and decreases in snags are followed by subsequent increases and decreases in woody debris. These influences are at play under all alternatives, and to a small degree the magnitude of these events varies slightly.

The differences across alternatives are caused primarily by the land allocations that influence the type and amount of vegetation management that can occur. These allocations include suitability for timber production, RWAs, and ROS settings. It is impossible to model the nuances of meeting the snag and downed wood plan components across the landscape through time, because it is not possible to model at the broad scale the variations of site-specific treatments. The Spectrum model reports numbers of snags and downed wood; however, snags and downed wood are not well accounted for in new “regeneration” stands that are modeled after a disturbance occurs.

This analysis therefore relies on the expected magnitude of processes that influence snags and downed woody debris to compare alternatives. Figure 11 shows the four primary influences on snags and downed wood that vary by alternative: wildfire, bark beetles, prescribed burning, and timber harvest. Wildfire and prescribed burning would generally create snags in the short term, most often of the smaller size classes, although some snags and downed wood could be consumed. Bark beetles would tend to create large or very large snags and not consume any existing snags or downed wood. After these events, the longevity of the snags would vary depending on site-specific conditions, and as they fall the downed wood component would increase. For this comparison, it is assumed that timber harvest would reduce snags and downed wood, although appropriate levels of snags and downed wood would be retained.

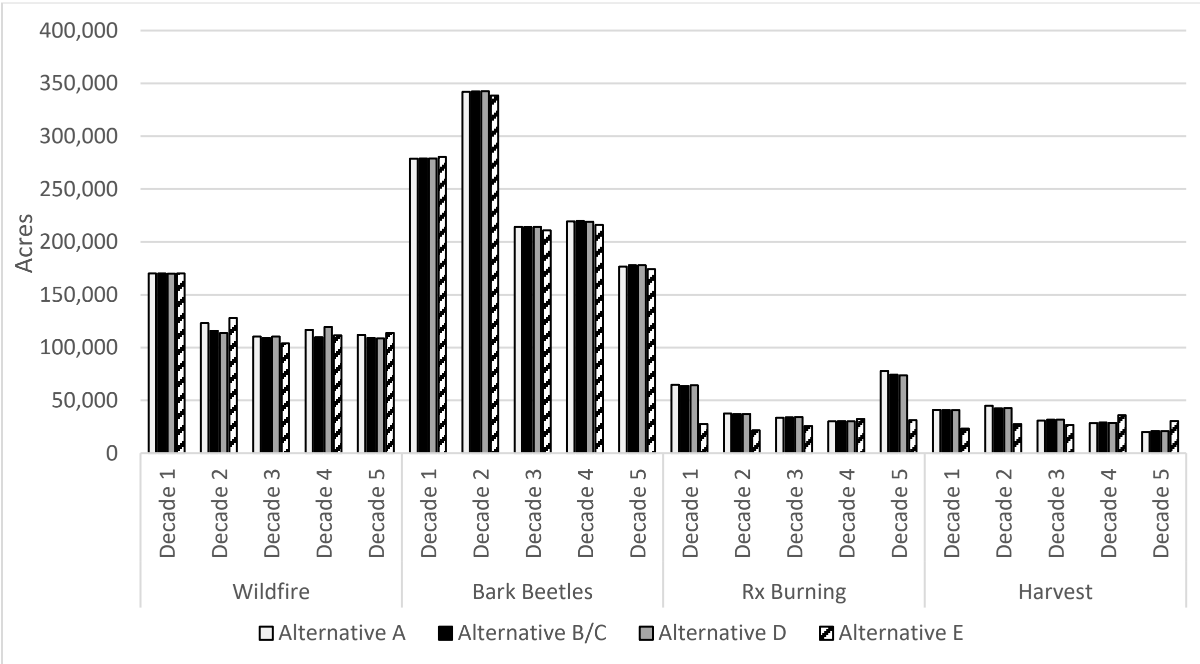


Figure 11. Processes and activities that influence snags and downed wood by alternative[1, 2, 3]

1. Source: Wildfire and bark beetle acres are from the SIMPPLLE model.
2. Prescribed burning is modeled by Spectrum for forested lands only, and does not reflect the entire burn program expected on the HLC NF, which would include nonforested lands as well. Actual accomplishment of burning would vary depending on operational considerations such as weather.
3. Harvest is modeled with Spectrum; see also the Timber specialist report.

While the alternatives vary slightly, at the programmatic level these differences are slight. Natural processes, primarily bark beetles, would influence snags more so than management activities under all alternatives. The potential loss of snags in timber harvest areas is far less than the potential creation of snags from natural disturbances and prescribed fire. It is likely that snags and downed wood would be within, or possibly higher, than the desired ranges for most periods in the future. Given that bark beetle activity is likely to be the most widespread disturbance, this may likely include creation of snags in the largest size classes available.

Effects from forest plan components associated with:

Vegetation management

Vegetation management (such as prescribed fire, timber harvest, and other stand tending) may occur for many purposes, including projects where coarse woody debris and snags are deliberately removed and others which maintain or increase these features. The influence of factors that drive how much vegetation management occurs is expressed by the projected acres of treatments that would occur by alternative, as shown in the terrestrial vegetation and timber sections.

The removal of snags and downed wood can also occur with salvage harvest, which is not predicted with the Spectrum model. The Forest salvage harvested approximately 2 percent of acres of lands that burned from 1986 to 2017. Although the amount is unknown, salvage harvest may occur in the future. If salvage is conducted under the action alternatives, plan components for snag and downed wood would ensure that at least the minimum levels of dead wood material would be retained, and FW-TIM-GDL-04 further would ensure that clusters of burned trees would be retained to provide habitat for wildlife species associated with burned habitats. Under alternative A, snag management standards would also result in at least minimum retention of snags. More information on the potential for salvage and the ecological effects is provided in the terrestrial vegetation and timber sections.

RWAs

Natural processes dominate these areas in terms of the influence on downed wood and snags. It is expected that snags and downed wood may be abundant in these areas given expected future disturbance and limited human influence, although the quantity and distribution may be cyclic in nature especially where stand-replacing disturbance regimes occur. Alternative D has the greatest acres of RWA, while alternative E has the least.

Aquatic habitat, riparian area, and watershed

Plan components that protect aquatic habitat, riparian areas, and watersheds generally contribute to the retention of snags and downed wood. The most specific plan direction for these resources related to dead wood are those for RMZs.

Under alternative A, the areas of the HLC NF west of the Continental Divide would be guided by riparian habitat conservation area direction found in the INFISH (USDA, 1995c); these areas are limited to portions of the Divide GA and most of the Upper Blackfoot. The remainder of the forest would be subject to state streamside management law and BMPs. This direction would generally ensure the retention of dead wood, snags, and a proportion of live trees immediately adjacent streams. The SMZs vary in size based on the type of stream but are generally smaller than the zones defined for the action alternatives.

With alternatives B/C, D, and E, all areas of the HLC NF would be subject to guidance for RMZs, which are defined based on the size and type of stream and include inner and outer boundaries. It is expected that greater amounts of snags and downed wood would be present in these areas, and vegetation management less common than in other areas on the landscape.

Cumulative effects

Portions of the HLC NF adjoin other NFs, each having its own forest plan. Generally speaking, management of vegetation is similar across all NFs due to law, regulation, and policy. In addition, the HLC NF is intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some GAs contain inholdings of such lands, while others are more unfragmented. The GAs which are island mountain ranges are typically surrounded by private lands. Harvesting or conversion of forests on adjacent private and state lands will affect vegetation conditions at the landscape level, changing forest composition and structures. Snags and large and very large trees (future snags) may be removed on non-NFS lands, increasing the importance of retention on NFS lands. Snags on adjacent private and other non-NFS lands are likely to be less abundant.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans to snags and downed wood, in conjunction with the draft plan, are summarized in Table 54.

Table 54. Summary of cumulative effects to snags and downed wood from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. While specific snag and downed wood components vary, all plans address these attributes to some extent. The cumulative effect would be that snags and downed wood are present across NFS lands at a scale broader than the HLC NF, and the management of these resources would be generally complementary. This includes specific adjacent landscapes that cross forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.

Resource plan	Description and Summary of effects
Montana Statewide Forest Resource Strategy (2010)	This plan guides forest management on state lands. It includes many concepts that are complementary to the plan components for the HLC NF, for example promoting forest resilience, providing wildlife habitat, and reducing hazardous fuels. This plan does not explicitly mention snags or downed wood. It is possible that these attributes would not be a focus on these lands, thereby increasing the importance of snags and downed wood found on nearby NFS lands.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) and includes components specific to snags and downed wood. The existing plans for the Missoula and Lewistown areas are under revision. It is likely that they would contain components similar to the Butte plan, and that to some extent snags and downed wood would be managed for on these lands in a fashion complementary to the HLC NF.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park does not mention snags or downed wood, but calls for preserving natural vegetation, landscapes, and disturbance processes. Snags and downed wood are likely present in this area to a similar degree, and subject to similar ecosystem processes, as the wilderness areas in the adjacent Rocky Mountain Range GA and would likely complement these habitat conditions.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily nonforested, although the plan does call for managing for fire-resilient vegetation. The plan does not have provisions related to specifically to snags or downed wood; therefore, it should be assumed that these lands would not contribute to a landscape abundance and distribution of these components associated with the Elkhorns GA.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Snags and downed wood are not specifically mentioned. While they may be present, it is unlikely that snags or downed wood would be a focus in these areas. These lands may not contribute to a landscape abundance and distribution of snags and downed woody debris.
Montana's State Wildlife Action Plan	This plan describes snag and downed wood habitat where important for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy. This plan should help ensure that snags and downed wood exists in some amount on state-owned lands and therefore would be complementary to the HLC NF Forest Plan.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI for that county. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. The snag and downed wood plan components in the revised forest plan specifically allows that these areas would have fewer snags and downed wood.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	This plan is relevant to an area that lies adjacent to NFS lands in the Divide GA, in proximity to the City of Helena. The plan emphases forest management and wildfire mitigation. It is likely that there would be relatively few snags and downed wood in this area due to its recreation emphasis, thereby increasing the importance of these components in other areas of the Divide GA.

Conclusions

Natural processes such as wildfire, insects, disease, and vegetative succession would be the primary drivers of snag and downed wood creation and attrition over time under all alternatives because of the vast areas of the HLC NF that have minimal human influence. Along open roadways, firewood cutting and other activities may reduce the dead wood components; this would occur to a similar extent under all alternatives. Vegetation management would also influence these components. It is in this regard that the alternatives vary slightly due to different land allocations and expected harvest and prescribed burning.

Medium snags are currently abundant on many landscapes due to the recent mountain pine beetle outbreak; it is expected that these snags will decrease over time as they fall to the forest floor, with a corresponding increase in downed wood – this trend would be most evident in lodgepole pine stands. Future wildfire and bark beetle outbreaks are expected to continue to create snags, along with prescribed fire. Decreases in snags that may be caused by timber harvest would generally be minor in comparison to these other factors. All alternatives are similar with regards to snags and downed wood.

The following key points summarize the conclusions for the snag and downed woody debris resources:

- Natural disturbances are the primary factors affecting snags and downed woody debris.
- The existing conditions of medium, large, and very large snag quantity is generally within or slightly above the desired ranges; the distribution of medium snags specifically is above the desired condition while the distribution of the other size classes is close to or only slightly above.
- The existing conditions of coarse woody debris are within the desired ranges.
- The anticipated effects to snags and downed wood are similar for all alternatives.
- The action alternatives contain desired conditions and standards that would ensure that snags 10” and greater in diameter and coarse woody debris are present in quantities and distributions consistent with our best understanding of natural conditions. The no-action alternative also contains specific quantitative snag standards that would provide for minimum numbers of snags within certain scales, but have no components related to down woody debris.

3.11 Plant Species at Risk

3.11.1 Introduction

The geographic scope of the analysis for effects to at-risk plant species in the planning area is the lands administered by the HLC NF. The specific range of each at-risk species may extend beyond the forest boundary, however the lands administered by the Forest represent the area where changes may occur to these species or their habitats from activities that might be allowed under the alternatives. In some cases, the BASI for at-risk species’ ecological relationships originated outside the analysis area. The full range of each species was considered to evaluate the viability and importance of each species’ habitat within the plan area, but only indicator measurements from within the analysis area was used in making conclusions.

3.11.2 Regulatory framework

Please refer to the introductory regulatory framework section of this chapter (3.3).

3.11.3 Assumptions

Assumptions in this analysis are based on the ESA (that applies to all alternatives) and the FS manual direction (that applies to alternative A). The revised FS manual policy regarding SCC is forthcoming and the changes and impacts are not known. The current management direction is to evaluate proposed management activities and project areas for the presence of occupied or suitable habitat for any plant species listed under the ESA or on the Regional Forester Sensitive Species (RFSS) list (alternative A). FS policy is expected to include similar policy to maintain the viability of SCC (alternatives B-E) in the plan area. Additional information regarding SCC policy is expected following the release of this plan.

Relevant considerations to the analysis that are common to all alternatives include (1) designated wilderness would continue to be managed as such, (2) there would be a general increase in recreational demand as the human population size increases, (3) weeds and weed seeds would continue to be deposited and spread onto and within the planning area, and (4) climate change trends would continue as projected, with warming temperatures and variable precipitation.

The general strategies in appendix C would be followed for all action alternatives.

At-risk species occupy specific habitats on the landscape. There is limited data regarding trends for many at-risk plant species, so monitoring would be essential to determine the impacts of project activities and management direction.

3.11.4 Best available scientific information used

Primary information sources for at-risk plant species and their occurrences on the Forest are the FS Natural Resource Manager, Montana Natural Heritage Program Element Occurrence databases and online Montana Field Guide, NatureServe database, and the Consortium of Pacific Northwest Herbaria. The majority of at-risk plant species that are not federally listed do not have the same level of scientific data available as federally listed species. Though there may be uncertainties and gaps in data and knowledge about rare plant species, the best available information is utilized in this analysis to assess the designated condition and determining potential effects between alternatives.

The HLC NF botany program maintains a forestwide inventory of known sensitive species occurrences. This inventory includes information on population size, viability and potential threats known to populations collected by trained botanists. Most information on these plants are derived from expert opinion and/or panel consensus, specifically at biannual meetings held by the Montana Native Plant Society in conjunction with the Montana Natural Heritage Program. There is little published information about most rare plant species concerning their viability, biology, habitat, population dynamics, and occurrences. Information gaps relevant to at-risk species may be filled in through future inventories, plan monitoring program results, or research, and this information would be integrated into the databases as it becomes available.

3.11.5 Affected environment

A total of 31 at-risk plant species were identified on the HLC NF, including one candidate species (see appendix D). Although some hotspots of diversity can be identified on the NF (like the high alpine species found on the Rocky Mountain Front GA, or the east side of the Little Belts range GA), at-risk plant species and/or habitat can be found in all floristic geographic subdivisions, and in all ecosystem types.

Threatened, endangered, and candidate species

While no federally listed species are currently known to occur on the HLC NF, there is one candidate species: whitebark pine (*Pinus albicaulis*). The USFWS determined in 2011 that whitebark pine is a candidate species, with listing as threatened or endangered warranted but precluded by higher priority actions (FR 76(138): 42631-42654). As a result, Region 1 added whitebark pine to the RFSS list in 2011. The USFWS initially assigned whitebark pine a listing priority number of 2, indicating the threats were imminent and of high magnitude. The listing priority number was changed to 8 (threats imminent but of moderate magnitude) in 2015 (FR 80(247): 80584-80614).

Whitebark pine is a key ecosystem component growing at the highest forested elevations in cold, windy, snowy, and generally moist climatic zones (Arno & Hoff, 1989) that are difficult areas for plants and animals to inhabit. These areas are naturally limited in species diversity, and whitebark pine is an important component of this diversity.

According to FIA data, whitebark pine is present on roughly 12% of the HLC NF, or about 333,350 acres. It is dominant on far fewer acres; the whitebark pine cover type occurs on only 4%. This is because in some areas whitebark is a minor component in areas dominated by other species such as subalpine fir. Whitebark pine primarily occurs on the cold broad PVT. Whitebark pine is present on most GAs except the Highwoods. There are 47,125 mapped acres of whitebark pine on the HLC NF that was used to analyze the effects of the draft plan based on differences in alternatives. Though whitebark pine occurs on a greater number of acres in the plan area, this number of mapped acres is used because it is the best available spatial data available. This mapping is based on remotely sensed imagery and best available field data, but does not necessarily represent the abundance statistically represented by FIA estimates.

The interrelated threats to whitebark on the HLC NF that raise concerns about the long term viability of whitebark ecosystems include fire suppression, white pine blister rust, mountain pine beetle, and climate change.

Plant species of conservation concern

Table 55 below lists the plant species that are currently determined to be SCC by the Regional Forester on the HLC NF. Additional information on these species can be found in appendix D. In addition, information regarding the rationale for identifying these species as SCC can be found on the Region 1 SCC web page at: http://bit.ly/NorthernRegion-SCC.

Table 55. Plant SCC

SCC	Conservation Categories[1]	Distribution and Abundance in the Plan Area
Musk-root (*Adoxa moschatellina)*	SCC, RFSS, SOC, G3	One occurrence along the Smith River in the Smith River Wild and Scenic byway.
Round-leaved orchis (*Amerorchis rotundifolia*)	SCC, RFSS, SOC, Adjacent SCC	20 mapped areas in the Rocky Mountain Front GA, outside of wilderness; occurrences clustered near center of GA
Short-styled columbine (*Aquilegia brevistyla*)	SCC, RFSS, SOC, S2	43 occurrences occur on the east side of the Little Belts GA, in the Judith RD
Lesser rushy milkvetch (*Astragalus convallarius*)	SCC, SOC	Much of the species' range occurs in the valley near Helena, between the Big Belt, Elkhorns and the Divide GA's. Two occurrences are mapped in the Big Belts GA. More are likely.
Lackschewitz's milkvetch (*Astragalus lackschewitzii*)	SCC, SOC, RFSS, S2, G2	12 mapped occurrences in 4 areas of the Rocky Mountain GA; species is endemic to the Rocky Mountain GA
Dainty moonwort (*Botrychium crenulatum*)	SCC, RFSS, SOC, G3	Two occurrences known on the Divide GA.
Peculiar moonwort (*Botrychium paradoxum*)	SCC, RFSS, SOC, G3, Adjacent SCC	Four occurrences in the Plan Area; one in the Divide GA and three in the Rocky Mountain GA.
Low northern rockcress (*Braya humilis* or (*Neotorularia humilis*)	SCC, SOC, S2 (S1 Nature Serve)	Big Snowies (2 mapped occurrences), Rocky Mountain GA (1 occurrence)
Kerry's paintbrush (Castilleja kerryana)	SCC, SOC, G3	Newly described species, endemic to MT on Scapegoat Plateau in the Straight Creek and South Fork of the Sun River.
Small yellow lady's slipper (*Cypripedium parviflorum*)	SCC, RFSS, S3	Occurs in one drainage on Rocky Mountain GA; one additional occurrence is adjacent to Divide GA
Sparrowleg lady's slipper (*Cypripedium passerinum*)	SCC, RFSS, SOC,S2, Adjacent SCC	Rocky Mountain Front - 10 mapped occurrences.
Limestone larkspur (*Delphinium bicolor ssp. Calcicola*)	SCC, T3 (variety equivalent to G3)	One occurrence in the Big Belt GA.
Denseleaf draba (*Draba densifolia*)	SCC, SOC, S2	Five occurrence in the Blackfoot and Rocky Mountain GAs.
English sundew (*Drosera anglica*)	SCC, RFSS, SOC	Two occurrences in the Indian Meadows RNA in the Upper Blackfoot GA. Habitat is limited in Plan Area.

SCC	Conservation Categories[1]	Distribution and Abundance in the Plan Area
Slenderleaf sundew (*Drosera linearis*)	SCC, RFSS, SOC, S2, Adjacent SCC	Known from two occurrences in the Indian Meadows RNA in the Upper Blackfoot GA. Habitat is limited in Plan Area.
Beaked spikerush (*Eleocharis rostellata*)	SCC, RFSS, SOC, Adjacent SCC	Little Belts GA, two occurrences mapped
Northern wildrye (*Elymus innovates*)	SCC, RFSS, SOC, S2	Known from four mapped occurrences at two locations in the Rocky Mountain and Little Belts GAs.
Giant helleborine (*Epipactis gigantean*)	SCC, RFSS, SOC, S2, Adjacent SCC	Rocky Mountain GA, one occurrence.
Fan-leaved fleabane (*Erigeron flabellifolius*)	SCC, SOC, G3	Crazies GA.
Macoun's fringed gentian (*Gentianopsis macounii*)	SCC, RFSS, SOC, S2	One mapped occurrence in the Rocky Mountain GA
Lesser rattlesnake plantain (*Goodyera repens*)	SCC, RFSS, SOC	Little Belts and Snowies GA. 94 mapped occurrences.
Howell's gumweed (*Grindelia howellii*)	SCC, SOC, RFSS, G3, S2, Adjacent SCC	One large occurrence mapped in the Divide GA.
Treelike clubmoss (*Lycopodium dendroideum*)	SCC, RFSS, SOC, S2	One occurrence is mapped in the Blackfoot GA.
Missoula phlox (*Phlox kelseyi var. missoulensis*)	SCC, RFSS, SOC, G3	53 mapped occurrences across the Little Belts, Big Belts, Divide, and Blackfoot Gas.
Austin's knotweed (*Polygonum austiniae or Polygonum douglasii var. austiniae*)	SCC, RFSS, SOC	35 mapped occurrences in the Big Belts, Rocky Mountain, and Little Belts Gas.
Bluntleaf pondweed (*Potamogeton obtusifolius*)	SCC, RFSS, SOC	Three occurrences in Rocky Mountain GA.
Northern buttercup (*Ranunculus pedatifidus*)	SCC, SOC	Two known occurrences in the Rocky Mountain GA; historical collection from Little Belts.
Water bulrush (*Schoenoplectus subterminalis*)	SCC, RFSS, SOC	One occurrence on the Upper Blackfoot GA, Indian Meadows RNA
Scorpidum moss (*Scorpidium scorpioides*)	SCC, RFSS, SOC, S2, Adjacent SCC	Rocky Mountain GA, one occurrence.
Sphagnum (*Sphagnum fimbriatum*)	SCC, SOC, S1	Upper Blackfoot GA, one occurrence.
Letterman's needlegrass (*Stipa lettermanii*)	SCC, SOC, S1	One occurrence in the Crazies GA.

1. RFSS = Regional Forester Sensitive Species; SCC = species of conservation concern; SOC = species of concern; S1 = state ranking 1; S2 = state ranking 2; G3 = global ranking 3.

Species guilds

Plant species have been grouped for purposes of analysis, based on broad similarity of habitat they occupy. Though there may be variation in specific habitat needs for species within a guild, the potential stressors and associated conservation strategies for the species in the habitat guild would be very similar, allowing for more efficient analysis and identification of relevant information pertaining to the species.

The list of plant species previously identified as sensitive and known to occur on the HLC NF, and their associated habitats, is in appendix D. There are a total of 34 species previously identified as sensitive. 14 species from the RFSS list would not be designated by the Regional Forester as SCC and 9 additional species would be added that were not previously identified as at-risk species. Of the 14 plant species previously identified as sensitive, 7 are not currently known to occur within the plan area or occur only historically. These species are ‘suspected, but not known’ and thus do not meet the criteria for SCC. This group includes *Botrychium ascendens, Carex chordorrhiza, Micranthes tempestiva, Salix barrattiana, Thalictrum alpinum, Trichophorum cespitosum*, and *Veratrum californicum*. These suspected species will not be considered further in this document. Also, *Pinus albicaulis* is not a SCC because it is addressed as a candidate threatened and endangered species under the ESA. The remaining 5 species, which are known to occur within the plan area, fall within habitat groups that are also associated with the identified plant SCC. This group includes *Carex rostrata, Erigeron lackschewitzii, Juncus hallii, Oxytropis podocarpa,* and *Potentilla nivea var. pentaphylla*. Stressors and effects to these species would be similar to those disclosed for the SCC in their respective habitat guilds.

SCC found on the HLC were placed in one or more of the following guilds:

- Peatlands
- Wetland-riparian
- Alpine
- Grasslands
- Mesic-Montane-Disturbance-Talus
- Aquatic

Benefits to people

Rare plants contribute to diversity on the landscape and recreation opportunities for rare plant enthusiasts. Please refer to the ecosystem services section for more information about multiple uses, key ecosystem services, and benefits to people.

3.11.6 Environmental consequences

Effects common to all alternatives

At the scale of the entire HLC NF, it is difficult to assess the impacts of Plan direction to 31 SCC, 1 candidate species, and 12 RFSS. Plant species may be rare due to evolutionary history, changes in climate, basic population ecology, historic or current human activities, or more likely, a complex combination of these factors. Human activities may or may not be responsible for the current distribution and abundance of the rare plant species. An important assumption in this analysis is that certain management actions may contribute or detract from the availability or quality of habitats that support rare plant species.

Threatened, endangered, proposed, or candidate species have special management requirements for all FS management activities. The ESA section 7 guidelines and recovery objectives would be followed if potential habitat for any threatened or endangered plant species were to occur on the Forest. For RFSS, policy to ensure the diversity of rare plant communities or their habitat are already in place and would continue under the No-action alternative. This policy would not continue under the new 2012 Planning Rule, but current and future policy for SCC would be followed.

In addition, all of the alternatives (including alternative A) retain Montana Statewide riparian area protection and riparian management objectives for habitat conservation areas and a comprehensive set of standards and guidelines related to what kind of activities may or may not occur within the riparian areas. Although they were not specifically designed to do so, many of the standards and guidelines serve as protection measures for rare plants that are associated with aquatic and/or riparian habitats.

Climate change

Anthropogenic caused increases in temperatures and changes in precipitation are likely to impact both ecosystem structure and ecosystem processes (IPCC, 2007). Climate controls many ecosystem processes including species distribution and abundance, regeneration, vegetation productivity and growth, and disturbance all of which could affect at-risk species on the HLC NF. While there is some uncertainty regarding the scale, rate, and direction of future climatic conditions in the western United States and Montana some general observation regarding past changes and expected future changes, the majority of published science suggests that climate changes may strongly influence the frequency, intensity, and size of disturbances (such as fire and extensive insect outbreaks) in coming decades on areas of the HLC NF. Changes in disturbance prompted by climate change are likely as important as incremental changes in temperature and precipitation for affecting ecosystem productivity and species composition. Recent research indicates that these risks may be particularly acute for forests of the Northern Rockies. Conservative future climate scenario models predict that the effects of climate change result in a growing season lengthened, the number of days with snow on the ground decreased, peak snow occurred earlier, and water stress increased for all sites in the study, which represent temperature and precipitation spectrum in the forests of the Rocky Mountain region (Boisvenue & Running, 2010).

All habitat guilds for at-risk species are expected to be impacted by climate change. Peatland, aquatic, wetland-riparian, grasslands, and montane-mesic-disturbance-talus guilds may increase the rate of desiccation due to increased and prolonged summer temperatures and/or drought conditions, although due to uncertainty, the opposite could be true and all guilds could see an increase in precipitation. Available habitat in the alpine habitat guild for sensitive species may decrease as a result of climate change and an upward shift of lower alpine habitats. Increased fire severity or frequency may also affect all habitat guilds except the aquatic guild, especially those found outside of rocky areas, either favorably or detrimentally depending upon their habitat requirements.

Increases in the severity of disturbances, combined with projected climatic changes, may limit habitat for at-risk species. Rare and uncommon species, disjunct populations and species at the edge of their known range are expected to experience a number of barriers when adjusting to a rapidly changing climate because of the combination of a small number of occurrences, narrow elevation ranges, and requirements of specific soils types. Some sensitive species with potential habitat in project area are known to occur on restricted and/or limited areas within the forest. Plants confined to outcrops of special soils are generally expected to have a far lower chance of successful migration to new suitable sites and thus far greater risks of extinction in the face of climate change, than plants that are soil generalists (Harrison 2009). Because of the uncertainty in scale, direction, and rate of climate change, management of sensitive species on the HLC NF focuses on maintaining viable populations throughout the species known range in the plan area.

Whitebark pine population trend

Based on a preponderance of data, the USFWS has concluded that there is an ongoing pattern of substantial decline of whitebark pine on the majority of its range (U.S. Department of the Interior, Fish and Wildlife Services, 2011). They predict whitebark pine forests may become extirpated and its ecosystem functions rendered obsolete in the foreseeable future. As discussed in the forest plan assessment, analysis at the Regional scale indicates that the abundance of live whitebark pine has decreased. The abundance of the whitebark pine cover type on the HLC NF is below the NRV, and SIMPPLLE modeling indicates that the cover type would generally remain static over time. In contrast, the overall distribution (presence) of whitebark pine is within the NRV, and at the forestwide scale slightly declines but remains within the natural range over a 50-year modeling period. Whitebark pine presence increases in some GAs, and decreases in others, as influenced by factors such as climate, disturbances, succession, and vegetation management.

The loss of whitebark has dramatically altered the structure, composition and pattern of high-elevation ecosystems, and threatened their long-term stability and integrity. This impacts hydrological processes and wildlife habitat values. Restoration activities are needed to address the threats to whitebark pine (USDI 2011). The percentage of whitebark that are resistant may increase slowly through the process of natural selection, if 5-needled pines are given a chance to regenerate (Tomback et al 2001).

The current Forest Plans do not contain specific standards or guidelines related to maintaining whitebark pine. The revised plan components include specific targets for treatments acres of whitebark pine. The current and revised plans have opportunities to restore whitebark pine and are expected to contribute to this species persistence in the plan area despite the current population trend.

Current stressors in habitat guilds

Peatlands

Threats to peatlands include land uses surrounding fens that can potentially alter the hydrology, water quality or nutrient inputs of these systems, thus changing their underlying processes (i.e. diversion, draining, development, road construction, and heavy grazing). Increased land use within 100 meters has been found to be correlated with increased nutrient levels in peatlands in Montana, suggesting that setbacks should be 100 meters or more for adequate protection (Jones 2003). Draining, heavy cattle use, and irrigation practices can also alter hydrology and result in the loss of species diversity. Localized peat mining may occur on private lands.

Wetland-riparian

Threats to wetland-riparian habitats include heavy grazing, invasive species, drought, alteration of the original hydrology or hydric soils (i.e. diversion, draining, development, road construction, and heavy grazing). Management activities that have the potential to disturb soils and vegetation within riparian areas or adjacent to wetlands, such as road construction, reconstruction, and maintenance; livestock use; disturbances/exclusion as they change vegetation conditions in riparian areas and vegetation adjacent to wetlands, invasive plant treatments, recreation use, trails, visitor trampling, camping in riparian areas.

Alpine

Alpine habitats are often fragile systems due to limited growing season and soil development. Although recreation and road construction are threats to rocky habitats, disturbance is often limited due to inaccessibility. Radio structures, mining, trail construction and recreation and are the main management related disturbance. Changes in fire patterns and severities, and associated effects on vegetation succession may be a stressor in some environments. Grazing has the potential to negatively impact these habitats, but this activities rarely occurs in these habitats due to low forage cover.

Grasslands

Threats to grasslands include fire suppression, agricultural conversion, heavy grazing, noxious species invasion, conifer encroachment, off-trail recreation (e.g. all-terrain vehicles, bicycles) and human development. In the absence of natural fire, periodic prescribed burns and appropriate grazing management practices can be used to maintain this system. The spread of nonnative grasses species has reduces native species diversity in all GAs in the plan area.

Mesic-montane-disturbance-talus

Stressors and ecological processes that influence upland forested habitats apply to all species to varying degrees. These include vegetation treatments (such as logging and prescribed fire), fire disturbances and fire exclusion/suppression, natural succession, cattle grazing, trampling, construction of roads and other developments, mining activities, recreational activities, such as trails, camping and off road vehicle use, that could disturb or trample plants, and invasive plant species and treatment of infestations.

Aquatic

Stressors to these species would be similar to those associated with fens and wetlands, including changes in hydrology or water quality that might occur either from natural or human caused sources. Threats include alteration of the original hydrology or hydric soils (such as diversion, draining, development, road construction, and heavy grazing). Invasive species also pose a threat to wetland plant communities.

Effects from forest plan components associated with:

Recommended wilderness

The alternatives vary in the quantity and location of RWAs, ranging from none in alternative E, to 16 areas in alternative D. RWAs would protect at-risk plant habitat from ground disturbing threats and development, and these areas would be managed allowing natural fire regimes to contribute to a mosaic of different seral stages and diversity habitats as much as possible. An increase in RWAs decreases threats to at-risk plants overall from ground disturbing activities (i.e. vegetation projects, some motorized/mechanized access) while promoting a naturally managed system that has the potential to improve the mosaic pattern on the landscape for approximately 15 years. Since the guidelines for RWAs are similar to IRAs, and the bulk of each RWA overlaps with IRAs, the decrease in threats overall are minimal in these areas. Areas proposed as RWAs that were not previously identified as IRA would see a more substantial decrease in threats. See the administratively and congressionally designated areas sections for more details on the management differences between RWAs and IRAs.

All action alternatives would have the same level of ability to achieve desired vegetation conditions within RWAs through the use of vegetation treatments within RWAs. All have forest plan direction that allow restoration activities to occur as long as the ecological and social characteristics that provide the basis for wilderness recommendation are maintained and protected. Anticipated vegetation treatment activities would largely be associated with the restoration of high elevation ecosystems, and whitebark pine forest communities in particular. There may be other treatments occurring to achieve restoration objectives outlined in the plan components. The most likely treatment would be prescribed burning (planned ignition), in some cases followed by limited planting of conifer seedlings. Objectives would include restoration of desired forest structure and compositions, and to restore desired landscape patterns.

Lands suitable for timber production

Timber harvest is most likely to occur on lands identified as suitable for timber production. Harvest increases some threats to at-risk species but also can create a mosaic pattern on a landscape and promote early successional stands with some treatments, such as regeneration harvest. Typically known at-risk species would receive site-specific protection following botanical surveys (FS Manual 2670) and negative effects would be minimized. This would continue to occur with the revised plan components for at-risk species and the management strategies in appendix C of the revised plan. Without these components and strategies, it is likely that several at-risk species would decline in the plan area. Vegetation treatments can also increase forest resiliency by treating insect and disease and reducing fuel loads, improving for health in the long term. Individual occurrences and suitable habitat could be impacted in the short term by mechanized equipment and incidental damage from felling trees. Site disturbance and increased weeds could also negatively impact habitat requirements. Long term habitat improvements include habitat heterogeneity, increased diversity and increased available forage.

Habitat connectivity

Habitat connectivity would be improved under three of the alternatives by the prioritization of certain areas of wilderness which creates uninterrupted habitat corridors. These areas would receive minimal disturbance and increase habitat quality. The focus on habitat connectivity improves the selection of wilderness areas to increase effectiveness of the naturally managed areas to support diverse natural ecosystems.

Motorized and mechanical means of transport

Motorized and mechanical means of transport impact sensitive plant occurrences within road prisms and parking areas and remove habitat in these areas. Vehicles that travel off-road can crush at-risk plant occurrences and compress soil, eliminating habitat along designated travel routes and roads open to motorized use. Reduced motorized and mechanized means of travel use correspond to reduce threats to at-risk species. Each alternative would use designated travel plans, which is considered a part of the designated condition of at-risk plant species. The no-action alternative currently allows mechanized means of transport and limited motorized use in RWAs. Alternatives C and E would continue to allow motorized use in RWAs, while alternatives B and D restrict motorized use in these areas. There are additional differences between alternatives for motorized and mechanized use, but no at-risk plant viability or habitat quality for at-risk plants is expected to be impacted outside of wilderness areas, which would be addressed separately under each alternative.

Elk security guidelines

The elk security desired condition states that ‘elk and other big game species are present and potentially available to hunters on NFS lands during both the archery and rifle hunting seasons. Habitat on NFS lands provides hunting opportunities that support MTDFWP population and harvest objectives.’ Additional plan components state that elk security areas should be maintained or increased to influence elk distribution. The elk security areas would be defined and applied at various scales dependent on best available science, and these areas should be centered on known elk habitat. These components are included in alternatives A, B and E, and are *not* included in alternatives C and D. A number of at-risk species suitable habitat overlap partially with elk security habitat, but no at-risk species are known to specifically rely on elk hiding cover or forest characteristics determined by elk security. Elk security guidelines are not expected to influence sensitive plant populations in the plan area for any alternative.

Canada lynx management

All alternatives would incorporate the NRLMD (USDA, 2007a), which would influence vegetation management and how desired conditions are applied in potential lynx habitat (49% of the HLC NF). Refer to appendix H of the revised forest plan for the lynx plan components. Although the management constraints are only required in occupied lynx habitat, the NRLMD specifies that its guidance should be considered on all lands. Occupied lynx habitat has been identified by the U.S. Fish & Wildlife Service, and currently includes only the Upper Blackfoot and Rocky Mountain Range GAs. However, because the guidance should be considered on all lands, and there is potential for occupied habitat to change, lynx constraints are applied and analyzed across the entire HLC NF for forest planning purposes.

Several of the objectives of the lynx direction complement the at-risk plant plan components, by describing a desired condition to management vegetation to approximate natural succession and disturbance processes (#1), and provide a mosaic of habitat conditions through time (#2). These components would contribute to the maintenance of habitat for at-risk species in the grasslands, wetland-riparian and mesic-montane-disturbance-talus habitat guilds. Standard VEG-S6 may potentially impact the management of terrestrial vegetation and could affect whitebark pine by limiting the opportunity for some restoration activities. Standard VEG S6 does not allow vegetation management that reduces winter snowshoe hare habitat in mature multi-story forests. This habitat condition most commonly develops on the cool moist and cold broad PVTs and overlaps with areas of whitebark pine that are being impacted by competition from other conifer species. VEG S6 does not include an exception for whitebark pine restoration treatments similar to the exception that is listed in VEG-5. An estimated 25,507 acres of mapped whitebark pine overlaps with lynx habitat, which equates to 56% of mapped stands in the plan area. This amount would fluctuate over time, as the condition is removed by disturbance and develops in other stands. Much of this area is located in IRAs, RWAs, or designated wilderness areas where the majority or all of vegetation treatments that could occur would be prescribed fire. VEG S6 would potentially reduce or delay the ability to achieve desired vegetation conditions in some areas. The inability to apply vegetation management in whitebark pine forests where fire exclusion has allowed spruce/fir canopy layers to develop would result in foregoing some whitebark restoration opportunities.

Effects common to all action alternatives

All action alternatives contain revised forest plan components that explicitly state the desired conditions for each aspect of forest condition, such as vegetation composition, structure, and pattern, livestock grazing, and timber harvest. The components that are likely to have an effect on at-risk plants species habitat guilds are summarized in the following sections. Individual species are not addressed for forestwide plan components – see supplemental botany report in the project file for more information.

Effects from forest plan components associated with:

At-risk plant species

Draft Plan components that are relevant to at-risk plants are the same for each action alternative (Table 56). The management direction recognizes the need to maintain or improve occurrences and habitats of plant SCC. Appendix C of the draft plan describes possible strategies for achieving desired conditions and objectives for at-risk plants, and also provides strategies for gathering data and including additional species that warrant inclusion, such as previous RFSS. These strategies include evaluating areas proposed for vegetation management activities for the presence of occupied or suitable habitat for at-risk species, focusing botanical surveys on increasing known information about other plant species (such as Montana state species of concern and newly discovered species), and monitoring known occurrences of at-risk species. More details are provided in appendix C of the draft plan.

Table 56. Draft plan components for at-risk plant species

At-Risk Plant Plan Components	Component Language and Summary of expected effects for at-risk plants
FW-PRISK-DC-01	This desired condition would maintain or restore at-risk plant species occurrence viability, habitat quality and provide opportunities to reduce threats in habitat guilds.
FW-PRISK-DC-02	This DC would promote rust-resistance populations of whitebark pine in the plan area, which is one of the recommendations by Keane at al (2012).
FW-VEGT-DC-02	This DC would maintain or restore at-risk plant species occurrence viability, habitat quality and provide opportunities to reduce threats in all habitat guilds.
FW-PRISK-GO-01	This goal would maintain or restore at-risk plant species occurrence viability, habitat quality and provide opportunities to reduce threats in all habitat guilds.
FW-PRISK-OBJ-01	This objective would improve whitebark pine population viability, habitat quality and reduce threats in all habitat guilds.
SCC	There are unknowns about future SCC policy; RFSS had defined policy but FS handbook policy is not yet available for SCC. An interim management policy is expected to become available prior to the revised handbook. Nothing is available currently except the above plan components.

As a result of these plan components, at-risk plant populations in all habitat guilds are expected to be maintained and continue supporting at-risk plant species with opportunities to restore sites if conditions warrant. RFSS that are not currently on the proposed SCC list would no longer be specifically protected once the new plan is implemented. The dropped RFSS occur in habitats with either infrequent project activity (e.g. alpine habitat guild) or in sensitive habitats protected by current plan standards (e.g. peatlands, wetland-riparian habitat guilds). The strategies in appendix C of the draft revised plan include recommended actions to review additional information as it becomes available and gather data during field work. If new pertinent information becomes available indicating a potential threat to loss of viable populations in the plan area these species would be reconsidered and the SCC list may be adjusted.

The revised plan components include components specific to whitebark pine that are expected to enhance restoration efforts. Due to wide spread decline of this species, these plan components focus on restoration of healthy populations for this species. Appendix C of the draft revised plan describes possible strategies for whitebark pine treatment.

Population viability for SCC is expected to remain stable for all species in the plan area because the plan components will maintain and restore habitat for these species. Habitat quality would improve for whitebark pine under the action alternatives at a faster rate than the no-action alternative, though both provide benefits and support long term persistence in the plan area. The action alternatives include additional opportunities for restoration activities; however the no action and action alternatives result in similar outcomes for at-risk plants. Habitat quality is expected to improve under these alternatives at a faster rate for all at-risk plant species than the no-action alternative. Threats remain similar between the no action and action alternatives for at-risk plant plan components.

Aquatic ecosystems

Four habitat guilds containing 30 at-risk species, including 2 RFSS and 22 SCC, are impacted by aquatic ecosystems. The threats to these species include changes to hydrologic and nutrient alternations. Mechanical vegetation treatments, off-road vehicles, roads and trails, livestock grazing, and catastrophic wildfires are some of the actions that affect the hydrologic regimes or nutrient inputs. Subwatersheds provide the distribution, diversity, and complexity of landscape-scale features including natural disturbance regimes and the aquatic, wetland, and riparian ecosystems to which native species, populations, and communities are uniquely adapted within those watersheds, such as at-risk plant species. The action alternatives include desired conditions that would specifically support sensitive plant habitat in the four previously mentioned guilds that overlap with aquatic ecosystems. The revised plan components have additional protection measures and an increased emphasis on the restoration and maintenance of riparian and aquatic resources when compared with the existing plans reflected in alternative A.

As a result of these plan components, wetland-riparian, peatland, aquatic and some areas in the mesic-montane-disturbance-talus and grasslands guilds are expected to be maintained and continue supporting all at-risk plant species that occur in these habitats. The revised plan is more explicit on aquatic ecosystems protections, connectivity in riparian habitats, and groundwater-dependent systems, and specifically expands the RMZs east of the Continental Divide, in addition to following state guidelines and BMPs in the previous plans.

These plan components are expected to contribute to stable populations for all at-risk species in peatlands, wetland-riparian, and aquatic habitats, and also for at-risk species that overlap with aquatic habitats in the mesic-montane-disturbance-talus habitat guild by preserving required habitat characteristics for these species. Habitat quality would improve for all at-risk species in the peatlands, wetland-riparian, mesic-montane-disturbance-talus, and aquatic habitat guilds under the plan components in the action alternatives. Threats would be reduced for at-risk plants in these four wetland guilds in the action alternatives.

Soil

All habitat guilds depend on soil quality and productivity within their respective habitats. FS activities that lead to soil compaction or soil contamination with toxic materials have the potential to negatively impact sensitive plant habitat. Some activities that can threaten soil quality include mechanized vegetation treatments, roads and trails, recreation, grazing and off-road vehicles.

As a result of these plan components, all habitat guilds are expected to be maintain soil quality and productivity, which would contribute to stable at-risk plant populations in the plan area. This plan provides similar protections and guidelines for soil productivity which would support sensitive plant habitats and populations, and includes a desired condition that supports biological soil crusts that is not in the no-action alternative. This component is expected to provide additional protection for bryophytes, lichens, and other flora that could exist in the plan area. Habitat quality would improve for all habitat guilds in the action alternatives. Threats would remain similar to the no-action alternative.

Fire and fuels management

All alternatives use fire as a tool to accomplish management goals and objectives. The objectives for fuel reduction are usually complementary to the other desired vegetation conditions, including those beneficial to at-risk species, and especially as related to forest resiliency. There are several factors that are important to consider with regard to at-risk plants. One factor that is important to some rare plants is the timing and placement of prescribed burns. For example, the use of prescribed fire in the spring has potential to impact to some rare plants that are not adapted to fire at this time of year and spring burning can interfere with flowering, fruiting, pollinator availability, and other physiological impacts. Other at-risk species prefer spring burning event due to a lower rate of litter build-up which reduced fire intensity and increases survival. Considering sensitive species during the planning process (FSM 2670) should ensure that the timing and placement of prescribed burns is used to maintain at-risk plant populations as much as possible by timing when phenologically appropriate and avoiding populations of species adverse to fire.

Another factor is the risk of high intensity wildfire as a result of high fuels. The current condition is overall a high risk of high intensity burns in many areas within the plan area due to high fuels load, which has resulted from various causes, such as fire suppression and the recent outbreak of bark beetle infestation. Without some prescribed fire introduced to mitigate the threat of high intensity fire, at-risk species populations are susceptible to being eliminated in areas on the landscape in all habitat guilds. Many species tolerate and in fact require frequent fire to maintain populations on the landscape. Frequent fire is has historically been low intensity or varied intensity in the plan area, depending on vegetation type. Stand-replacing fires have the potential to kill at-risk plants and reduce or eliminate seed banks, making reestablishment difficult or even impossible without additional seed sources brought in.

A third factor to consider is that some at-risk species require regular fire to maintain early successional conditions that supports known occurrences. This includes species in the wetland-riparian, grassland, mesic-montane-disturbance-talus guilds, and could potentially incorporate additional habitat guilds in the future depending on species specific requirements, which can change depending on new best available science and adjustments to the SCC list. These species require fire, typically low intensity fire to maintain sensitive habitats. The lack of fire has reduced the amount of available habitat. In general, most plant species would benefit by the restoration of more historical fire regimes. For those rare plants that thrive in open areas created by fires, using fire to help restore a more natural fire regime could benefit those species in the long-term. There are also impacts to plants associated with wildfire suppression activities, such as fire line construction and other mechanical activities, reforestation following fire, and the increased potential for the spread of noxious weeds.

Sensitive plants have various reactions to fire. As a result of these plan components, all habitat guilds are generally expected to be maintained and continue supporting at-risk plant species, including the species that are currently on the RFSS list but that would not be specifically protected as a SCC once the new plan is implemented. Analysis prior to implementation would omit populations and habitat that could be detrimentally impacted, and overall habitats on the HLC NF benefit from fire occurring on the landscape similar to historic fire regime conditions. Emphasis in the new plan to allow natural fire to function in its ecological role would likely benefit native plant species as a whole, with few exceptions.

As a result the plan components that encourage natural fire on the landscape, habitat for multiple habitat guilds is expected to maintained and re-established. This would contribute in the long-term to stable at-risk plant populations in the plan area, though increased short-term risk would likely occur. Habitat quality would improve for all at-risk species habitat guilds that require frequent fire to maintain desired seral stage under the plan components in the action alternatives by allowing natural fire to play a larger role in the plan area. Threats currently exist from large, high intensity fire and also from fire suppression tactics. The minimum impact strategy for fire suppression in some locations would reduce threats to at-risk plant species in those habitats. Threats from suppression in location where minimum impact strategies are not used and threats from catastrophic fire events would remain.

Terrestrial vegetation

All habitat guilds are impacted and supported by the action alternative vegetation desired conditions. Broadly, the desired conditions for terrestrial vegetation on the HLC NF are characterized by increases in large trees and large forest size classes; more open forest densities; vigorous nonforested plant communities; increasing early-seral shade tolerant species; and maintaining the full suite of native biodiversity on the landscape. More information is available in the terrestrial vegetation section. The desired conditions are consistent with our understanding of the NRV and are most likely to be resilient in the future given expected drivers such as climate change, drought, vegetation succession, wildfire, insects and disease, and the demands of people. Desired conditions for vegetation support native species and habitats within their NRV, including at-risk species.

Ground disturbing activities and changes in site conditions that could impact at-risk species are likely to result from the terrestrial vegetation plan components. As discussed above, the restoration of historical fire regimes and restoration of conditions towards historical range of variation with a range of seral stages for different potential vegetation groups may benefit some at-risk species in the long-term.

These revised vegetation plan components are expected to maintain and continue supporting at-risk plant species in the plan area. Habitat quality would improve for at-risk species in all habitat guilds under the plan components in the action alternatives. Threats would be remain similar for at-risk plants in regards to vegetation plan components.

Invasive species

Invasive species have a major impact on at-risk species in the plan area. Introduced, invasive plant species can displace at-risk species through competitive displacement. Impacts include herbicide spraying and mechanical ground disturbance to control noxious weeds once they gain a foothold. Competition from invasive non-native species and noxious weeds can result in the loss of habitat, loss of native pollinators, and decreased rare plant species viability. Roads, trails, livestock, and canopy reduction can provide ideal pathways for the introduction of exotic and non-native species. Regarding the risk of weed invasions and/or expansion of populations, the alternatives would vary in some ways. In general, increased ground disturbance corresponds with increased weed spread.

As a result of these plan components, all habitat guilds are expected to benefit from the reduction of invasive species, particularly the wetland-riparian, grasslands, and mesic-montane-disturbance-talus guilds. This would contribute to stable at-risk plant populations in the plan area. This plan provides similar protections and guidelines for invasive species treatment as the existing plans, however additional plan components specify treatment of weeds in at-risk plant habitats. This is expected to increase the opportunities for at-risk plant restoration in the plan area. Habitat quality would improve for all habitat guilds in the action alternatives. Threats would remain similar to the no-action alternative. The revised plan includes language specifically to target at-risk plant species and would likely provide additional protection to sensitive native plant populations when compared to the two older plans. Habitat quality would improve for at-risk species in all habitat guilds under the plan components in the action alternatives. Threats would be reduced for at-risk plants by the action alternatives plan components for invasive species.

Recreation setting, designated areas and infrastructure

Recreation impacts can include trampling, both by hikers and off-road vehicle use. Road building and the development of campgrounds and other facilities used by recreationists also contribute to plant impacts, as these developments make more areas accessible and concentrate use. Dispersed camping and recreation have similar impacts, which are more difficult to monitor. Parking areas, particularly undesignated areas, pose similar impacts to plants. In addition, there can be long-term impacts of bisecting a rare plant population with a road or similar feature and affecting the reproduction and/or plant dispersal. Other recreational impacts include off-road vehicle use, which can also disturb soil, affecting both habitat and potential habitat. Roads and trails for recreational use can contribute to the spread of noxious weeds and increase the accessibility of areas to livestock as well as native ungulates, which in turn can increase the impacts of trampling, herbivory, and congregation.

Increased access to transportation can increase the amount of the plan area that is available for restoration, fire or timber treatments. These treatments can provide opportunities to improve habitat, or the lack of access can remove opportunities and lead to habitat degradation overtime. Infrastructure can also provide vectors to weeds and cause unintentional erosion, which can negatively impact at-risk species over time.

These plan components are expected to contribute to the maintenance of viable at-risk populations in the plan areas by including additional ecosystem protections associated with recreation opportunities. Threats are reduced for at species in all habitat guilds by multiple plan components. Aquatic guilds are protected from recreational related damages by other components, reducing risk for species that occur in with these habitats. There is additional resource protection language and components allowing restoration activities to be completed in wilderness areas. Wilderness areas and WSRs are still protected under national guidance and would continue from the old plans. Habitat quality would remain similar between the action and no-action alternatives for at-risk species in all habitat guilds under the recreation plan components. Threats would be reduced for at-risk plants by the action alternatives plan components for recreation.

Livestock grazing

Livestock grazing can greatly impact riparian habitats and at-risk plant habitat. All habitat guilds except alpine have the potential to be impacted by livestock grazing, which can cause hydrologic conditions to change, trampling to individual species, and habitat degradation through invasive species introduction.

As a result of these plan components, grasslands, peatlands, wetland-riparian, aquatic and mesic-montane-disturbance-talus habitat guilds are expected to be maintained and to continue supporting at-risk plant species in livestock allotment. There would be opportunities in the future to restore habitats that have become degraded over time. The language in the new plan is more explicit than the other plans, but management direction to preserve habitat quality is generally similar. Habitat quality would improve with the action alternatives for at-risk species in all habitat guilds under the livestock grazing plan components due to increased monitoring and active management. Threats would be reduced for at-risk plants by the action alternatives plan components for livestock grazing.

Timber

All alternatives have varying amounts of land suitable for timber production, but the impact of timber plan components on at-risk species is consistent between action alternatives. All habitat guilds can be impacted by timber production, even if habitats guilds, such as aquatic, alpine or grassland, or not directly harvested for timber. Mechanical activities include vegetation management treatments, whether for restoration or to meet timber production objectives. Activities, such as logging, can have impacts to plants and plant habitat through canopy removal, soil disturbance and erosion, and stream sedimentation. In addition, mechanical activities for vegetation treatment may require road building. Roads increase access to sensitive habitats and can fragment habitat, thus, providing an avenue for invasive plant species. Reconstruction and maintenance of designated roads can directly or indirectly affect plant populations by introducing competitive weeds and altering availability of light, nutrients, and moisture. Sudden changes in seral stage, or an abundance of early seral stages, also reduce the available habitats for those plants that require mid-to-late seral stages. However, those species that prefer openings, early-seral stages, or some ground disturbance, could benefit from moderate levels of mechanical activities. The restoration of historical fire regimes and conditions within the NRV (with a range of seral stages for different potential vegetation groups) may benefit some at-risk species in the long-term.

As a result of these plan components, at-risk species and their respective habitats would be considered during vegetation projects and grasslands, peatlands, wetland-riparian, aquatic and mesic-montane-disturbance-talus habitat guilds are expected to be maintained and continue supporting at-risk plant species despite the potential for impacts in areas used for timber production. The new plan is more explicit regarding resource protections, though similar guidelines applied under the old plans. Habitat quality would remain similar between the no action and action alternatives for at-risk species in all habitat guilds under the timber plan components. Threats would be reduced for at-risk plants by the action alternatives plan components by including additional language to protect sensitive habitats.

Alternative A, no action

Effects from forest plan management direction

The no-action alternative is represented by the designated 1986 Forest Plans, as amended. Law and regulation that have been adopted since the 1986 plans would be analyzed as part of the No-action alternative (for example, the designation of IRAs). The designated forest plans (1986) were developed over 30 years ago under a different planning rule and paradigm, a direct comparison to the revised plans is difficult. The plan content in the designated forest plans relevant to at-risk plants are summarized in Table 57.

Table 57. Helena NF and Lewis and Clark NF 1986 Plans' at risk plants plan components

Resource	Lewis and Clark Forest-Wide Standards	Helena Forest-Wide Standards
Threatened and Endangered Plants	• Standard C-2 (1): Comply with law, regulation, and policy regarding threatened and endangered. • Standard C-2 (2): This evaluation would determine whether or not informal or formal consultation with the USFWS on T&E species is appropriate.	The Forest Plan refers to Section 7 of the ESA
Sensitive Plants	• Standard C-2 (2): This evaluation would determine whether or not informal or formal consultation with the USFWS on T&E species is appropriate. • Standard C-2 (3): This evaluation may result in specific management recommendations in addition to those above. • Standard C-2 (13): Assessments of suitable habitats for sensitive plants would be conducted before surface disturbing activities are permitted.	Species of Special Concern There are habitats on the Forest where species of special concern may be found. If any of these species are verified on the Helena Forest, appropriate measures, pursuant to Section 7 of the Endanger(ed) Species Act, would be taken."

The FS manual and ESA policy is followed under both plans. No threatened and endangered species are currently known to occur in the plan area. The combination of FS handbook policy for RFSS and the existing two plans provide protections that are similar to the revised plan's components. The 1986 plans differ from each other and the revised plan: the Helena NF Plan calls out species that are not based on current BASI and relies on FS handbook policy to support RFSS plant species in the plan area; the Lewis and Clark NF plan did includes direction in a 1995 amendment with explicit direction that repeats FS handbook direction.

The separate 1986 Helena and the Lewis and Clark Forest plan standards have led to the current condition of the affected environment for sensitive plants. These plans have specifically called out at-risk species in a number of cases; northern rattle snake plantain in the minerals section of the Lewis and Clark NF Plan, and the sensitive species listed in the threatened and endangered species section in the Helena NF Plan, though additional information has removed several of the Helena Plan species from protected status. Whitebark pine is not specifically mentioned. These plans would ensure that at-risk species persist in the plan area. These plans have fewer opportunities for restoration and less of a focus on native vegetation improvements than the new plan components.

Population viability is expected to remain stable for all at-risk species in the plan area with these plan components. Habitat quality has the potential to improve, however there are fewer plan components promoting restoration and there are inconsistencies between the two forest plans. The no-action alternative is expected to maintain similar habitat quality for at-risk plant species in all habitat guilds. Threats would be remain similar to current conditions for at-risk plants.

Effects of plan components associated with:

Recommended wilderness and undeveloped areas

There are 34,226 acres proposed as RWAs under this alternative. Mechanized means of transport and limited motorized uses are allowed in RWAs. Undeveloped areas are provided by designated wilderness, IRAs, and RNAs. Designated wilderness does not change between alternatives, however this analysis considers all occurrences for each species that are within either designated or recommended wilderness to assess and quantify what percentage of occurrences occur in areas with reduced threats and the relative value of including more in proposed recommended wilderness. Frequently, occurrences that are known within RWAs currently overlap with IRAs. Threats only minimally decrease in these areas; threats decrease to a greater degree in areas that were not previously designated as IRAs.

There are 15 at-risk species with known occurrences in designated or RWAs. There are 82 plants occurrences in designated wilderness areas and 6 additional at-risk plant occurrences in RWAs. *Amerorchis rotundifolia, Astragalus lackschewitzii, Castilleja kerryana, Cypripedium passerinum, Erigeron lackschewitzii, Oxytropis podocarpa* and *Ranunculus pedatifidus* do not have additional occurrences in RWAs but much of their known occurrences and habitat exist in currently established wilderness areas in the Rocky Mountain Range GA with decreased threats from motorized and mechanized access.

The RWAs include suitable habitat in all habitat guilds. The at-risk species that have suitable habitat within the RWAs include *Astragalus convallarius, Botrychium spp*, *Delphinium bicolor ssp. calcicola, Juncus hallii,* and *Phlox kelseyi var. missoulensis.* Habitat for RFSS that would not be carried forward with the SCC designation that have known occurrences in designated wilderness or RWAs include *Erigeron lackschewitzii, Juncus hallii,* and *Oxytropis podocarpa.* Some suitable habitat occurs for *Carex rostrata*. More suitable habitat for these species, and additional species, are present under the RWAs under alternatives B, C and D and less suitable habitat under alternative E. Threats to at-risk species and habitats in RWAs are would remain consistent with the old Forest Plans and there would be no additional protections (e.g. permissible restoration activity, limited access to motorized vehicles) for at-risk plant occurrences. Habitat quality and threats would remain consistent with current plans.

Land suitable for timber production and habitat connectivity

There are 430,489 acres proposed as suitable for timber production in the current forest plans. The emphasis on timber production in these areas increases threats to sensitive species from timber related activity. There are 1,151,728 acres unsuitable for timber production where harvest may occur for other reasons, but these areas do not have a management emphasis on timber production and are therefore not considered in as much detail. These areas would be subject to the plan components listed above, and since there is no specific emphasis on timber production, these areas were not considered separately in this analysis. There are 224 known sensitive plant populations in areas suitable for timber production. This number is inflated due to the greater number of surveys that occur in project areas, such as vegetation projects. There is suitable habitat for at-risk species outside of lands suitable for timber production.

Species that do not occur in lands suitable for timber production include *Amerorchis rotundifolia, Astragalus convallarius, Astragalus lackschewitzii, Botrychium crenulatum, Braya humilis, Castilleja kerryana, Cypripedium passerinum, C. parviflorum, Delphinium bicolor ssp calcicola, Draba desifolia, Drosera anglica, D. linearis, Epipactis gigante, Erigeron flabellifolius, E. lackschewitzii, Gentianopsis macounii, Lycopodium dendroideum, Oxytropis podocarpa, Potamogeton obtusifolius, Potentilla nivea var pentaphylla, Ranunculus pedatifidus, Schoenoplectus subterminalis, Scorpidium scorpioides, Sphagnum fimbriatum,* and *Stipa lettermanii.* These species populations and suitable habitat may still occur within forest projects, including vegetation projects, and subject to potential direct and indirect effects. The RFSS species would be protected by the FS manual guidelines and current forest standards during vegetation project work to prevent listing, as listed above. SCC not included on the current 2011 RFSS list would not be protected under this alternative.

Alternatives B and C

Effects of forest plan components associated with:

Recommended wilderness and undeveloped areas

These alternatives recommend nine RWAs totaling 213,076 acres. There are 21 at-risk species with known populations in designated or RWAs. There are 82 occurrences in designated wilderness areas and 24 additional at-risk plant occurrences in RWAs. *Amerorchis rotundifolia, Astragalus lackschewitzii, Castilleja kerryana, Cypripedium passerinum, Erigeron lackschewitzii, Oxytropis podocarpa* and *Ranunculus pedatifidus* do not have additional occurrences in RWAs but much of their known occurrences and habitat exist in currently established wilderness areas in the Rocky Mountain Range and Blackfoot GA’s with decreased threats to populations as a result of reduced motorized and mechanized access. Habitat for *Erigeron lackschewitzii* and *Oxytropis podocarpa* is especially valuable because these species would not be carried forward on the species of conservation list.

The RWAs include suitable habitat in all habitat guilds. The species with suitable habitat within the recommended wilderness include *Astragalus convallarius, Botrychium spp, Braya humilis, Delphinium bicolor ssp. calcicola, Draba densifolia, Drosera anglica and D. linearis, Goodyera repens, Juncus hallii, Phlox kelseyi var. missoulensis,* and *Schoenoplectus subterminalis*. More suitable habitat for these species, and additional species, are present under the RWAs under alternative D. Habitat for RFSS that would not be carried forward with the species of conservation designation that have known populations in designated wilderness or RWAs include *Juncus hallii* and *Carex rostrata*. Threats to at-risk species and habitats in RWAs are reduced due to the reduction of ground disturbing activities, restriction of motorized and mechanized travel in some cases, and the authorization of restoration activities.

Land suitable for timber production and habitat connectivity

There are 442,601 acres of land suitable for timber production in these alternatives. Habitat connectivity was addressed as several areas identified as being narrow fragments of remaining connectivity in the Upper Blackfoot GA were excluded from lands identified as suitable for timber production. Some harvest may occur in these areas for purposes other than timber production, where consistent with other plan components. There are 1,573,374 acres unsuitable for timber production where harvest may occur for other reasons. These areas would be subject to the plan components listed above, and since there is no specific emphasis on timber production, these areas were not considered separately in this analysis. There are 244 known sensitive plant populations in areas suitable for timber. This number is inflated due to the greater number of surveys that occur in project areas, such as vegetation projects. There is suitable habitat for at-risk species outside of lands suitable for timber production.

Species that do not occur in lands suitable for timber production under these alternatives include *Amerorchis rotundifolia, Astragalus lackschewitzii, Botrychium crenulatum, Braya humilis, Castilleja kerryana, Cypripedium passerinum, C. parviflorum, Delphinium bicolor ssp. calcicola, Drosera anglica, D. linearis, Epipactis gigantea, Erigeron flabellifolius, E. lackschewitzii, Gentianopsis macounii, Oxytropis podocarpa, Potamogeton obtusifolius, Ranunculus pedatifidus, Schoenoplectus subterminalis, Scorpidium scorpioides,* and *Stipa lettermanii.* These species populations and suitable habitat may still occur within forest projects, including vegetation projects, and subject to potential direct and indirect effects. These species would be protected by the revised plan components during vegetation project work to prevent listing.

Alternative D

Effects of forest plan components associated with:

Recommended wilderness and undeveloped areas

There are sixteen RWAs totaling 474,589 acres. These include the nine from the alternatives B and C, plus seven additional areas. There are four additional areas recommended as undeveloped areas outside of recommended wilderness for this alternative. Motorized and mechanized use would no longer be allowed in RWAs.

There are 25 at-risk species have known populations in designated or RWAs. There are 82 plant occurrences in designated wilderness areas, 81 additional at-risk plant occurrences in RWAs, and 19 occurrences in the undeveloped areas proposed for primitive recreation. *Amerorchis rotundifolia, Astragalus lackschewitzii, Castilleja kerryana, Oxytropis podocarpa* and *Ranunculus pedatifidus* do not have additional populations in RWAs or undeveloped recreation areas but much of their known populations and habitat exist in currently established wilderness areas in the Rocky Mountain Range GA. Additional suitable habitat for these species occurs in the undeveloped recreation area in the Rocky Mountain Front GA. *Cypripedium passerinum* and *Erigeron lackschewitzii* have additional populations and suitable habitat that occurs in undeveloped recreation area under this alternative. These species in designated wilderness would experience fewer threats to populations as a result of reduced motorized and mechanized access. The undeveloped recreation would receive less ground disturbing activity than developed areas and another layer of protection for suitable habitat and populations of the above species. Habitat for *Erigeron lackschewitzii* and *Oxytropis podocarpa* is especially valuable because these species would not be carried forward on the SCC list.

The additional RWAs include suitable habitat in all habitat guilds. The species with suitable habitat within the RWAs include *Aquilegia brevistyla, Astragalus convallarius, Botrychium spp, Braya humilis, Cypripedium passerinum, Delphinium bicolor ssp. calcicola, Draba densifolia, Drosera anglica and D. linearis, Elymus innovatus, Erigeron flabellifolius, Goodyera repens, Juncus hallii, Phlox kelseyi var. missoulensis, Polygonum austiniae* and *Schoenoplectus subterminalis.* This alternative includes additional suitable habitat and a greater number of at-risk species than all other alternatives. More suitable habitat for these species, and additional species, are present under the RWAs under alternative D. Habitat for RFSS that would not be carried forward with the SCC designation that have known populations in designated wilderness or RWAs include *Juncus hallii* and *Carex rostrata*. The undeveloped recreation areas include 18 populations of 9 at-risk species, including *Astragalus convallarius, Cypripedium passerinum, Delphinium bicolor ssp. calcicola, Draba densifolia, Elymus innovatus, Erigeron lackschewitzii, Juncus hallii, Phlox kelseyi var. Missoulensis,* and *Polygonum austiniae.* Threats to at-risk species and habitats in RWAs are reduced due to the reduction of ground disturbing activities, restriction of motorized and mechanized travel in some cases, and the authorization of restoration activities.

Land suitable for timber production and habitat connectivity

There are 435,730 acres suitable for timber production in this alternative. Habitat connectivity was addressed as additional recommended wilderness, and primitive and semi-primitive non-motorized ROS areas. There are 1,195,455 acres unsuitable for timber production where harvest may occur for other reasons. These areas would be subject to the plan components listed above, and since there is no specific emphasis on timber production, these areas were not considered separately in this analysis. There are 236 known sensitive plant populations in areas suitable for timber. This number is inflated due to the greater number of surveys that occur in project areas, such as vegetation projects. There is suitable habitat for at-risk species outside of lands suitable for timber production.

Species that do not occur in lands suitable for timber production include *Amerorchis rotundifolia, Astragalus convallarius, Astragalus lackschewitzii, Botrychium crenulatum, Braya humilis, Castilleja kerryana, Cypripedium passerinum, C. parviflorum, Delphinium bicolor ssp calcicola, Drosera anglica, D. linearis, Epipactis gigantea, Erigeron flabellifolius, E. lackschewitzii, Gentianopsis macounii, Oxytropis podocarpa, Potentilla nvea var pentaphylla, Ranunculus pedatifidus, Schoenoplectus subterminalis, Scorpidium scorpioides,* and *Stipa lettermanii.* These species populations and suitable habitat may still occur within forest projects, including vegetation projects, and subject to potential direct and indirect effects. These species would be protected by the revised plan components during vegetation project work to prevent listing, as listed above.

Alternative E

Effects of forest plan components associated with:

Recommended wilderness and undeveloped areas

There are no RWAs in this alternative. There are 9 at-risk species have known populations in designated wilderness. There are 82 plant populations in designated wilderness areas. Much of their known populations and habitat exist in established wilderness areas in the Rocky Mountain Range or Blackfoot GAs for *Amerorchis rotundifolia, Astragalus lackschewitzii, Botrychium spp, Castilleja kerryana, Cypripedium passerinum, Erigeron lackschewitzii, Oxytropis podocarpa* and *Ranunculus pedatifidus.* These species in designated wilderness would experience fewer threats to populations as a result of reduced motorized and mechanized access. Habitat for *Erigeron lackschewitzii* and *Oxytropis podocarpa* is especially valuable because these species would not be carried forward on the SCC list.

More at-risk plant occurrences and suitable habitat for these species are present under the RWAs under alternatives A, B, C and D. This alternative would not include additional suitable habitat for RFSS that are not being carried forward on the SCC list in wilderness areas.

Land suitable for timber production and habitat connectivity

There are 474,184 acres suitable for timber production. Habitat connectivity was addressed as a part of this alternative. There are 1,664,257 acres unsuitable for timber production where harvest may occur for other reasons. These areas would be subject to the plan components listed above, and since there is no specific emphasis on timber production, these areas were not considered separately in this analysis. There are 248 known sensitive plant populations in areas suitable for timber. This number is inflated due to the greater number of surveys that occur in project areas, such as vegetation projects. There is suitable habitat for at-risk species outside of lands suitable for timber production.

Species that do not occur in lands suitable for timber production include *Amerorchis rotundifolia, Astragalus convallarius, Astragalus lackschewitzii, Botrychium crenulatum, Braya humilis, Castilleja kerryana, Cypripedium passerinum, C. parviflorum, Delphinium bicolor ssp calcicola, Drosera anglica, D. linearis, Epipactis gigantea, Erigeron flabellifolius, E. lackschewitzii, Gentianopsis macounii, Oxytropis podocarpa, Potamogeton obtusifolius, Ranunculus pedatifidus, Schoenoplectus subterminalis,* *Scorpidium scorpioides*, and *Stipa lettermanii.* These species populations and suitable habitat may still occur in forest projects, including vegetation projects, and subject to potential effects. These species would be protected by the draft plan components during vegetation project work to prevent listing, as listed above. *Trichophorum cespitosum* would no longer be protected by forest plan standards. These species are not known to occur in the plan area, but if found would be reconsidered for SCC protection.

Cumulative effects

Increasing human populations

Additional stressors that may increase in the future are increasing population levels, both locally and nationally, with resulting increasing demands and pressures on public lands. At present, local populations are increasing in the counties on the west side of the plan area, but are declining or stable in other areas. As related to forest and vegetation conditions, these changes may lead to increased demands for commercial and non-commercial forest products, elevated importance of public lands in providing for habitat needs of wildlife species, and changing societal desires related to the mix of uses public lands should provide. The plan components are adequate to support viable at-risk plant populations and habitat in the plan area as human populations and demands increase. Activities known to be threats to at-risk plant habitat guilds as described in the effects common to all alternatives section above that occur or originate on other ownership land can impact populations and habitat in the plan area.

Adjacent lands and other management plans

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 58 below, for those plans applicable to at-risk plants. Activities known to be threats to at-risk plant habitat guilds as described in the effects common to all alternatives section above that occur or originate on other ownership land can impact populations and habitat in the plan area.

Table 58. Summary of cumulative effects to at-risk plant species from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All plans address at-risk plant species. Generally speaking, management of vegetation is consistent across all NFs due to law, regulation, and policy. The cumulative effect would be that the management of at-risk plants and habitats would be relatively consistent and provide adequate protection to prevent species from decline. This includes specific adjacent landscapes that cross Forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
Montana Statewide Forest Resource Strategy (2010)	MT conducted a Statewide assessment of forest resources and identified issue-based focus areas with implementation strategies and deliverables for each including Focus area 1: Forest Biodiversity and Resiliency. Strategies include managing ecosystem and biotic composition to achieve ecological integrity through recovery of species diversity, water quality and quantity, soil quality and function by implementing best available science and adaptive management; and increasing terrestrial carbon sequestration and soil carbon sinks. The maintenance of native vegetation and emphasis on diversity is expected to benefit at-risk plant species that often occur in rare or sensitive habitats. This management is complementary, though some impacts to populations could occur.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the designated plans for the Missoula and Lewistown areas are under revision. These resource management plans equivalent to a forest plan. The primary issues included special status and priority plant and animal species and are complementary to the HLC NF revised plan in terms of

Resource plan	Description and Summary of effects
	managing for multiple uses and sustaining healthy and functional ecosystems. Broadly speaking the plan would likely contribute toward similar desired conditions as the HLC NF and much of the management guidance has similar intent with respect to resource protections and monitoring.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the terrestrial vegetation characteristics in this area and guidance toward at-risk plant species are therefore likely similar to the wilderness areas in the adjacent Rocky Mountain Range GA and would likely complement these conditions.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily non-forested, and calls for managing for fire-resilient vegetation, restoration of native vegetation including mountain mahogany specifically, identify special plants, and survey and manage for weeds including bio control. This plan would be generally complementary to the HLC NF most especially in promoting the health of native vegetation.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions. Species in the grasslands guild in these areas would likely benefit from open forest habitat.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	This plan is relevant to an area that lies adjacent to NFS lands in the Divide GA, in proximity to the City of Helena. The Mount Helena City Park is being managed as a “natural park”, which ensures its natural character in perpetuity. The plan emphases forest management, wildfire mitigation and noxious weed management. This would be complementary and additive to management on some HLC NF lands, specifically the South Hills Special Recreation area (alternatives B, C, and D) and maintain the native vegetation composition. Heavy recreation use and high noxious weed density could impact sensitive plant populations in these areas, but in general this management plan supports at-risk populations by reducing threats and maintaining quality habitat.
Bureau of Reclamation Canyon Ferry Shoreline Management Plan 2012; Canyon Ferry Reservoir Resource Management Plan 2003	These plans cover the management of the Canyon Ferry Reservoir, which lies between the Big Belts and Elkhorns GAs. The shoreline plan includes resource considerations such as (but not limited to) recreation access, erosion control, hunting and fishing, off road vehicle use and weed management. The Canyon Ferry Wildlife Management Area was transferred to MT Fish Wildlife & Parks for management. The plan includes direction for campgrounds, weed control, fire rehabilitation, fisheries, habitat improvement on the wildlife management area; heritage resources; integrated pest management; and water quality monitoring. Habitats for a few at-risk plants would be maintained in these areas.
Natural Resources Conservation Service – Montana Soil Health Strategy 2015	Plan briefly outlines goals related to promoting soil health and conservation, primarily on agricultural lands. Soil quality is expected to good, but these areas not likely to support at-risk plant populations on agricultural lands. These areas are considered to put sensitive plants in the grasslands habitat guild at greater risk for impacts with little to no suitable habitat available compared to historic conditions.
County Growth plans (Broadwater, Cascade, Choteau, Jefferson, Judith, Lewis and Clark, Meagher, Ponderosa, Powell, Teton counties)	No at-risk plant protection provided as a part of these plans. Would work with FS to enhance communities. At-risk plant on private lands are considered to be at greater risk of local extirpation due to lack of protections. The county plan generally aim to maintain native vegetation communities and reduce noxious weeds. The reservation of native habitats would maintain habitat for at-risk species where they occur.
Blackfeet Integrated Resource Management Plan	In general Integrated Resource Management Plans there are guidelines for rangeland management to maintain or improve ecological functions in rangeland habitats and eradicate noxious weeds when feasible. They comply with the ESA on tribal lands. There is no information available on at-risk species management, though there is information on

Resource plan	Description and Summary of effects
	preserving native plant communities. In areas managed at natural systems it is likely that at-risk plant species would persist and receive some level of protection; in developed areas there is a high likelihood of eradication of at-risk species.

Conclusions

All action alternatives include language to ensure that SCC and federally listed species are considered during ground-disturbing project activities. The RFSS that would no longer be covered under a protected designation with the draft plan have been individually evaluated and determined not to be at risk of declining in the plan area.

Federally listed plants

Due to the lack of federally listed plant species within the plan area, and on the Forest in general, implementation of any of the proposed alternatives would have no impacts on listed plants.

Candidate for listing: whitebark Pine (Pinus albicaulis)

Indirect and cumulative effects for all alternatives were considered. Whitebark pine is currently trending downwards range wide due to stressors not under NFS control (e.g. disease, climate change) and stressors under NFS control (e.g. fire suppression). This species is expected to benefit from each alternatives by restoration treatments designed to improve habitat. Threats exist in the plan area and would persist under all alternatives. Changes in proposed management designations, such as proposed recommended wilderness acres and lands suitable for timber production, adjust the benefits for whitebark pine by the acres of area feasible for restoration treatments and incidental negative impacts resulting from project activities. The comparison between alternatives is largely qualitative and each subsequent decision would evaluate impacts to this species.

The no-action alternative (alternative A) provides the least direction to treat whitebark pine stands with the intention to improve population health in the plan area. All action alternatives include plan components specifically targeting whitebark pine for 1,500 - 10,000 acres treated during the life of the plan, though restorative whitebark pine treatments are expected under all alternatives. Alternative D has the greatest number of mapped acres with reduced potential for restoration treatment by mechanical methods at 53%, alternatives B and C have the moderate restricted acreage with 41%, and alternatives A and E have the fewest limited acres with 24%. Threats are similar for each alternatives.

Species of conservation concern

Indirect and cumulative effects for plant SCC were analyzed using habitat guilds to compare plan components and impacts of habitat management. There are 6 habitat guilds: peatlands with 7 species, wetland-riparian with 8 species, alpine with 3 species, grassland with 5 species, mesic-montane-disturbance-talus with 6 species, and aquatic with 2 species. Alternative A provides the least direction to protect habitats for SCC, though the at-risk plant species plan components are adequate to maintain viable populations of all SCC in the plan are in conjunction with FS manual guidance. All action alternatives (alternatives B-E) include additional plan components to maintain at-risk plant habitat in the plan and are expected to provide additional beneficial impacts to habitat quality for at-risk plant species in the plan area. The comparison between alternatives is largely qualitative and subsequent project decisions would evaluate impacts to these species while they are designated as SCC.

These species were also considered individually between alternatives to determine the impacts of wilderness designation and lands suitable for timber production. The threats are similar for all alternatives in regards to proposed lands suitable for timber production due to consistent proposed acres and overarching FS manual and at-risk plant components protecting these species during project activities. Threats to SCC are reduced in alternative D due to the highest number of RWA acres. Alternatives B and

C provide the second highest acreage and alternative E provides the least. All action alternatives provide additional opportunities for at-risk plant restoration. Alternatives A, C and E allow motorized and mechanized means of travel in RWAs, which increases threats to at-risk plant species. Alternatives B and D do not allow motorized and mechanized transportation and therefore threats are reduced in these areas.

Regional Forester's sensitive plants species

Indirect and cumulative effects for RFSS were analyzed using habitat guilds to compare plan components and impacts of habitat management. *Carex chordorrhiza, Micranthes tempestiva, Salix barrattiana, Thalictrum alpinum, Trichophorum cespitosum* and *Veratrum californicum* are not known to occur in the plan area, therefore no indirect or cumulative impacts are expected. The remaining species occur within 4 habitat guilds: peatlands with 3 species, wetland-riparian with 3 species, alpine with 5 species, and mesic-montane-disturbance-talus with 2 species. All species that are being removed from the list that overlap with lands suitable for timber production occur in habitats that would be omitted during project activities (e.g. peatlands and wetland-riparian habitats). Habitat would be maintained in the plan area for all species and threats are not considered to pose a risk to decreased viability in the plan area for these species based on BASI and revised plan components that protect specific habitat requirements. As new information becomes available or additional threats become known, these species would be reconsidered for the SCC designation. The comparison between alternatives is qualitative. Additional information on species-specific responses to threats is available in the project record.

3.12 Pollinators

Invertebrate pollinators are crucial components of functioning ecosystems. There is evidence that many species may be in decline due to a variety of factors. Broadly, the desired conditions in the action alternatives increase habitat quality for invertebrate pollinator species and decrease threats with the revised plan components. All alternatives provide habitat for pollinator species in the plan area with native plant species, a variety of habitats, and large areas without the habitat fragmentation that has become characteristic of agricultural and developed land. All action alternatives include plan components specific to pollinators. Those components coupled with the plan components for other resources that improve habitat for pollinators in the plan area contribute more to increases in habitat quality under the action alternatives. Please see the project record for the full specialists report.

3.13 Invasive Plants

3.13.1 Introduction

While invasive plants are often adapted to habitats where they are not native, they lack the natural controls (insects, disease) they may have evolved within their native ranges. As a result, they tend to spread aggressively and reduce overall native community diversity, and generally disrupt the natural processes of the environment. They displace native plants or reduce forage for some animal species, degrade natural communities, change hydrology, change microclimatic features, increase soil erosion, alter wildfire intensity and frequency, and cost millions of dollars in treatments and fire suppression to land management agencies and governments (USDA APHIS 2001). Invasive plants are capable of successfully expanding their populations into new ecosystems beyond their natural range and can create lasting impacts to native plants.

The geographic scope of the analysis for non-native invasive plants are the NFS lands of the HLC NF. This area represents the lands where changes may occur to vegetation as a result of management activities or natural events. For cumulative effects, the analysis area also includes the non-NFS lands within and adjacent to the administrative boundary of the HLC NF.

Measurement Indicators

The following are indicators used for the analysis of invasive species:

- Acres of timber harvest, measured as a qualitative correlation between acres treated or harvested and the potential for ground disturbance at risk for week invasion.
- Miles of open motorized roads and trails, measured as miles of open roads and motorized trails that could serve as weed vectors.
- Acres affected by management changes to livestock grazing, measured as a qualitative assessment of potential changes in disturbance from livestock grazing projects and practices.
- Acres disturbed by fire activity, measured as acres burned by prescribed or wildfire events.

3.13.2 Regulatory framework

Federal law

The Federal Noxious Weed Act of 1974 states that each federal agency shall establish and adequately fund an undesirable plant management program; complete and implement cooperative agreements with state agencies regarding the management of undesirable plant species on federal lands under the agency's jurisdiction; and establish an integrated management system to control or contain undesirable plant species targeted under cooperative agreements.

The Federal Insecticide Fungicide and Rodenticide Act (Public Law 92-516) requires all pesticides to be registered with the Environmental Protection Agency. It also states that it is unlawful to use any registered pesticide in a manner inconsistent with its labeling.

The Carlson-Foley Act of 1968 (Public Law 90-583) authorizes and directs heads of Federal Departments and Agencies to permit control of noxious plants by State and local governments on a reimbursement basis in connection with similar and acceptable weed control programs being carried out on adjacent non-federal land. In other words, this act permits county and state officials to manage noxious weeds with herbicides on Federal lands and to be reimbursed for that management, given that other applicable laws such as the National Environmental Policy Act are also met.

Executive orders

Executive Order 13112 directs federal agencies to prevent the introduction of invasive species; detect and respond rapidly to and control populations of such species in a cost-effective and environmentally-sound manner; to monitor invasive species populations accurately and reliably; to provide for restoration of native species and habitat conditions in ecosystems that have been invaded; to conduct research on invasive species and develop technologies to prevent introduction; to provide for environmentally sound control of invasive species; and to promote public education on invasive species and the means to address them. Federal agencies are also called to collaborate with Federal, State, and local partners to address invasive species that can spread from adjacent lands. All of these actions are subject to the availability of appropriations. The desired condition inferred from Executive Order 13112, FSM 2900 and the national strategy is the prevention of new infestations (within the area where activities would occur or from the use of travel routes associated with those activities) and to manage the infestations currently established on the forest through control measures. For all forests, management goals for invaders are to:

- Potential invaders—prevent establishment, and if found, promptly eradicate
- New invaders—for small infestations, eradicate, and for larger infestations, reduce
- Widespread invaders—contain areas that are already infested and reduce plant populations.

State and local law

The State of Montana County Noxious Weed Management Act states that it is unlawful for any person to permit any noxious weed to propagate or go to seed on the person's land, except that any person who adheres to the noxious weed management program of the person's weed management district or who has entered into and is in compliance with a noxious weed management agreement is considered to be in compliance with this section.

Other regulation, policy, and guidance

The FS National Strategic Framework for Invasive Species Management (2013) provides broad and consistent strategic direction on the prevention, detection, and control of invasive species and incorporates the Invasive Species Systems Approach to respond to threats over the next 5 to 10 years. This policy directs the FS to: 1) Determine the factors that favor establishment and spread of invasive plants; 2) Analyze invasive species risks in resource management projects; and 3) Design management practices that reduce these risks.

3.13.3 Assumptions

It is assumed that the establishment of new, undocumented weed infestations has likely occurred, and are not reflected in the existing condition description for invasive plant infestations.

3.13.4 Best available scientific information used

The HLC NF utilizes the Montana Noxious Weed List (2017) to identify which invasive species to manage across the forest, as well as project specific invasive plant risk assessments (risk assessments). Risk assessments help identify threats to native vegetation as a result of project related ground disturbance and invasive species within or near the project area. They also prescribe mitigation measures to reduce these threats. As project areas are surveyed, new infestations are inventoried. These data are entered into the Natural Resource Manager’s Threatened, Endangered, and Sensitive Plants, and Invasive Species database, a system of database tools for managing Agency data across the forest. Invasive plant infestation data (spatial and tabular) is stored and can be retrieved for later reference and analyses. This database has been continually updated with inventoried infestations with a special emphasis on correcting geospatial data.

Invasive plant treatments are also recorded and entered into the Natural Resource Manager system, which allows the HLC NF to track invasive plant treatment accomplishments.

3.13.5 Affected environment

Land use and land-cover change has undoubtedly been the underpinning for the successful establishment of invasive plant species (Parks et al., 2005). Locally, the rate of establishment and spread has been influenced by timber harvest, road building, grazing, and recreation. Most of these activities began on a large scale in the 1950s and 1960s on the HLC NF.

Current invasive plant infestations

As of December 23, 2014, 142,052 acres (5%) of the HLC NF had been inventoried as having invasive species present. The number of currently recorded invasive plant species is 26. A majority of recoded infestations on the HLC NF are associated with past disturbances. Approximately 98 percent of the current inventoried invasive plant infestations occur within ½ mile of major transportation routes (system roads and trails). 15 percent of the inventoried infestations on the HLC NF are within 30 feet of major system roads and trails. The main vectors for spread are road maintenance equipment, logging vehicles, all-terrain or off-highway vehicles, and passenger cars and trucks. Seeds of many species are also wind or animal dispersed (wildlife and livestock). Many roadless areas remain relatively weed free because of healthy undisturbed native plant communities where few mechanisms exist to spread invasive species.

The most abundant invasive plant species on the HLC NF are spotted knapweed (*Centaurea maculosa*), oxeye daisy (*Leucanthemum vulgare*), dalmation toadflax *(Linaria dalmatica*), musk thistle (*Carduus nutans*) Canada thistle (*Cirsium arvense*), houndstongue (*Cynoglossum officinale*), and leafy spurge (*Euphorbia esula*). The species of highest priority for treatment are spotted knapweed, leafy spurge, toadflax (yellow and dalmatian), orange and meadow hawkweed (*Hieracium spp.*) and those species that are on the state noxious list but not currently present on the HLC NF (e.g., yellow starthistle). These species are known to be highly aggressive (e.g., spotted knapweed) or are not currently established on the HLC NF (e.g., yellow starthistle). Reduction of particular aggressive species is critical for the protection of intact plant communities and associated habitats. Avoiding the establishment of additional species is equally important in the maintenance of healthy landscapes within the HLC NF. Eradication is likely not feasible for many of the invasive species on the HLC NF. Although there are large infestations of species such as Canada thistle and houndstongue, these species are not considered high priority due to their abundance, both on the forest, in the state, and in the West at large. They are still considered a priority to treat but due to the level of infestation of these species on NFS lands, they are targeted for control instead of eradication (some exceptions may apply to specific project areas depending on local conditions).

Disturbance and invasive plant species

Disturbance is widely recognized as a primary influence on plant community composition and is frequently implicated in the spread of invasive exotic plants (Hobbs & Humphries, 1995). Disturbance is defined as “any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment” (Pickett and White 1985). Parks et al. (2005) examined the patterns of invasive plant diversity in northwest mountain ecoregions and found an overwhelming importance of disturbance in facilitating the establishment of non-native plants. Disturbances can occur as a result of natural events such as floods, wind events and animals disturbances. Disturbance can also result from human activities such as construction of roads and trails, livestock grazing, features common to logging activities such as skid-trails and landings, and off-road vehicle use. Fire suppression efforts can also result in disturbances. Fire-line disturbances create suitable conditions for many non-native species to become established (Parks et al., 2005).

Fire and invasive plant species

Even as fire is considered a factor in modifying sites and leading to suitable conditions for weeds, it can also be used to control weeds to an extent (DiTomaso et al., 2006). Considering the fire-prone nature of the HLC NF during the time when these plants would need to be burned (mid- to late-summer), fire is not a practical control tactic. It is useful, however, to remove thatch left behind by dead plants to allow herbicide access to fresh shoots at ground level. This burning approach could be conducted during the fall or spring burning windows.

Treatments such as manual, mechanical, biological, and chemical methods are used to treat infestations and are typically focused on those species included on the Montana state noxious weed list. Containment tactics are employed when eradication is not feasible. Containment tactics combine prevention and treatment actions with the objective of limiting the spread of an existing infestation, reducing the acres of existing infestations by treating around the perimeter of the infestation and increasing the resiliency of threatened ecosystems to mitigate the impacts of the invading species.

Treatment of identified infestations is accomplished through herbicide applications and biological control, from this point forward referred to as “treatments.” The HLC NF has a strong commitment to weed control efforts and cooperates with a variety of partners (such as non-governmental organizations, counties, and state agencies) to accomplish these treatments.

Over the past 5 years, a total of 56,842 acres of invasive plants have been treated on NFS lands on the HLC NF. The average acres treated per year is approximately 9,473 acres. A typical year would result in the treatment of six to seven thousand acres as large aerial projects on the Helena NF have increased the average. Specific treatment levels vary depending on funding levels and project priorities. Treatments include both herbicide and biological control methods and are accomplished by FS employees, counties (through agreements), volunteers (cooperative spray days) and other partners.

Criteria for determining order of treatment priority are influenced by the species to be controlled, its rate of spread, infestation size, habitat, and location. Species vary in their reproduction methods, and weeds that reproduce vegetatively require different treatment methods than species that only reproduce by seed.

Areas of high public use, such as roads, trails, campgrounds, trailheads and other recreation sites are a high priority since these areas receive a lot of visitor use and are typically at greater risk of invasion and/or function as vectors into less infested areas. Other areas that are remote and/or are less disturbed and considered natural areas (e.g., wilderness and RNAs) and areas considered to be weed free are also a high priority for treatment. These areas are a high priority due to the effort needed to access and treat the areas as well as the fact that they are presumably not yet heavily infested or are weed free. There is a far greater chance for eradication and equally lower costs associated with management when infestations are detected and treated early.

Removal of roads and trails can lead to an increased risk of invasion or expansion of existing infestations. The HLC NF has implemented mitigation measures such as seeding of temporary roads to improve desirable species cover and reduce invasive species infestations. Desirable non-native mixes of grasses and forbs have primarily been used in the past. Native grasses and forbs have been used only recently. Observations of some of the temporary roads constructed in the last 30 to 40 years indicate some success in the prevention of invasive plant invasion within the road corridors. Sun-loving species, such as knapweed, are not as abundant as the native and non-native grass and forb seed mixes on these old roads. However, shade-tolerant species, such as Canada thistle, hounds tongue and musk thistle are often abundant along these legacy roads. There is no information on the design and construction of these legacy roads or subsequent early rehabilitated efforts. As such, it is difficult to infer specifics of how invasive species became established along the legacy road beds. Observations of historic roads (built over 50 years ago) indicate that plant communities on some roads may naturally recover as the road prism is filled in by forest vegetation. A majority of legacy roads were constructed to support harvest operations. Prevention measures were most likely not implemented during these older harvest operations.

The HLC NF now implements an integrated invasive species management process for all approved management actions. Methods used to prevent invasive species from being introduced and spreading into new areas include closing infested areas to travel, washing vehicles and equipment upon entering an area, requiring use of weed-free hay for pack animals, and using weed-free seed and straw mulch for re-vegetation. Treatments such as manual, mechanical, biological, and chemical methods are generally limited to localized areas and those species on the Montana state list. Containment combines prevention and treatment with the objective of limiting spread of an existing infestation and reducing the acres of existing infestations by treating around the perimeter of the infestation. Invasive weed management in cooperation with private and agency partners, county weed districts and others is important in all of these treatment activities. Seeding of temporary roads as a conservation measure to reduce invasive species infestations has been occurring on NFs for many years. Desirable non-native mixes of grasses and forbs have primarily been used in the past. Native grasses and forbs have been used more in recent years.

Infestations in some sites have been reduced by these measures. However, in spite of these control efforts, existing infestations continue to invade disturbed areas and intact plant communities. Changes to the landscape with warmer temperatures, associated drier conditions, and more severe or frequent droughts, may lead to more frequent fires and may increase the ability of invasive plants to out-compete native plants in the future.

3.13.6 Environmental consequences

Effects common to all alternatives

Invasive species will continue to have a presence on the HLC NF landscape, with existing infestations and continual introductions of new invaders. Some invasive species have become almost "naturalized" to vegetation communities on the HLC NF, and some level of their presence will persist in all alternatives. Other invasive species have become well-established and continue to increase in dominance within native plant communities. Canada thistle, cheatgrass, houndstongue, Kentucky bluegrass, smooth brome, and timothy are all examples of invasive species that have spread to many herbaceous plant communities across the Forest. Management under alternatives would attempt to slow the spread and introductions of new invaders as well as prevent existing weed species from establishing to new non-infested areas. The HLC NF will continue to conduct weed treatments with the most effective options (chemical, mechanical, and biological) as they become available and to implement mitigations such as the weed-free forage program, and vehicle washing/inspections for contract work.

Development of additional management direction for noxious weeds has occurred under the existing Forest Plans and implementation may continue based on this direction under all alternatives. In 1994, the Lewis and Clark NF signed a ROD for the Noxious Weed Control FEIS, which implemented an integrated pest management approach to treat 1,787 acres of NFS lands, as well as providing the ability to apply herbicide in wilderness areas. The analysis also evaluated the use of new herbicides and imposed new environmental safeguards. However, the analysis (1994) underestimated future invasive species problems and limits weed managers on available tools.

The Helena NF issued a ROD for Noxious Weed Treatment in May of 2006. The document authorized a more aggressive noxious weed control approach by permitting additional types of herbicides, adopting adaptive management, and broadening herbicide application methods to include aerial treatment options. Existing and newly approved biological agents could also be introduced to infestations where appropriate. The selected alternative contained environmental protection measures to reduce non-target species exposure to herbicides caused by spray drift through wind speed restrictions during application, buffering of sensitive areas, weather monitoring, boundary marking, and restrictions on areas to be sprayed, and use of drift reduction agents.

Under all alternatives, management of invasive species would continue following Noxious Weed Control EIS documents (1994, 2006). Both Noxious Weed analysis documents provide acceptable invasive species management options while being flexible to budget constraints, but are not quickly adaptable to adopt new technology and treatment options.

All alternatives contain multiple use resource management objectives, with varying degrees of forest vegetation management. Timber production, livestock grazing, and farming activities continue to provide endpoints for introduction and subsequent seed dispersal, as well as the environmental disturbance that enhances germination and establishment of non-native plants (Toney et al. 1998).

Invasive species have significantly increased across the HLC NF, with a present infestation level of approximately 142,000 acres. Assuming that the national average annual rate of spread of 8 to 12 percent applies, the HLC NF can expect to encounter an increase in invasive plant infestations at a rate of up to approximately 11,000 to 17,000 acres per year (when applying the range of 8% to 12% rate of spread to the current combined inventory of 142,052 acres). Initial data review suggests that the rate of spreads is greater on the western portions of the HLC NF (Helena NF) and less rapid on the Eastern portion (Lewis and Clark NF) due to differences in precipitation and habitat types.

Of equal importance is the current and predicted continuation of globalization, or the free movement of goods, capital, services, people, technology, and information. Globalization processes will most likely significantly affect the State of Montana, especially as the human population continues to grow. Globalization facilitates and intensifies the spread of invasive alien species (Meyerson & Mooney, 2007). As a result, the extent and density of invasive plant infestations as well as the number of invasive plant species has the potential to increase on NFS lands within the plan area.

Climate change

Climate change is likely to result in differing responses among invasive plant species, due to differences in their ecological and life history characteristics. Climate change could result in either range expansion or contraction of an invasive species (Halofsky et al., in press-b). For example, modeling indicates that leafy spurge is likely to contract and spotted knapweed is likely to shift in range. Invasive species are generally adaptable, capable of relatively rapid genetic change, and many have life history strategies (e.g., prolific seed production, extensive deep roots) which can enhance their ability to invade new areas in response to changes in ecosystem conditions. Warmer temperatures, and associated drier conditions, more severe or frequent droughts, and more favorable conditions for wildland fire may increase the ability of invasive plants to establish and out-compete native plants. These changes may provide more opportunities for invasive plants to gain an advantage over native species, and spread within and beyond the HLC NF's boundaries. This potential effect is common to all alternatives.

Studies have shown that elevated carbon dioxide levels can lead to a reduction in herbicide efficacy (Archambault 2007, (Ziska & R., 2000). Reduced treatment effectiveness coupled with the potential for increased opportunities for growth and vigor has the potential for invasive plants to gain an even greater advantage over native species.

The effects of climate change on species' distributions are likely to be complex given the potentially differing climatic controls over upper and lower distribution limits (Harsch & Ris Lambers, 2015). Some studies predict a movement in some invasive plant species range closer to the poles or upward in elevation (Chen, Hill, Ohlemuller, Roy, & Thomas, 2011). Pauchard et al. (2009) suggest that the threat posed to high-elevation biodiversity by invasive plant species is likely to increase because of globalization and climate change. Other studies, such as Harsch and Lambers (2015) suggest that distribution shifts in response to recent climate change could occur in either direction (upward or downward).

Fire is another factor affected by climate change. When combined with climate change, fire/invasive plant relationships may be exacerbated leading to greater invasive species populations and spread. Other disturbances or shifts in historical patterns may be affected by climate change and in turn affect the spread of invasive species. As the agency responds to climate change by new, different, or more land and vegetation management actions, those disturbances could provide suitable conditions for invasive plants.

Effects from plan components associated with:

Infrastructure

In all alternatives, inadvertent seed spread could decrease areas that are either closed to motorized access or are more difficult to access. During road closure/decommissioning activities that require short-term ground disturbance, there could be short-term invasive plant establishment until invasive weed treatments are applied to the disturbed area. Additionally, road closures and/or decommissioning make administrative access more difficult to treat invasive species in some areas of the forest. Many of the roads and trails previously closed to motorized vehicles have invasive species present within the trail corridor. These infestations, known and yet to be discovered, are a concern for weed managers under all alternatives.

Road obliteration projects for travel management purposes also can create ideal conditions for invasive species to establish. Road obliteration would occur under all alternatives.

Road maintenance, reconstruction and construction can contribute to the establishment and spread of invasive plants. Gravel pits can oftentimes become infested with weeds if not routinely checked and treated. Weed seeds can be spread onto lands far from the gravel pit when gravel is used for road surfacing or other purposes. This potential for this effect would be the same under all alternatives; however plan components are in place to mitigate this. Management direction to address invasive plant species is in place for all alternatives and would continue to be followed. Gravel pits and main road corridors would be a priorities to consider for weed management and treatments.

Fire

Fire can result in an increase in non-native species diversity and cover, whether it is a prescribed burn or a wildfire (Zouhar, Kapler Smith, Sutherland, & Brooks, 2008). Invasive species such as cheatgrass may alter fire regimes in drier forests, shrublands and grasslands which comprise much of the HLC.

Wildfires would occur in the future under all alternatives, although uncertainty exists as to extent and location. Weather and climatic factors along with fuels conditions would affect intensity and spread of a fire event. Effects of wildfire on invasive species spread potential is the same across alternatives. Generally, prescribed fire implementation would be similar under all alternatives as well. There is potential for establishment and spread of invasive plant species within burned areas, depending largely upon site-specific conditions, such as fire location, vegetation types that were burned, presence of weed infestations pre-fire, potential vectors, and fire characteristics. Weed infestations within burned areas would be addressed following forest plan management direction, which is similar for all alternatives.

Recreation

Recreational activities, including non-motorized, are vectors for potential seed establishment and dispersal. Recreation activities and areas receive concentrated and frequent use and continual ground disturbance. Generally, wilderness areas and large un-roaded lands are less likely to contain invasive weeds due to less widespread public access, especially via motorized means. However, these large un-roaded areas are vulnerable to weed infestation and spread from recreational uses. Seed transport happens inadvertently, by humans, dogs, and pack stock. Trails that receive high uses, including those in wilderness areas, are vulnerable to invasive weed infestation. Mountain bike, horse, and motorized trails may be at higher risk of introduction, spread and establishment of weeds compared to hiking trails. Areas of high use and ground disturbance occur within wilderness areas and are as vulnerable to weed infestation as developed sites outside wilderness. Frequently, infestations are found around trailheads, trails, campgrounds, and other developed recreation sites. These seed sources pose a risk of further spread into wilderness and undeveloped lands. Areas located immediately adjacent to and surrounding developments tend to experience the most disturbance, while the peripheries of these areas are less disturbed and less likely to be favorable for invasive species establishment and persistence.

Methods used to help prevent invasive species from being introduced and spreading into recreation areas include public education and requirements for use of weed-free hay for pack stock. Public education efforts, such as the Play Clean Go campaign, have helped raise invasive species awareness for many recreational activities. Lack of public knowledge, combined with limited enforcement and/or monitoring options for recreational activities is a concern for weed introductions, and would be similar for all alternatives.

Wildlife

Invasive species expansion is most likely occurring to some degree with transport of seed from wildlife. Several satellite patches of noxious weeds are located on the HLC NF that are far from roads and trails, have no possible livestock or pack animal access, and are far from any know infestation. Native ungulates can move seeds from infested areas and relocate them in remote or off-the-grid areas. Hounds tongue has been and will continue to be on the move throughout the forest, but other species such as spotted knapweed and toadflax species are showing up in unexplainable places. Birds could be a major transporter of Dalmatian toadflax on the Helena and Townsend Ranger Districts. These transport issues from wildlife will continue under all alternatives.

All alternatives would incorporate standards and guidelines of the Grizzly Bear Conservation Strategy. This strategy is not expected to create un-due hardship to noxious weed control efforts for the Forest as treatments are already limited in time and space within the primary conservation area, as weed infestations are generally lower as compared to other areas of the HLC NF. Budget constraints, topography, and lack of personnel also already hinder weed treatment options within the primary conservation area. Weed treatments generally occur as opportunities allow in the backcountry.

Effects common to all action alternatives

A primary difference the action alternatives have compared to the no-action alternative is their targeted management direction, including treatment objectives and more clarity regarding treatment strategies, priorities and methods. Management direction under all the action alternatives for non-native invasive plants includes a guideline and treatment objective to obtain desired conditions of invasive species control and maintenance of natural ecological functions. Targeted objectives for non-invasive plant control are an administrative change that promotes measurable objectives and accountability to the program toward reaching desired conditions. The objective was chosen to be responsive toward desirable conditions while also being flexible to uncertain yearly budgets, which is the program's primary operating constraint.

While preference for use of low-leaching chemical treatments is currently exercised under the no-action alternative, the action alternatives formalize this practice, and promote effective long-term treatments that are compatible with other resources. Consideration of technological advances in weed treatments is emphasized, if they are shown equivalent to, or more effective than, existing treatments. Preference is stated regarding the use of low-leaching chemical treatments and application methods to minimize ground and subsurface drift effects. Additionally, the ability to evaluate and incorporate new chemical treatments, if equivalent or more effective than existing treatments, to the integrated pest management program is also current program practice. Thus, the action alternatives update the 1986 forest plans by formalizing current invasive species management practices that prevent or decrease the spread or densities of noxious weeds and invasive plans and enhance native plant communities.

Alternative A, no action

The current Helena and Lewis and Clark forest plans, as amended, are the existing management direction being used by the HLC NF to address non-native invasive plants. This direction represents the no-action alternative. However, because the no-action alternative is the baseline to which the action alternatives are compared, it is important to understand what actions would continue under the no-action alternative.

The existing Helena NF Plan (1986) and Lewis and Clark NF Plan (1986b) include forestwide objectives that emphasized the need to control noxious weeds through an integrated pest management approach utilizing chemical, biological, and mechanical methods. The Helena NF Plan specifically called for spot herbicide treatment of identified weeds and considering biological control as it became available (1986 HNF Plan, II-22). The Lewis and Clark NF Plan (1986) discussed in even lesser detail the need to control noxious weeds through an integrated pest management strategy. At the time of these forest plans' publication, the extent and magnitude of ecological issues invasive species would create for the HLC NF was unforeseeable.

The 1986 forest plans lack specificity in plan direction for noxious and invasive species management. The no-action alternative as amended with Noxious Weed Control FEIS documents (1994, 2006) encompasses current management practices on the Helena NF, but is outdated and limits managers on Lewis and Clark NF.

Effects that vary by alternative

Effects of plan components associated with:

Watershed, aquatic habitat, riparian areas, and soils

Plan components and activities related to watershed, soil, riparian, and aquatic habitat would have effects on invasive plant management. The plan components that would have the greatest influence are those associated with RMZs. With the action alternatives, east of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative. Please refer to the RMZ section.

With the action alternatives, the use of herbicide treatments within RMZs would be limited to instances where they are needed to maintain, protect, or enhance aquatic and riparian resources or to restore native plant communities (FW-RMZ-STD-05). Further, peatlands, fens, and other groundwater dependent ecosystems would be buffered 100 feet from management activities that alter water chemistry, unless site-specific information supports a smaller or larger buffer (FW-RMZ-GDL-03). These components may limit the treatment methods for some invasive plants in riparian areas and near groundwater dependent ecosystems; for example, hand pulling may be required instead of herbicide use. The herbicides selected for use in these areas would be those that would not alter water chemistry.

Timber and vegetation management

Ground-disturbing activities, equipment transport and use associated with management activities such as timber harvesting, fire treatments and fire suppression, or other authorized uses are a common vector influencing the expansion of noxious weeds. Most of these risks are minimized with localized site restoration and rehabilitation, as well as the use of weed control measures during implementation (e.g., contract clauses to wash equipment).

Vegetation management activities such as timber harvest, the use of skidders and mechanical harvest techniques and equipment have contributed to the introduction, spread, establishment and persistence on the landscape. Contract specifications help prevent introduction of weed seed to units from outside NFS lands by requiring cleaning of equipment. Other weed BMPs include pre- and post-implementation spraying of haul routes, as well as seeding disturbed areas after implementation to prevent establishment of infestations.

Lands suitable for timber production are where the vast majority of timber harvest activities and associated road access could be expected to occur. It could be assumed that a larger amount of area suitable for timber production may result in more areas where timber harvest or active management could occur. In actuality, acres harvested are not necessarily directly tied to the amount of suitable lands, but also to the treatment type that may be applied. Timber harvest may also occur on lands unsuitable for timber production. For analysis of potential of invasive species spread, projected harvest acres were used to assume the amount of ground disturbance expected to occur. The direct correlation between ground disturbance and potential of invasive species to establish in those areas was used to differentiate effects between alternatives. Table 59 provides a comparison of lands suitable for timber production and the projected harvest by alternative.

Table 59. Acres of lands suitable for timber production and projected harvest by alternative

	A	B	C	D	E
Acres of land suitable for timber production	430,489	442,601	442,601	431730	474,184

	A	B	C	D	E
Projected average annual harvest acres (decade 1 constrained by budget)	4,108	4,091	4,091	4,075	2,336

The potential ground disturbing activities associated with timber harvest would be similar for alternatives A, B, C, and D, and therefore, potential weed spread would be similar. Alternative E would be the most favorable for restricting weed spread as the alternative would have the fewest acres harvested under a constrained budget. Alternative E would also harvest timber on more productive forest lands, which generally receive more moisture. These sites, in general, would be more resilient with quicker re-establishment of native vegetation and thus more resistant to invasive species.

Based on projected harvest levels, no single alternative presents weed managers with an unmanageable level of monitoring or treatment workload as it relates to timber management activities.

Motorized use and recreation settings

A main vector for seed spread is vehicle use (Taylor, Brummer, Taper, Wing, & Rew, 2012). Many existing infestations can be found along, or have originated from, roadsides because vehicle traffic provides ideal means for noxious weed spread. Primitive two-track roads also provide opportunity for noxious weeds to become established on areas of bare soil and disturbance. Once invasive species establish on road or trailside prism, the threat of spreading into adjacent native plant communities has a high likelihood if vigilant monitoring and treatments do not occur. An even greater threat for spread of invasive species is from unauthorized cross-country travel. Infestations can go undetected for years, resulting in a well-established population that oftentimes are difficult to access.

Transportation of weed seed by contractor or special use vehicles, or equipment, on NFS roads is managed to a degree. Contract stipulations are used to require specific actions, e.g., vehicle and equipment washing, to lessen the possibility of weed transport to reduce the risk of new infestations. Recreational use of roads and motorized trails as well as unauthorized cross-country travel by the general public presents a greater risk, because of the lack of control measures and the lack of knowledge about invasive species spread.

Alternatives vary in the amount of motorized access opportunities for recreational use, both on roads and trails, based on ROS settings. Summer motorized uses pose the greatest risk of invasive weed transport. Because of the small differences and site-specific localized nature of weed infestation and spread, changes in weed infestations estimated at the programmatic level would be subtle and may not be noticeable on the ground. In general, the potential for weed infestation threats would be heavily correlated to the amount of open motorized routes and area of summer motorized travel (Table 60).

Table 60. Miles of open roads, trails and percent of desired ROS settings pertaining to summer use

Alternative	Miles of open Roads and Trails	Acres of Primitive/semi-primitive (summer)	Acres of semi-primitive motorized (summer)	Roaded natural (summer)	Percent of total forest open to motorized (roaded natural and semi-primitive)
A	4462	1,789,460	365,953	700,160	37
B	4448	1,801,888	367,377	686,186	37
C	4462	1,802,251	367,323	685,877	37
D	4383	1,849,039	341,327	666,817	35
E	4462	1,782,174	244,040	830,397	37

Alternative D would be the most favorable to limit the spread of invasive species from motorized use because it has the least about of open roads and trails and acreage identified in motorized ROS classes. Alternatives A and E would be similar for having a higher potential to increase the spread of invasive species through motorized transportation since the alternatives have the most miles of open motorized routes and less acres of primitive/semi-primitive settings. Alternatives B and C would be have similar effects to weed spread, with alternative B being more favorable as motorized trails are slightly less.

Although alternative D would be the most favorable for slowing the spread of invasive species by motorized means, the alternative could also create issues for existing weed infestations to go undetected and untreated in new RWAs. Alternative D would eliminate the most miles of open routes and possible weed vectors of any alternative, but could also increase treatment difficulty or detection of existing weed populations in recommended wilderness. As long as resources continued to be devoted to monitoring and treatment of weeds on closed motorized routes, minimal negative effects would result from all action alternatives with a reduction in road and trail mileage.

Livestock grazing

Invasive species expansion may also occur with the transport of seed by livestock from infested areas. Seeds can be spread through livestock feces, fleeces, and hooves, and many can pass through an animal's digestive system and retain the ability to germinate (A. Joy Belsky & Gelbard, 2000). Native grazers such as mule deer, bighorn sheep and elk, and some birds such as mourning doves and starlings (Carr 1993), can also perform this same method of seed spread. Conversely, domestic livestock grazing (in a process known as prescribed grazing) has also been shown to be an effective method in managing some large invasive plant infestations while assisting the ecological succession process (Jacobs, 2007).

Localized areas where congregation can occur, such as water developments and supplement locations, contribute to reduced ground cover and can become potentially susceptible to invasive plant establishment. All alternatives could have equal impacts from domestic livestock grazing relating to invasive species establishment on acres where disturbance results in reduced native plant vigor and cover. Action alternatives include plan components that should enhance rangeland vegetation communities, which would be more resistant to invasive species. Options to adjust livestock grazing management in the future may involve more range improvement infrastructure, thus increasing acres disturbed by construction activities in the short run. Some initial ground disturbance from new off-site water development and fencing may cause some ground disturbance, and therefore, provide a niche for invasive plants to establish. In the long term, action alternatives would improve livestock grazing management, which in turn promotes the enhancement of desirable native plant communities. Action alternatives provide plan components to increase the resistance and resilience of native plant communities and pursue the best available invasive species management options while maintaining multiple uses like livestock grazing.

Fire and fuels

Site-specific projects are evaluated under the NEPA for the impact of invasive species and generally projects have requirements to prevent their spread as mitigations for project implementation. For fire treatments, both wildfire, and planned ignitions, invasive species introduction, spread, establishment and persistence has a potential for occurrence. These circumstances result in a change of treatment priorities for the invasive species management program, under all alternatives.

Projected prescribed burning acres are similar for alternatives A, B, C, and D, and less with alternative E. Therefore alternative E would have slightly less potential to encourage the spread of invasive species through vegetation management activities than the other alternatives. However, for all alternatives plan components are in place that would limit or mitigate this potential.

Cumulative Effects

Invasive species spread without regard to administrative boundaries. As such, the cumulative effects of the HLC NF invasive species management under any alternative, including the no-action alternative, may negatively or beneficially impact adjacent federal, state and private lands depending upon the specific site treatment or lack thereof. Adjacent or nearby landowners specific site conditions and weed treatment efforts also would affect weed conditions and treatments on NFS lands. Over 327,895 acres of individual and other private entity lands lie within the boundaries of the plan areas of the Forest, though not all these lands are directly adjacent to NFS lands. Under all of the alternatives, coordination with state and local agencies and communication with the public would continue to combat the spread of undesirable non-native invasive species.

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 61, for those plans applicable to invasive species management.

Table 61. Summary of cumulative effects to invasive species from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All plans address invasive species management. Generally speaking, management of invasive species is consistent across all NFs due to law, regulation, and policy. The cumulative effect would be that the management of invasive plants would be generally complementary. This includes specific adjacent landscapes that cross Forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components related to invasive species, and would therefore be complementary to the plan components for the HLC NF. Weed control efforts on BLM lands have great potential to influence spread on invasives to Forest lands.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the plan shares common goals and desired conditions to reduce invasive species in this area, which is similar to the wilderness areas in the adjacent Rocky Mountain Range GA. This plan would be complementary to the goals of the HLC NF concerning invasive species.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily nonforested, and calls for managing invasive species that is generally complementary to efforts on the HLC NF.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Invasive species management is a component of these parks, although not always the primary feature. Management of invasive species in these areas would help control the spread to other areas, as visitors to these parks would most likely visit the HLC NF at some point. Goals for invasive species management would be largely complimentary to the goals of the HLC NF.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact Forest Plans and be complementary to the efforts to manage invasive weeds.

Resource plan	Description and Summary of effects
County noxious weed control agreements	Most counties within the plan area have agreements with the HLC NF which coordinate noxious weed treatment areas and roads as well as provide a mechanism for the in which the Forest can financially fund county weed control efforts on NFS lands and other priority areas in order to help preserve native plant communities at the landscape level. These weed agreements are consistent with goals and objectives of the HLC NF.

Conclusions

Alternatives B, C, D, and E update the 1986 Forest Plans for management of non-native invasive plants by formalizing current, effective invasive species management practices. Plan components in action alternatives should have a positive effects to slow the spread of invasive plants as well as manage existing infestations by moving towards adopting best tools and practices available in the future. These practices are administrative in nature and result in no adverse effects to the invasive species management program.

Plan components regarding livestock grazing should generally have positive effects on rangeland vegetation condition. In turn, acres within grazing allotments should have more resilient and resistant plant communities that can compete with invasive species to a certain degree. Small, localized areas of disturbance relating to range improvement construction may be vulnerable to weed infestation and will need monitoring and treatment actions built into project design. However, these improvements should help improve vegetation condition and grazing management that will benefit rangeland vegetation in the future.

All alternatives have potential to create similar amounts of disturbance relating to timber harvest. Alternative E may be the most favorable as far as limiting the total harvest footprint on the Forest. Vegetation management projects will have plan components that prescribe BMPs that should limit the introduction of invasive species as well as implement treatment options if they are found.

Alternative D, with more RWAs, would have 65 less miles of open road and trail mileage than the next lowest alternative. In terms of trail mileage as a weed vector, alternative D would be move favorable to limit the spread of invasive species. All alternatives have options to treat weeds on open motorized routes.

Ultimately, consequences to non-native invasive plants from forest plan components associated with other resource programs or revision topics are similar under both the no-action and action alternatives. An aggressive integrated pest management approach must be implemented in order to keep invasive species from expanding beyond existing infestation levels.

3.14 Terrestrial Wildlife Diversity

3.14.1 Introduction

The 2012 Planning Rule (U.S. Department of Agriculture, Forest Service, 2012) provides direction to maintain diversity of animal communities and the persistence of native species through emphasis on a coarse filter approach (FSH 1909.12 23.11 (1) (c)) (USDA, 2015). As described in the Rule and in the Directives, plan components developed for ecosystem integrity and ecosystem diversity are expected to provide for ecological conditions necessary to maintain the persistence or contribute to the recovery of native species within the plan area (FSH 1909.12, sec 23.11).

By design, this section relies on the coarse-filter information in the terrestrial vegetation section. Plant communities discussed in the terrestrial vegetation section are discussed here as vegetation groups or as plant communities that generally provide for the needs of a number of wildlife species.

The Rule recognizes that for some at-risk species (i.e. threatened, endangered, proposed, or candidate species or those identified as SCC), coarse-filter plan components may not be sufficient to ensure recovery or persistence of those species within the plan area. Where that is the case, species-specific plan components that would contribute to the recovery of listed species or maintain the viability of SCC within the plan area (219.9 (b) (1)) (U.S. Department of Agriculture, Forest Service, 2012) are included in the plan.

Terrestrial wildlife species are important as contributors to biological diversity and ecosystem integrity, as well as providing benefits to humans.

Organization of the terrestrial wildlife section

This section is organized by key ecosystems or groupings of vegetation systems or their characteristics, such as size or structural class, that provide habitat for associated wildlife species. Although all wildlife species ultimately rely on vegetation, various aspects of that vegetation are the key components of habitat. Some species are associated with a particular cover type or group of cover types, whereas others may be associated with a structural stage (e.g. early seral openings, large dead trees, etc.), or with a combination of type and structure. Some species are more strongly associated with certain landscape features, such as cliffs, streams, or caves. For the purposes of analyzing how the alternatives provide for the ecological conditions required by terrestrial wildlife species, this section discusses wildlife species in the context of the vegetation group, structural stage, or landscape feature most often associated with their requirements or that contributes to a key or critical part of their life history. That discussion provides an analysis of the ecological conditions (coarse filter) expected to maintain the diversity of native wildlife species.

Most native wildlife species' needs are evaluated in the context of the habitat groupings as described in the above paragraph, so most wildlife species are not discussed individually. For some species, however, species-specific or habitat-specific plan components were considered necessary to mitigate potentially negative impacts of management actions or activities occurring on NFS lands. The effects of those plan components are described within the section where the species is discussed, even where that section may not relate to the species-specific components. For example, bighorn sheep are discussed under the section "Species Associated with Grass and Shrub Habitats", because that vegetation type is critical for bighorn sheep foraging and movement. The revised plan includes components for separation of bighorn sheep from domestic sheep; those components are not related to the vegetation group, but the consequences of those components are discussed within the section "Species Associated with Grass and Shrub Habitats" because that is where bighorn sheep are otherwise addressed. Similarly, species currently designated by the Regional Forester as sensitive (RFSS) are discussed briefly in the section for the vegetation or landscape feature group with which they are associated. A detailed analysis of potential effects to species currently listed as sensitive will be provided in a separate BE to be prepared when a preferred alternative is selected. The BE will be completed concurrent with the FEIS.

The sections that address species associated with specific vegetation groups, structural stages, or landscape features are followed by a discussion about the potential effects of plan components guiding management of specific resources or broad programs (e.g., livestock grazing, recreation, minerals and energy development, etc.).

3.14.2 Regulatory framework

Please refer to the introductory regulatory framework section of this chapter (3.3).

3.14.3 Assumptions

The primary assumption underlying the analysis in this section is based on the 2012 Planning rule and the directives for implementing the rule: that plan components developed for ecosystem integrity and ecosystem diversity would provide for ecological conditions necessary to maintain the persistence or contribute to the recovery of native species within the plan area (FHS 1909.12, 23.13). Therefore, we assume that effects to vegetation systems and characteristics as described in the terrestrial vegetation section provide the basis for understanding most of the potential effects to wildlife species associated with those systems.

The directives for implementing the planning rule state that “ecological conditions include habitat and the effects of human uses (for example, recreation, grazing, and mining)” (FHS 1909.12, 23.13). We have incorporated this assumption into this section.

The analyses discussed in the terrestrial vegetation section rely on two analytical models, SIMPPLLE and Spectrum, which are described in that section and in appendix B. Those models “use numerous assumptions to simplify ecosystem processes as well as treatment implementation”. The assumptions that are a part of the vegetation analysis are inherently part of the analysis of impacts to wildlife species using those vegetation systems.

3.14.4 Best available scientific information used

A thorough review of the scientific information was completed, and the BASI was used to inform the planning process and develop plan components. Key information on the population, life history, and status of animal species on the HLC NF was obtained from the Montana Field Guide (http://fieldguide.mt.gov) as well as from other sources listed in the references section of this document. Published, peer-reviewed articles and data in which reliable statistical or other scientific methods were used, where those were available. For best relevance, studies conducted in north-central or north-western Montana, western North America, or other areas with habitat conditions similar to those in the plan area where used, where those were available. When not available, articles that considered ecological processes or conditions similar to those in the plan area were used. The planning rule acknowledges that the BASI may include expert opinions, inventories, or observation data prepared and managed by the FS or other agencies, universities, reputable scientific organizations, and data from public and governmental participation. Those sources of information were relied upon when published, peer-reviewed information was not available or when needed to provide additional information specific to the plan area. Where needed in the assessment and in this section, specific discussion may be included regarding contradictory science, why some information is used to the exclusion of others, and regarding areas for which scientific information is lacking.

Because the number of terrestrial wildlife species present on the HLC NF is vast, it is not feasible nor useful to summarize here the large body of current scientific literature or other information available. Sources that were used regarding the presence, distribution, requirements, or impacts to various species are cited throughout the text of this section. Because of the programmatic level of this analysis, however, detailed discussion of the life histories and drivers of terrestrial wildlife species and populations are generally not provided here. The information in this analysis relies heavily on information in the Assessment of the Helena and Lewis and Clark National Forests (U.S. Department of Agriculture, Forest Service, Northern Region, 2015) regarding both terrestrial wildlife species and vegetation. That document contains extensive citations and bibliographies of the science used to determine life history, status, presence and distribution, threats, and drivers of terrestrial wildlife species and terrestrial vegetation. Additional discussion of science regarding terrestrial wildlife and vegetation is found in supporting materials in the project file.

Please also refer to the terrestrial vegetation and aquatic ecosystems sections. Analysis for those resources forms the foundation of analysis of terrestrial wildlife species considered in this section.

3.14.5 Affected environment

Species associated with aquatic, wetland, and riparian habitats, affected environment

This vegetation group includes the riparian/grass shrub cover type along with aquatic and wetland environments where that cover type occurs, and some associated forested areas. Riparian associated vegetation and systems are identified and categorized in a variety of ways, making description of the affected environment somewhat complex. The affected environment for the riparian/grass shrub cover type is described in the terrestrial vegetation section and as a component of the non-forested cover type. Additional description of the riparian/wetland habitat type is provided in the assessment (U.S. Department of Agriculture, Forest Service, Northern Region, 2015) in the Riparian Species Guild section.

Aquatic, wetland, and riparian habitats are inherently limited in the plan area. Estimates vary depending on the data sources used. Slightly more than 20,000 acres of riparian/wetland habitat type occur on the HLC NF (U.S. Department of Agriculture, Forest Service, Northern Region, 2015). River or riverine systems make up 1% or less of the administrative area in each GA, with the exception of the Highwoods, where they make up over 5% (ibid).

Many wildlife species use aquatic, wetland, or riparian habitats during all or a portion of their life cycle, and riparian areas can be of particular importance in maintaining connectivity within watersheds. Examples of terrestrial wildlife species that are dependent on these habitats for all or part of their life cycle and that occur on the HLC NF include several amphibian and small mammal species, a variety of waterfowl, shorebirds, and migratory birds, garter snakes, several bat species, beavers and moose. Low-elevation riparian areas may be important to black and grizzly bears, particularly during spring or during hot dry periods in the summer months.

Species that are currently identified as Regional sensitive species (RFSS) and that rely on aquatic, wetland, or riparian habitats for all or part of their life cycle include bald eagle (forages and nests near rivers and lakes), harlequin duck (breeds on fast-moving, low-gradient mountain streams), northern bog lemming (found mainly in peatlands and wet meadows with sphagnum component), and western toad (breeds in shallow, silt-bottom ponds with emergent vegetation).

Stressors under Forest Service control

Stressors to these systems that can be influenced by FS management actions include livestock grazing, invasive species, pattern and timing of motor vehicle use, draining or diversion, administrative or recreational facility development, harvest of adjacent timber, and prescribed fire. Not all of these processes or actions are stressors to all species using these habitats.

Stressors not under Forest Service control

Threats to these systems that are not under control of FS management include drought, climate change, alterations to hydrology occurring on connected or adjoining non-NFS lands, and alterations to water chemistry resulting from pollution, sedimentation, or other inputs originating outside of FS control. Threats to terrestrial wildlife species using these habitats may include those as well as some types of human disturbance.

Species associated with grass and shrub habitats, affected environment

This vegetation group comprises the grass, dry shrub, and mesic shrub cover types described in the terrestrial vegetation section. The affected environment for this cover type is described in the terrestrial vegetation section, and as a component of the non-forested cover type. Although the grass and shrub cover types are included within the non-forested type for the purposes of vegetation analysis, wildlife species using these habitats may also use adjacent forested areas.

In general, the non-forested cover type represents less than 15% of the area on the HLC NF, with the grass and shrub types representing less than that. Many grassland or grass/shrub areas occur at or near the boundary of HLC NF lands, extending onto adjoining private and other lands that comprise a larger extent of these cover types.

Many wildlife species use these habitats during all or a portion of their life cycle. Grass and shrub vegetation types may be important to some species for forage, particularly in winter. Species dependent on grasslands or shrub habitats are often not yearlong residents on HLC NF lands. Terrestrial wildlife species that are dependent on grass or shrub cover types for at least a part of their life cycle include elk, mule deer, and pronghorn, all of which depend more heavily on these habitats during winter, and all of which may spend a portion of winter on lower elevation, non-NFS lands. Elk and mule deer are found in all GAs. Gray wolves, currently listed as RFSS, rely on ungulate prey and so are indirectly dependent on the habitats that support big game. Additional factors, such as legal hunting and trapping, and depredation-related mortality on non-NFS lands also influence gray wolf numbers and distribution. Other species depending on these habitats include a number of migratory bird species (for foraging and/or nesting), several small mammal species, red foxes, coyotes, and others. Mesic shrub types may be important to both black and grizzly bears, providing forage in early spring before other foods are available, and berries as a key food source during summer months.

Bighorn sheep, currently listed as a RFSS, use primarily nonforested habitats, with some use of savannahs or open forest where visibility is good and in proximity to escape terrain (generally cliffs or steep, rocky hillsides). This species occurs in a metapopulation structure, with herds scattered throughout western and central Montana, connected by occasional movement of individual sheep among separate herds. Bighorn sheep herds currently occur on the Rocky Mountain Range, Big Belts, and Elkhorns GAs. Bighorn sheep occupied the Little Belts GA historically, and have been observed there recently (Pers. Comm. D. Kemp, 2017) after a prolonged absence. The Elkhorns herd was reduced to fewer than 20 animals as a result of a disease-related die-off in 2008. Respiratory disease epidemics are considered a primary limiting factor for bighorn sheep populations, and research has confirmed that healthy domestic sheep can carry the disease and transfer it to bighorn sheep (Besser et al., 2012; Wehausen, Kelley, & Ramey, 2011; WSWG, 2012). Separation between domestic and wild sheep is considered an effective way to minimize the risk of disease transmission from domestic to wild sheep.

Stressors under Forest Service control

Threats to grass/shrub vegetation types that may be affected by FS management activities include grazing impacts to native plant communities, fire management (including fire exclusion), and invasive exotic plant species. Note that management of invasive exotic plants is likely affected by FS management only to a limited degree in many areas. Although not a stressor to the habitat group discussed here, grazing of domestic sheep and goats in proximity to wild sheep is a stressor to bighorn sheep that use these and other habitats.

Stressors not under Forest Service control

Threats outside of FS management influence that may affect grass/shrub vegetation types include habitat conversion and alteration and climate change. Stressors such as fire management (including fire exclusion) and grazing that occur off-NFS lands may also impact these vegetation types where they occur on adjoining NFS lands. Grazing of domestic sheep and goats on private land adjoining or near NFS lands where bighorn sheep occur is a stressor to wild sheep populations.

Species associated with hardwood tree habitats, affected environment

As noted in the terrestrial vegetation section, persistent hardwood-dominated plant communities are rare on the HLC NF. Aspen and cottonwood are by far the main hardwood tree species. Aspen may occur as a persistent community in riparian areas, or it may be a transitional stage in upland sites, where it may dominate the early stages of succession following major disturbance. As such, aspen-dominated habitats may vary widely in location, spatial extent, and overall distribution over time. Cottonwood is confined to riparian areas on the HLC and is more common on lower-elevation private lands outside the forest boundary. Cottonwood exists to a very limited extent on the HLC NF.

Although hardwood habitats make up a small proportion of the vegetation communities on the HLC NF, these habitats are important for a variety of wildlife species, including several woodpecker species (Lewis's woodpecker, a SCC on the HLC NF, is discussed in the at-risk species section), other migratory birds, several bat species, black bears, flying and red squirrels. Ungulate species such as elk, moose, and deer may forage on young aspen during certain times of year, as well. Aspen and to a larger extent cottonwood communities in riparian areas may provide habitat connectivity within drainages, as well as across the forest boundary onto adjoining lands, by providing a more complex vegetation structure and composition to support animals transitioning across otherwise unsuitable habitats.

Stressors under Forest Service control

Threats that may be affected by FS management actions include grazing and fire exclusion.

Stressors not under Forest Service control

Threats outside FS control include excessive herbivory by ungulates, climate change, insect infestations, disease, forest succession (conifer encroachment), changes in groundwater or stream flows, and human development.

Species associated with dry conifer habitats, affected environment

This group of habitats includes the cover types identified in the terrestrial vegetation section as ponderosa pine, some dry Douglas-fir, and some xeric ecotones and savannahs. Dominant tree species tend to be ponderosa pine, limber pine, and some Douglas-fir, with Rocky Mountain juniper and interspersed dry shrub in some areas (see terrestrial vegetation section). These vegetation types generally occur at lower elevations or on south and west-facing aspects that maintain lower snow levels during winter, providing key winter habitat for a number of ungulate species. In some areas these habitats form the transition from conifer forest to grass/shrub or grassland types, and as such may be relatively rich in wildlife diversity. Savannahs may be important foraging areas for bighorn sheep where they occur in proximity to escape terrain (cliffs and rocky outcrops). Flammulated owls and Lewis's woodpeckers, both identified as SCC, use stands of large-diameter ponderosa pine and occasionally Douglas-fir. Clark's nutcrackers forage on seeds from ponderosa pine and limber pine. Other species using these vegetation types include numerous migratory bird species including a wide variety of songbirds and several types of hawks and owls, small mammals, mountain lions, bobcats, and wolves. Dry conifer habitats may be important foraging and daytime roosting areas for fringed myotis, a bat species currently identified as a RFSS. Limber pine is often found in the area of transition from mid-elevation conifer forest to low-elevation grasslands, which means it is also often present at the transition of NFS lands to adjoining lands under other ownership. As such, limber pine forests may be an important transitional habitat used by grass/shrub associated wildlife species as well as by montane conifer forest associated wildlife species. Intact limber pine forest in some areas may provide important connectivity between NFS and other lands.

Stressors under Forest Service control

Fire exclusion may influence the abundance, distribution, and composition of dry conifer types. Vegetation management practices may also influence this vegetation group through selection of species or size classes for harvest.

Stressors not under Forest Service control

Climate change, wildfire, beetle infestation, and disease are all processes that can influence the abundance, distribution, and composition of dry conifer forests.

Species associated with mixed conifer habitats, affected environment

This vegetation group encompasses a broad array of habitats occurring in the montane conifer environment, which is the dominant land cover on the HLC NF. It includes habitats within the warm dry, cool moist, and cold broad PVTs. Cover types (see terrestrial vegetation section) include dry Douglas-fir (this cover type may also be included in the dry conifer group discussed above), mixed mesic conifer, western larch mixed conifer, lodgepole pine, spruce-fir, and to some extent whitebark pine (but see section on species associated with high elevation habitats, below). The trend in amount and distribution of these cover types, as well as trend in structural characteristics such as tree size and density, varies by type as shown in the terrestrial vegetation section. In general, forested cover types have increased compared to their historic range, with greater tree density and smaller average tree size for many cover types (U.S. Department of Agriculture, Forest Service, Northern Region, 2015).

In addition to the varied mix of tree species and corresponding understory, wildfire, insects, and disease have historically created a variety of seral stages, structures, and mix of species within the broad area of coniferous forest. Coniferous forest on the HLC NF is often intermixed with open grasslands/shrublands, wetlands and riparian areas, creating a mosaic of habitat types. Therefore this vegetation group provides a diversity of habitats used by a correspondingly wide diversity of wildlife species. Wildlife species that use mixed conifer habitats for all or part of their life cycle include ungulates (deer, elk, and moose), pine marten, a variety of hawks and owls including northern goshawk, Cooper's hawk, sharp-shinned hawk, and great gray owls, a variety of small mammal species including snowshoe hare and red squirrel, a diversity of migratory birds, and several bat species, including three that are currently identified as RFSS: fringed myotis, long-eared myotis, and Townsend's big-eared bat.

Canada lynx, currently listed as threatened under the ESA, are dependent on boreal forests that provide their primary prey species (snowshoe hare), secondary prey (red squirrel), and have deep, fluffy snow during the winter. Lynx rely largely on the spruce/fir cover type. Canada lynx are discussed separately in the at-risk species section.

Fisher are currently listed as a RFSS that could be found on the HLC NF. There have been two observations of fisher on the Rocky Mountain Range GA, possibly of the same individual, and four in the Upper Blackfoot GA, three of which were harvested. Recent mapping, however, has shown that very little fisher habitat exists on the HLC NF, likely not enough to support a fisher population or enough individuals to contribute to supporting a fisher population in Montana (USDA, 2014).

Stressors under Forest Service control

Stressors on mixed conifer habitat are similar to those described for dry conifer habitat. Fire exclusion may influence the abundance, distribution, and composition of conifer forests directly and by influencing the size and severity of future fires. This vegetation group is the focus of most of the harvest activity that occurs on NFS lands; therefore vegetation management practices may also influence this vegetation group through selection of species or size classes for harvest, fuels reduction, or other management activity.

Stressors not under Forest Service control

Climate change, wildfire, beetle infestation, and disease are all processes that can influence the abundance, distribution, and composition of mixed conifer forests.

Species associated with high elevation habitats, affected environment

High elevation habitats are those generally occurring in the subalpine and alpine zone, characterized by the alpine and herbaceous shrub habitat type group described in the assessment (U.S. Department of Agriculture, Forest Service, Northern Region, 2015). This habitat also includes expanses of non-vegetated area, and the whitebark pine cover type. Alpine herbaceous types have minimal soil development and consequently sparse vegetation, generally in the form of grasses, forbs, and some low shrubs, with trees occurring in some protected and moist microsites. These habitats are usually affected by climate and weather, with wind, extreme temperatures, unstable rock, and avalanches all shaping habitat. High elevation habitats are often within designated wilderness or IRAs, in part because of their relatively inaccessible nature and location with respect to historic resource extraction efforts, as well as a lack of merchantable timber. Most ecosystems that occur at high elevations are not substantially altered from historic conditions, with the exception of declines in whitebark pine. Whitebark pine is an important component of some high elevation ecosystems, with mature trees producing seeds that are a key food for species such as Clark's nutcrackers and grizzly bears. Whitebark pine has experienced extensive mortality due to a variety of factors, including white pine blister rust, and consequently occurs less frequently and as younger trees than it historically occurred throughout much of its range. The species is a candidate for listing under the ESA (for more information refer to the terrestrial vegetation and at-risk plants sections).

Species that use high elevation habitats for all or part of their life cycle include mammals such as pika, golden-mantled ground squirrel, hoary marmot, mountain goat, and wolverine (refer to terrestrial wildlife species at risk section), and birds such as white-tailed ptarmigan, and various migratory bird species including black rosy finch and gray-crowned rosy finch. In addition to feeding on caches of whitebark pine seeds, grizzly bears may also feed on army cutworm moths found in high elevation rock and talus. Some wildlife species, such as wolverine, have evolved to rely on high-elevation snowpack for shelter, cover, or denning.

Stressors under Forest Service control

Most habitats occurring at high elevations are not substantially influenced by forest management. Recreation can impact habitat through stock and foot travel impacting thin, fragile soils.

Stressors not under Forest Service control

Climate change may play the most important role in affecting high-elevation habitats by altering the timing and levels of snowfall and snowmelt. Whitebark pine is affected by blister rust, which may have a profound effect on the amount and distribution of that cover type on the HLC NF and throughout Montana.

Species associated with late successional forest including large trees and old growth, affected environment

Large and very large trees, late successional forest, and old growth provide habitat for a variety of wildlife species. Much of the literature regarding wildlife associated with old growth habitats originates from west of the continental divide, often in the wetter, milder, more productive forests of the northwestern United States. In the northern Rocky Mountains, wildlife species usually associated with old growth habitat may be associated with individual components of old growth (e.g., very large live, decayed, dead or downed trees) in stands or areas that do not meet identified old growth criteria in their entirety. This may be particularly true on the HLC NF, the majority of which occurs east of the Continental Divide, where there is relatively low annual precipitation and a short growing season, and where wind and frequent fire are important factors shaping vegetation.

Wildlife species associated with large or very large trees include pileated woodpeckers and northern flickers, which may excavate cavities used by birds such as Lewis's woodpeckers, and flammulated owls. Barred owls, and several migratory songbird species use standing large diameter trees or rely on the multi-layered canopy often associated with late-successional stage forest. American marten, various small mammal species, salamanders and other amphibians use downed and decaying large trees for cover and forage, particularly in late-successional and old growth stands.

Stressors under Forest Service control

Harvest or other vegetation management can remove large trees, alter stand characteristics and dynamics, and fragment large tree and late-successional forest habitat. Fire exclusion can also influence stand characteristics and development and alter natural fire regimes. Other stressors may include other fire management activities, road construction, recreation site development, and firewood gathering.

Stressors not under Forest Service control

Existing old growth and late-successional forest is vulnerable to moderate or high severity fire, insect infestations, and disease.

Species associated with snags, affected environment

Dead, dying, and decaying trees provide nesting sites for a variety of birds; these include several woodpecker species such as pileated woodpecker, northern flicker, northern three-toed woodpecker, and Lewis's woodpecker (see terrestrial wildlife species at risk species section), a large number of migratory songbird species such as mountain bluebird and brown creeper and others, and various owl species such as flammulated owl (see at-risk species section), screech owl, boreal owl, and others. Snags also provide foraging habitat for a number of bird species that include many of those above, as well as black-backed woodpecker (currently listed as a RFSS), nuthatch, and others. A variety of bat species, including long-eared myotis (currently identified as a RFSS), silver-haired bat and others use snags for roosting, either in cavities or under loose bark. Other species that use or rely on snags and snag habitats include northern flying squirrel, short-tailed weasel, pine marten and others. Various wildlife species tend to prefer specific sizes and species of snags, as well as different stages of hardness or decay. Therefore a variety of species, sizes, densities, and conditions of snags is needed to provide for the needs of the wide variety of wildlife species that use them.

The snags and downed wood section provides estimates of current snag abundance by size class, GA, and wilderness vs. non-wilderness. It notes that snags are a dynamic resource influenced by numerous factors both natural and human-related, and in an ongoing state of development and loss. Historic or natural snag abundance can only be estimated currently by inference, comparing snag abundance in wilderness areas with that of non-wilderness. It appears that snags may be more abundant in wilderness overall, possibly as a result of recent large fires. Aside from the influence of fire, it is not clear whether snags are more or less abundant now than they were historically. The difference between wilderness and non-wilderness does not exist for large and very large snags, which may be naturally rare on the HLC NF (Bollenbacher et al., 2008).

Stressors under Forest Service control

Salvage logging can be a primary influence on snag presence in some areas, reducing abundance and altering distribution of snags following fire or insect infestation. Fire exclusion may also reduce snag abundance and distribution. Other stressors that have impacts in more localized areas include firewood cutting, hazard tree management, and certain vegetation management practices.

Stressors not under Forest Service control

Climate and weather may degrade snags or cause them to fall, while fire may consume previously existing snags. Climate change may impact snag development, abundance and distribution by altering fire regimes, and influencing precipitation cycles.

Species associated with coarse woody debris, affected environment

Coarse woody debris is defined as wood of 3 or more inches in diameter that is on the ground. Coarse woody debris may be an important habitat component for some wildlife species, particularly debris of larger diameter. This habitat feature is present in a variety of vegetation types and situations, although debris that has greatest value to wildlife is more often associated with late successional stages and less often associated with dry forest types. Discussion of the various vegetation groups and structural stages that create woody debris will not be repeated here, nor will discussion of plan components noted above that would ensure the appropriate distribution and abundance of various tree species, size classes, densities, or successional stages. Coarse woody debris is a product of processes that are the same as or similar to those that create snags.

Wildlife that use coarse woody debris varies according to the size, structure, and habitat in which the debris occurs. Amphibians such as salamanders may use rotten and hollow logs that retain moisture. Small mammals such as certain voles and shrews, as well as mid-sized mammals such as squirrels use this habitat for cover and sometimes food caching, and mammals such as weasel and marten may use it for both cover and foraging. Canada lynx (see terrestrial wildlife species at risk section) and mountain lion may use piles of woody debris for denning.

The snags and downed wood section provides information on the estimated status of coarse woody debris by GA. There is currently no way to estimate the NRV of this type of habitat. The trend for downed wood is tied to the disturbances and drivers that affect vegetation, and therefore will vary according to those factors.

Stressors under Forest Service control

Timber harvest, and fuels management may reduce the amount of coarse woody debris in some areas, and can create pulses in debris by creating even-aged stands. Fire exclusion may also impact the amount and distribution of this habitat, increasing it in some areas and vegetation types.

Stressors not under Forest Service control

Insect and disease outbreaks may create dead trees that eventually become coarse woody debris. Fire can create this habitat by weakening or killing trees, or reduce it through burning existing debris on the ground or removing trees entirely as occurs with more intense fires. Fire can create pulses of debris by killing large numbers of trees in an area and by creating even-aged stands in some areas.

Species associated with cave, cliff, rock or other geologically-determined habitats, affected environment

Cliff, cave, and rock habitats are created and changed primarily by geologic forces, although subsurface mineral extraction and associated mining activities can create underground structures that may function as habitat for some wildlife species. Use of these habitats by wildlife depends on the structure of the site and its associated characteristics, as well as by proximity to habitat required for activities such as foraging. This section will address only those aspects of these habitats or the species that use them that could be affected by NF management. The portion of this habitat that is comprised of rock and scree is represented by the “sparse” areas mapped in VMap. This type occurs on roughly 5% of the administrative area (U.S. Department of Agriculture, Forest Service, Northern Region, 2015). The majority of the “sparse” type occurs on the Rocky Mountain Range GA. Although many caves have been identified on the HLC NF, a complete inventory of caves and of mines or associated structures that may provide habitat for wildlife species does not exist, and therefore the distribution, abundance, and characteristics of cave and cave-like habitats on the HLC NF is not known. Similarly, no estimate exists for the amount, distribution, or characteristics of cliff habitats.

Cliff habitats may be used by birds such as peregrine falcon (currently listed as a RFSS) and golden eagle for nesting, and by bighorn sheep (currently listed as a RFSS) and mountain goat for escape terrain and as general habitat. Rocky habitats such as boulder and talus fields and slopes may be used by species such as pika, golden mantled ground squirrel, hoary marmot, bushy-tailed woodrat and wolverine (see at-risk species section for detailed discussion of this species) for shelter, hibernation, or denning. Caves and some mines or related structures may be used by a number of bat species, including fringed myotis, long-eared myotis, and Townsend's big-eared bat (all three species are currently listed as RFSS), for roosting, hibernation, and maternity habitat. Several bat species, particularly those in the genus Myotis, are vulnerable to a disease (White-Nose Syndrome) that is caused by a fungus that can be transmitted by other bats as well as by humans visiting caves where bats are roosting.

Stressors under Forest Service control

Removal of rock from surface areas for personal or commercial use by humans could impact some localized areas. Cave and mine habitats may also be impacted by changes in temperature or humidity caused by the creation or alteration of openings to the surface, or by changes to actual structure. Although not a stressor to the habitat itself, human activities that disturb bats or that introduce the fungus associated with White Nose Syndrome may be significant stressors to bats using caves or mines on NFS lands. Recreational use of NFS lands by the public is not regulated by forest plans, although procedures exist for managing those uses in specific situations.

Stressors not under Forest Service control

Cave, cliff and rock habitats are physically affected primarily by natural, geologic forces. Species that use these habitats may also be affected by changes to adjacent or nearby vegetation, caused by the various stressors discussed in the vegetation group sections above. Bats may be affected by transmission of diseases from other bats travelling among different roosts. Pikas, wolverines, hoary marmots, and other species that use rock habitats at high elevations may be affected by alterations in seasonal temperature and precipitation associated with climate change (see also "species associated with high-elevation habitats" section above).

3.14.6 Environmental Consequences

Effects common to all alternatives

Aquatic, wetland, and riparian habitats

Aquatic, wetland, and riparian habitats are characterized by a combination of hydrology, geology, and vegetation and as such would continue to occur in the same amount and distribution under all alternatives.

Grass and shrub habitats

The terrestrial vegetation section notes that predicted warm and dry climate, which may be affected by climate change, along with vegetative succession, wildfires, and insect and disease activity would be the primary shapers of vegetation under all alternatives. Under all alternatives, nonforested vegetation, particularly in the xeric vegetation types, is expected to initially increase and then decline slightly, with overall abundance slightly higher over the next five decades than current abundance. That trend is not consistent across all GAs, with increases largely occurring in the Castles, Divide, and Little Belts GAs. Some decreases relative to current levels are predicted in other GAs, with the largest decrease predicted in the Rocky Mountain Range GA.

Plan components in the Grizzly Bear Amendment, which would be incorporated into all alternatives, require no increase in the number of active sheep allotments or in permitted sheep animal unit months in the primary conservation area and in zone 1 (Rocky Mountain Range and north half of Upper Blackfoot GAs), and guide managers to reduce the number of open or active sheep grazing allotments in that area. Although these components are intended to reduce potential conflicts with grizzly bears, their effect would also be to limit or reduce the risk of disease transmission from domestic to wild sheep.

Hardwood tree habitats

Broad-scale modelling predicts that both aspen/hardwood and cottonwood would increase slightly over time under all alternatives (terrestrial vegetation section), with some variation among GAs.

Dry conifer habitats

Broad-scale modelling estimates that under all alternatives, the ponderosa pine, limber pine, and Rocky mountain juniper cover types would increase, while dry Douglas-fir would decrease with some variation among GAs. These trends could benefit some species that rely on the dry conifer forest type and would ensure that this habitat continues to exist in the plan area.

Mixed conifer habitats

Broad-scale modelling predicts that the mixed mesic conifer cover type would likely decrease over time across the HLC NF under all alternatives, with some variation among Gas (see appendix B). However, this cover type is predicted to remain within or above the estimated NRV. Lodgepole pine is predicted to have a similar trend, remaining below the estimated NRV only within the Crazies and Rocky Mountain Range GAs. The spruce/fir cover type is predicted to increase slightly under all alternatives, and remain above the estimated NRV. The estimated NRV roughly approximates the range of conditions under which wildlife species using these habitats evolved or originally occupied this niche. Because the cover types comprising this habitat group would contine to be within or near the estimated NRV, they would continue to provide habitat for wildlife species that use them for all or part of their life cycle.

High elevation habitats

Because the primary influences on this type of habitat are climate, weather, geology and topography, most forest management actions are not expected to have substantial influence on these habitats or on the species that use them. Under all alternatives, whitebark pine is estimated to remain fairly static over time, with some variation among GAs. Clark’s nutcrackers may be affected by current or future declines in whitebark pine under all alternatives, but on the HLC NF ponderosa pine and limber pine provide additional food sources. Wolverine are thought to be affected primarily by climate-caused changes in the amount and distribution of snowpack that remains throughout the spring, which would be the same under all alternatives. The availability of both whitebark pine seeds, and army cutworm moths as food sources for some bears could change as a result of changing climate, or in the case of moths, as a result of agricultural practices occurring in other areas during other phases of their life cycle. Refer to the terrestrial wildlife species at risk section for a more detailed discussion of wolverine and grizzly bear.

Late successional forests

Broad-scale modelling estimates that under all alternatives the large tree size class would increase in abundance, as would concentrations of large trees, while the very large size class would remain relatively static, below the estimated natural range. Multistoried structure, which in some cover types can be a component of late-successional stage forest and old growth, would likely increase over time under all alternatives, particularly in some cover types and broad potential vegetation groups. Although it is not possible to effectively model old growth, proxy indicators described in the old growth section lead to predictions that old forests would increase over time under all alternatives.

Snags

The majority of the HLC NF is in wilderness, RWAs, or IRAs where harvest, including salvage, would be prohibited or greatly limited and natural disturbances would be predominant, including fire that creates abundant burned forest conditions.

Coarse woody debris

The majority of the HLC NF is in wilderness, RWAs, or IRAs where natural processes, including those acting on the amount and distribution of coarse woody debris, would predominate.

Cave, cliff, rock or other geologically-determined habitats

The majority of the HLC NF is in wilderness, RWAs, or IRAs where disturbance to species using cave, cliff and rock habitats would be minimal. The Federal Cave Resources Protection Act of 1988 would provide assurance under all alternatives that caves listed as significant would be protected and maintained, through cooperation with other entities, and through participating in research, protecting information about the location of significant caves, and mapping and evaluating significant caves.

Effects of the action alternatives

Aquatic, wetland, and riparian habitats

All action alternatives include direction to establish RMZs, intended to protect the integrity and function of those areas. Although vegetation management, livestock grazing, or other activities could occur within riparian habitats, these activities would be constrained by plan components designed to protect watershed integrity, riparian habitats, and hydrologic function. RMZs are identified as not suitable for timber production. The adoption of RMZs would substantially increase protection of water quality and habitat conditions, particularly in areas east of the continental divide, where existing INFISH guidance does not apply. Establishment of RMZs would also be expected to increase the total acreage of riparian-influenced area in which protections for water and habitat quality would apply as compared to the no-action alternative. Management direction for RMZs would contribute to wildlife habitat connectivity and protection of plant species and animal communities associated with wetlands.

Direction for RMZs in the action alternatives is clearer and more flexible regarding vegetation management in riparian areas compared to the no-action alternative. This would allow for more likelihood in achieving desired conditions in vegetation associated with these areas. The plant species at risk section also provides a brief summary of potential effects to wetland-riparian, peatland, and aquatic vegetation guilds, noting that the revised plan provides more explicit protections for aquatic ecosystems than provided by the existing plans. Habitat quality is expected to improve for at-risk plant species in the peatland, wetland-riparian, and aquatic habitats under these alternatives. Those improvements in habitat quality would also likely represent improvements in habitat quality for terrestrial wildlife species that rely on those habitats.

Under all action alternatives, plan components describing specific desired conditions for aquatic, wetland, and riparian habitats would improve the likelihood of maintaining their integrity, resiliency, and connectivity. Delineation of RMZs (FW-RMZ-STD-01), clear and specific management direction for those zones (FW-RMZ-STD-03-07), plan components for maintaining key habitat components (FW-RMZ-GDL-01, 02), and components for minimizing impacts to riparian and aquatic habitats (FW-RMZ-GDL-03-12) all would maintain or contribute to the long-term persistence of species dependent on these habitats.

All action alternatives include some species-specific or habitat-specific (fine-filter) plan components that would minimize impacts to certain wildlife species or groups of species using aquatic habitats. Table 62 displays those plan components and includes a brief description of the component and its effect on terrestrial wildlife species or habitats. For the exact wording of each component, refer to the draft plan.

Table 62. Draft plan components that would directly affect terrestrial wildlife species associated with aquatic, wetland, and shrub habitats

Plan component	GA where applies	Summary of expected effects
FW-WL-GDL-03	Forestwide	Would protect western toad breeding sites from livestock trampling, and would direct livestock management so that emergent vegetation would be retained at those sites. This plan component would help maintain the integrity of these sites for western toads and for other species, including amphibians, birds, and small mammals.
FW-WL-GDL-04	Forestwide	Would help prevent the spread of pathogens to and among western toad breeding sites.
FW-WL-GDL-15	Forestwide	Would minimize the risk of impacts to amphibians from use of piscicides for fisheries management.
FW-WTR-DC-08; FW-WTR-GDL-03	Forestwide	Would direct managers to retain, where possible, beaver presence and complexes to maintain watershed and wetland habitat and resilience. Many wildlife species, such as moose, swans, migratory songbirds, amphibians, waterfowl, and others use habitats created and maintained by beavers.
RM-WL-DC-03; RM-WL-GDL-02; UB-WL-DC-03; UB-WL-GDL-02	Rocky Mountain Range; Upper Blackfoot	Would minimize management-related disturbance to and displacement of harlequin ducks on known breeding streams

Grass and shrub habitats

All action alternatives include desired conditions to generally maintain or increase the non-forested cover types to within the estimated natural range (FW-VEGNF-DC-03) with most of that increase in the grassland or shrubland cover types. All action alternatives also include plan components that emphasize the use of fire to achieve some vegetation objectives, and in some areas allowing fire to play more of its natural role as a process shaping ecosystems (FW-VEGNF-DC-04). Fire is an important process in maintaining many grasslands and some shrublands, through removal of tree encroachment, and rejuvenation or restoration of some grass and shrub species. All action alternatives include plan components stating that “forage use by livestock should maintain or enhance the desired structure and diversity of plant communities on grasslands, shrub lands…” (FW-GRAZ-GDL-01), and include components that constrain grazing where not compatible with vegetation desired conditions, maintaining forage for wildlife, or other resource objectives.

The revised plan includes a guideline to emphasize restoration of sagebrush where it historically occurred (FW-VEGNF-GDL-02), which may benefit a number of bird species, including Brewer’s sparrow. -FW-VEGNF-GDL-01 emphasizes treatments to maintain or restore grasslands in areas that are important for use by big game species and pollinators. This emphasis would help to maintain or restore key winter habitats for use by elk, mule deer, and bighorn sheep where they occur. Emphasis on sagebrush as noted above may benefit wintering mule deer and in some areas pronghorn.

All action alternatives include some species-specific or habitat-specific plan components that would minimize impacts to certain species or groups of species using grass and shrub habitats. FW-WL-DC-05 and FW-WL-GDL-05 establish desired conditions and guidelines to minimize disturbance to big game on winter ranges, and FW-WL-DC-06 and FW-WL-GDL-06 call for maintaining or improving the availability of cover on or adjacent to big game winter ranges. FW-WL-GDL-01 calls for livestock management to maintain forage for wildlife use, and FW-WL-GDL-15 guides managers to manage identified seasonal habitat on NFS lands consistently with similar identified habitat on adjoining lands managed by other agencies, when those adjoining lands are managed for wildlife values. In general, this guideline is intended to foster consistent and coordinated management on big game winter ranges that consist of a mix of NFS land and state-owned wildlife management areas.

Plan components for the Big Belts, Little Belts, and Elkhorns GAs include a standard requiring adherence to interagency recommendations for separation of bighorn sheep from domestic sheep and goats. Plan component RM-WL-STD-01 for the Rocky Mountain Range GA prohibits domestic sheep grazing on NFS lands, in order to minimize risk of disease transmission and to prevent potential conflicts with grizzly bears. These plan components, along with those discussed above that would maintain or restore grass and shrublands, would maintain bighorn sheep presence on NFS lands to the extent that NFS management actions are able to do so. Introduction of disease from domestic sheep could still occur, as a result of bighorn sheep moving among areas or using areas not under NFS management where domestic sheep or goats are grazed.

Hardwood tree habitats

The amount of hardwood tree habitat, which includes mainly aspen and cottonwood on the HLC NF, is lower than it likely was historically in some GAs on the HLC NF. The desired condition is to maintain or in some areas increase the amount of these vegetation types. The desired condition specific to aspen is to generally increase its presence throughout the plan area, with more emphasis in some GAs (e.g. the Big Belts, Little Belts, and Snowies GAs) that are less in line currently with the historic range or where increasing aspen has been identified as desirable for other reasons, including as wildlife habitat. Modelling predicts a slight increase in aspen over time forestwide. Hardwood tree habitats on the HLC NF are often associated with wetlands and riparian areas; refer to the watershed section and to the section above on species associated with aquatic, wetland, and riparian habitats for a discussion of how plan components in the revised plan would maintain or restore function and resilience of aquatic, wetland, and riparian habitats.

As a result of components that would maintain or restore function in wetland and riparian habitats, and those that would maintain or restore hardwood (particularly aspen) types, habitat for wildlife species using this vegetation group would continue to be provided in the plan area, and is predicted to increase slightly at a forestwide scale. Refer to the terrestrial wildlife species at risk section for information about Lewis's woodpeckers; refer to sections below on snags for information pertaining to cavity-nesting birds, as that section includes consideration of all cover types, including aspen.

Dry conifer habitats

The revised plan includes components that identify desired conditions for the cover types that are included in the dry conifer habitat group. Forestwide desired conditions are to generally increase ponderosa pine and decrease Douglas-fir, as well as to increase the amount and distribution of large and very large trees in the warm dry broad PVT (FW-VEGF-DC-01, FW-VEGF-DC-02, FW-VEGF-DC-05, and FW-VEGF-DC-06). All action alternatives include plan components to allow fire to play a more natural role, where possible, in shaping ecosystems (FW-FIRE-DC-01, FW-FIRE-GDL-03 and 04). Ultimately those components might allow fire to occur in a manner that promotes and maintains open-understory, mature ponderosa pine and limber pine forests in areas where those types historically occurred. This would improve habitat for species such as flammulated owl, Lewis's woodpecker, and other species that rely on mature, open-understory ponderosa pine as well as on snags. Increasing this type of habitat, as well as maintaining the amount of limber pine, could also increase the amount of transitional and winter range for ungulates such as elk and mule deer, and could improve connectivity between escape terrain and foraging areas in some areas for bighorn sheep. Maintaining or increasing limber pine at lower elevations may maintain or improve habitat for a wide variety of wildlife species associated with either grassland or montane conifer habitat types. Maintaining or increasing the amount and distribution of ponderosa pine and limber pine would provide a food source for Clark's nutcrackers that could be of increasing importance if whitebark pine continues to decline as a result of blister rust (refer to high-elevation habitat discussion below).

Modelling of the estimated trend of limber pine, ponderosa pine, and Rocky Mountain juniper shows a slight increase in these cover types and tree species presence under these alternatives that would be likely indistinguishable from the trend estimated for the no-action alternative, although estimated trend varies somewhat by GA.

In summary, specific desired conditions for the cover types and tree species that comprise the dry conifer forest habitats would be more likely to result in moving the abundance and distribution of this type toward the historic or NRV. Plan components specifically aimed at maintaining or increasing dry conifer types, particularly ponderosa pine and limber pine, would result in maintaining or increasing available habitat for species that use dry conifer vegetation types.

Mixed conifer habitats

The revised plan includes components that identify desired conditions for the cover types that are included in the mixed conifer habitat group. Forestwide desired conditions provide specific direction to move toward the historic or NRV for conifer types (FW-VEGF-DC-01, FW-VEGF-DC-02) and structure within those types (FW-VEGF-DC-03, FW-VEGF-DC-04, FW-VEGF-DC-05, FW-VEGF-DC-06, and others) would provide conditions that allow populations of species dependent on mixed conifer forest to persist over the long term. Some species, such as pine marten, Canada lynx, red squirrel, and others that rely on certain structural or seral stages, cover types, or combinations of those would be affected by trends in those specific habitat components. The revised plan identifies desired conditions for some key structural components, which are addressed separately (see below regarding large and very large trees, old growth, snags, and downed woody debris). In summary, specific desired conditions for the cover types and tree species that comprise the mixed conifer forest habitats would be more likely to result in moving the abundance and distribution of these types toward the historic or NRV. Consequently, the range of habitats would be maintained that support the full variety of wildlife species using mixed conifer forest for all or part of their life history.

A more detailed analysis of potential effects to species currently listed as sensitive and that are mentioned above in the affected environment section will be provided in a separate BE to be prepared when a preferred alternative is selected. The BE will be completed concurrent with the FEIS.

High elevation habitats

The revised plan includes desired conditions for non-forested vegetation types, which includes alpine ecosystems (FW-VEGT-DC-01 and FW-VEGF-DC-01). The desired conditions describe the components of healthy, resilient alpine ecosystems and the desired prevalence of non-forested types, providing managers with clear direction for restoring or maintaining these systems. The revised plan also includes desired conditions for whitebark pine (FW-VEGF-DC-01, FW-VEGF-DC-02, FW-PRISK-DC-01, 02 and FW-PRISK-GDL-01), providing managers with clear direction to maintain or restore functional whitebark pine systems. These plan components would ensure that habitat continues to be available for species that use alpine ecosystems.

Late successional forests

Unlike the no-action alternative, the revised plan includes specific desired conditions for large and very large trees, at the forestwide and where appropriate at the GA scale (FW-VEGF-DC-03, FW-VEGF-DC-06), as well as by broad PVT (FW-VEGF-DC-05). The revised plan includes standards for retaining large and very large trees (FW-VEGF-GDL-01), as well as retaining snags based on size and vegetation group (FW-VEGF-GDL-01). Those desired conditions would be more effective than the current plans in maintaining or restoring large and very large trees as habitat on the HLC NF. The revised plan also includes desired conditions for old growth that are based on broad PVT (FW-VEGF-DC-07), recognizing that not all areas or vegetation types have the inherent capability to produce large and very large trees, or old growth as currently defined. The revised plan includes guidelines for management of old growth (FW-

VEGF-GDL-04 and 05) designed to retain or enhance existing old growth and to promote development of old growth in the future. Thus, rather than trying to meet a numeric standard that may not be applicable in a particular area or vegetation type, the revised plan ensures that stands meeting the criteria for old growth are retained or are managed to retain or enhance their old growth characteristics. The result of that management would be to conserve all existing old growth and promote the development of old growth in the future, which would be more effective at maintaining old growth habitat than management under the existing forest plans.

In sum, plan components for large and very large trees and for old growth would ensure that large and very large trees, both alive and dead, along with late successional forests and old growth would continue to move toward desired conditions. In turn, adherence to the plan components, and movement toward desired conditions for these structure types would ensure that these habitats would continue to be available at current levels or in greater abundance than currently in the plan area.

Snags

The revised plan includes components regarding snag management that would ensure development and retention of snags at an appropriate scale during vegetation management and other activities. FW-VEGF-DC-08 displays the desired condition for snags by size class and by broad PVT and other vegetation type, based on current understanding of the estimated abundance of snags. FW-VEGF-GDL-02 recommends retention of at least a minimum number of snags per acre within vegetation management project areas, which would ensure availability of snags for use by wildlife at an appropriate scale for management. This guideline is specific to size class as well as vegetation type, recognizing that some size classes may be key but less abundant naturally, and that different vegetation types or groups naturally have differing snag abundance. Specific information for implementing this guideline also includes information about implementation and lists exceptions to snag retention guidelines that focus on human safety in specified areas or situations. These exceptions would help to limit the situations and the extent to which snags may be removed for safety reasons, thus ensuring a relatively conservative approach to maintaining snag habitat for wildlife. FW-TIM-GDL-04 guides managers implementing salvage harvest to retain clusters of burned trees of a variety of sizes to provide habitat for wildlife.

These plan components, in addition to the fact that much of the HLC NF would be continue to be subject to natural forces such as wildfire, insect and disease (see effects common to all alternatives above), would ensure that adequate numbers, distribution, and variety of snags would continue to exist throughout the plan area, providing habitat for species that use snags for all or part of their life history requirements.

Coarse woody debris

The revised plan includes components regarding retention of coarse woody debris that would ensure development and retention of this type of habitat at an appropriate scale during vegetation management and other activities. FW-VEGF-DC-09 establishes desired conditions for coarse woody debris based on broad PVT, recognizing that certain vegetation types have different inherent capability to produce woody debris. FW-VEGF-GDL-06 guides vegetation management projects to retain a minimum amount of coarse woody debris based on the desired conditions. The guideline also provides specific guidance for retention that includes emphasis on large diameter debris that is of higher value to wildlife. The guideline also includes exceptions to provide for management of fire risk in some areas.

Specific desired conditions for coarse woody debris and the guideline emphasizing retention of large-diameter debris for wildlife, in combination with the large amount of area on the HLC NF in which natural processes predominate, would ensure that this habitat continues to be available for wildlife species that use it for a portion of their life history needs.

Cave, cliff, rock or other geologically-determined habitats

The revised plan includes a number of components that provide direction for management of and relating to caves and cave habitats. The following plan components are relevant to this habitat:

- FW-WL-DC-08 establishes the desired condition that caves, mines, and underground habitats are relatively free of human disturbance.
- FW-WL-GDL-10 guides managers to avoid disturbing roosting, hibernating, or pup-rearing bats.
- FW-WL-GDL-11 guides managers to use measures to prevent disease spread in caves or mines used by bats.
- FW-WL-GDL-12 and 13 guide managers to not create new views of caves or access to caves known to be used by bats.
- FW-EMIN-DC-03 and FW-EMIN-OBJ-01 establish a desired condition and an objective for the number of abandoned mines to be reclaimed.
- FW-EMIN-GDL-02 states that seismic or other surveys or actions that use explosives not be carried out over or close to caves known to be used by bats.
- FW-BRDG-GDL-01 guides managers to time bridge removal or reconstruction to minimize impacts to nesting or roosting wildlife.

These plan components would increase the likelihood that cave habitats would continue to support populations of bats and other species that rely on them.

The revised plan also includes a plan component (FW-WL-GDL-09) guiding managers to avoid disturbance at known raptor nesting and fledging areas, which would include cliffs used by peregrine falcons, golden eagles, prairie falcons, and other birds associated with those cliff habitats.

These plan components, combined with the fact that cave, cliff, and rock habitats are relatively inaccessible, and are affected primarily by geologic forces, would result in these habitats continuing to be available for species that use them for all or part of their life cycle. The plan components listed above would provide more protections for species using these habitats than would be provided under the no-action alternative.

Effects of forest plan components associated with:

Aquatic ecosystems and soils

The effects of these plan components are discussed under the section “species associated with aquatic, wetland, and riparian habitats” above.

Fire and fuels management

Plan components for fire and fuels management are intended to achieve the desired condition to maintain and enhance resources and allow fire to function in its natural ecological role (FW-FIRE-DC-01). Specific plan components are designed to provide for public and firefighter safety, reduce risk to high value resources such as adjacent communities, and minimize impacts to designated wilderness, recommended wilderness, and other areas that are managed to allow natural processes to predominate. Terrestrial wildlife species on the HLC NF evolved in ecosystems largely shaped by fire, so allowing fire to play its natural role, to the extent possible, would be expected to sustain ecosystem components and characteristics on which they depend. Some fire management activities could affect individual animals or local populations of some species that have small home ranges or use areas, through temporary displacement from areas where and when activities (such as fire suppression or fuels reduction) are taking place.

Terrestrial vegetation; plants at risk, and invasive species

Plan components for management of terrestrial vegetation are largely designed to maintain or move toward the NRV for ecosystem composition, structure, and function, and to maintain resilience in the face of disturbance (FW-VEGT-DC-01). Vegetation-related plan components also are intended to “provide habitat requirements to support populations of… native and desired non-native species… based on the inherent capability of lands” (FW-VEGT-DC-02) and to “provide connectivity and allow genetic interchange to occur” (FW-VEGT-DC-03). Specific objectives, standards, and guidelines for vegetation, including forested and non-forested vegetation types, are designed to maintain or move toward desired conditions within the NRV for cover types, species or community presence, and vegetation structure; these are incorporated into and discussed in the specific habitat sections above. Plant species at risk, including whitebark pine, are to be recovered or sustained. Invasive species are to be contained, controlled, suppressed, or eradicated (FW-INV-DC-03). In sum, plan components for management of vegetation would sustain healthy, resilient plant communities on which terrestrial wildlife species depend on for food, cover, breeding/nesting/denning, and movement among different habitats, use areas, or seasonal ranges.

Terrestrial wildlife

Most of the plan components relating to terrestrial wildlife are discussed in the sections above. In general desired conditions would guide managers to provide for a diversity of wildlife habitats that would support most native species within the plan area, provide for connectivity among and within NFS parcels in the plan area, and provide for seasonal or other important wildlife habitats. Goals relating to terrestrial wildlife would encourage coordination with MTDFWP and other agencies that manage wildlife or habitats, which would facilitate effective management across administrative boundaries and throughout the ranges of many species. Standards and guidelines in the draft plan would limit or mitigate potential impacts to wildlife or habitats of a variety of management actions.

Recreation settings, opportunities, access, and scenery

Certain recreation activities have the potential to impact terrestrial wildlife species by the simple fact of humans recreating in their habitat. The draft plan does not directly constrain public uses, but it sets desired conditions, guides placement of recreation facilities, places constraints on permitted recreation activities, and establishes the general types of recreational uses allowed or expected to occur in specified portions of the plan area. Certain types of human recreational activities have the potential to affect various wildlife species, but impacts depend on the type of activity, species present, species’ habitat needs and life history factors, etc. Plan components that guide management of recreation activities have the potential to affect the degree to which recreation could impact wildlife, in both positive and negative ways. Table 63 shows the plan components that have some relevance to wildlife or habitats, and a brief summary of the potential effects of those components on wildlife or habitats.

Table 63. Plan components for management of recreation that could affect terrestrial wildlife species or habitats

Plan Component	Description	Potential Effect to Wildlife or Habitat
FW-ROS-DC-01	Desired distribution of ROS classes, desired condition within those classes and standards and guidelines to meet desired conditions	More than half of HLC NF in the two non-motorized categories would provide large amount of habitat with no potential disturbance or displacement by motorized travel. Vegetation management in these areas would be largely by natural processes, and developed recreation would be minimal. Over half the HLC NF lands would provide habitat with minimal human influence. Other ROS classes have defined desired conditions and varying impacts to wildlife depending on site-specific factors within those areas.
FW-REC-DC-03; FW-REC-DC-04;	Desired conditions for developed recreation sites	Establishes desired conditions that help concentrate developed recreation, minimize impacts to threatened and

Plan Component	Description	Potential Effect to Wildlife or Habitat
FW-REC-DC-06; FW-REC-DC-07;	and facilities and dispersed recreation camping sites	endangered wildlife and to vegetation, and minimize conflicts with other resources. However, providing for recreation opportunities potentially brings humans into wildlife habitat.
FW-REC-OBJ-02	Remove or relocate number recreation facilities out of RMZs	Would improve riparian habitat at those sites and in vicinity; also may improve connectivity within and among riparian habitats
FW-REC-GDL-01	Management of developed recreation is responsive to environmental changes	Directs management to address issues that may arise regarding various factors, potentially including changes in amount, distribution, or location of wildlife habitats or other wildlife-related issues
FW-REC-GDL-03; FW-REC-GDL-04; FW-REC-GDL-05	Constraints on developed recreation facilities and impacts related to groundwater-dependent ecosystems and riparian zones	Components would maintain water quality and flows, and reduce impacts to riparian areas. Would maintain or improve habitat in or associated with those sites, may improve riparian habitat connectivity
FW-REC-GDL-07	Use native seed for plantings	Would minimize potential of wildlife to be attracted to non-native vegetation and potentially come into conflict with humans near access roads and developed sites; also maintains native vegetation and minimizes risk of potentially invasive plant species
FW-RSUP-DC-01; FW-RSUP-DC-02; FW-RSUP-DC-03	Provide for opportunities, experiences, services, and jobs	Providing for recreation special uses potentially brings humans into wildlife habitat
FW-RSUP-GDL-01	Recreation special uses mitigates conflicts with other resources	Would minimize or reduce potentially negative impacts occurring to wildlife or habitats
FW-ACCESS-DCs (all); FW-ACCESS-GO-01; FW-ACCESS-GDL-02	Provides system of roads, trails, and airstrips for public access to NFS lands	Providing access to humans potentially brings humans into wildlife habitat. Total mileage, density, and other characteristics of access routes would have varying potential impacts to wildlife species and habitats that vary according to site, area, species, and type of habitat. Refer also to grizzly bear section of At-Risk Species section for details regarding impacts of motorized access to bears.
FW-ACCESS-GDL-01	Rehabilitation of unauthorized routes	Would restore habitat and remove human impacts on a site-specific basis

In summary, plan components for management of recreation would potentially result in some impacts to some individual animals where specific facilities exist or activities occur, but would minimize impacts to individual animals and to wildlife populations by including constraints designed to reduce conflicts, disturbance, displacement, or negative impacts to habitat. Some components would improve wildlife habitat by moving facilities out of sensitive areas such as riparian areas, and by rehabilitating unauthorized access routes.

Designated areas, including recommended wilderness

Plan components for designated areas vary in potential effects on wildlife and habitats, depending not only on species and habitat but also on type of designated area. Plan components for designated wilderness areas (FW-WILD) support the provisions of the Wilderness Act of 1964, providing areas free of mechanized and motorized uses, where natural processes would be the primary forces affecting vegetation. FW-WILD-DC-03 establishes the desired condition that designated wilderness areas would contribute habitat and connectivity for wildlife species with large home ranges. FW-WILD-GDL-01 would protect aquatic and riparian habitats from recreational livestock use, and FW-WILD-GDL-02 would ensure that caves (which may provide habitat for bats) would be protected from exploitation by recreational users.

Plan components for RWAs are similar to those for designated wilderness; FW-RECWILD-DC-02 establishes that these areas would have a natural environment where ecological process are the primary forces affecting the environment, and FW-RECWILD-SUIT-02-08 identify activities, such as timber production and harvest, commercial uses, and road construction that should not occur in these areas. FW-RECWILD-SUIT-01, which is included in alternatives B and D, states that mechanized and motorized uses are not suitable in RWAs, but some such uses may be allowed for specified purposes or if already existing in these areas. This could result in a somewhat lower potential for disturbance or displacement of certain wildlife species in those alternatives compared to alternatives C and E. In alternative C, existing motorized and mechanized uses would be allowed to continue in RWAs, while in the other alternatives those uses would be disallowed. The amount and distribution of RWAs would also vary by alternative (refer to Draft Plan section on Designated Areas). In general, however, plan components for RWAs would provide for wildlife habitats similar to that described above for designated wilderness areas. Furthermore, because RWAs overlap with IRAs (see below), the differences among alternatives would likely be slight.

Plan components for IRAs support the provisions of the FS Roadless Area Conservation Rule (USDA, 2001). Plan components establish IRAs as large, undisturbed, unfragmented areas of land (FW-IRA-DC-01) where natural processes predominate (FW-IRA-DC-02. As such, these areas provide for wildlife habitats similar to that described above for designated wilderness areas and RWAs.

Plan components for eligible WSRs are intended to support or maintain the outstanding remarkable values for which the segment is identified. Plan components vary according to those values (FW-WSR-GDL-01), which include wildness, scenic value, or recreational value. Whether wildlife habitat would be emphasized for eligible WSR segments depends on the segment, each of which is described in the Draft Plan. Where the primary emphasis is recreation, wildlife habitat value would not be emphasized but that does not mean wildlife habitat values could not be maintained or improved (refer to discussion of effects of plan components for management of recreation, above). Where the primary emphasis is fish or wildlife, maintaining or improving those habitats would likely be a primary management emphasis. Effects to wildlife or habitats would primarily occur at a site-specific level or at the scale of the river segment, and would depend on the species and habitat present or potentially present in the area.

Plan components for national recreation trails, the Continental Divide Scenic Trail, the Lewis and Clark Historic Trail, and the Lewis and Clark Interpretive Center all support the specific purposes of those trails and the interpretive center. The management emphasis of these designations is specific recreational or interpretive opportunities, which potentially brings humans using these areas into wildlife habitat. Management of recreation occurring in these areas would be subject to the plan components discussed above (refer to discussion of effects of plan components for management of recreation, above). Plan components for the Continental Divide National Scenic Trail provide for minimizing human impacts and evidence of modern human activities, including motorized travel, but the presence and management of this trail also attracts a substantial number of forest visitors using portions of the trail. Therefore, impacts of plan components that manage for these characteristics would likely have mixed impacts to wildlife that would vary according to location, habitat, species, and level of human activity.

Plan components for management of RNAs support the purposes for which these areas are designated, which vary by individual area but that emphasize research, education, and/or maintenance of biological diversity. Most RNAs are relatively small in size, but often support unique or unusual plant communities that may provide correspondingly unique or uncommon habitat features. Plan components constrain management actions to ensure that natural processes predominate in these areas with limited human influences (FW-RNA-DC-01). Therefore these areas contribute relatively undisturbed habitat for the species that inhabit them, which varies by area (refer to the Draft Plan).

Cultural, historic, and tribal resources

Few plan components for these resources would have effects to terrestrial wildlife species or habitats. FW-OFP-DC-01 establishes a desired condition of “healthy, sustainable, and harvestable populations of culturally significant flora and fauna are available to ensure the rights reserved by Native Americans”. This plan component would provide for maintaining those plant and animal species or habitat of cultural importance, but would also provide for harvest of some of those species.

Land status and ownership and land uses

Plan components for these resources include providing public access to NFS lands (FW-LAND-DC-02 and FW-LAND-OBJ-01), which could potentially bring humans into wildlife habitats, depending on the location of the access points. FW-LAND-DC-03 and 04, and FW-LAND-GDL-02 guide managers to protect wildlife habitat, riparian areas, and other natural resource values when managing lands. Plan components for Land Uses accommodate the needs for various uses such as utility and energy corridors and road uses, all of which could have impacts to wildlife depending on their location relative to specific habitats and the nature and timing of activities in those areas. Guidelines for land uses direct managers to maintain riparian habitat conditions (FW-LAND USE-GDL-03 through 05), as well as to consolidate utility infrastructure and activities that would potentially reduce impacts of land use activities on wildlife species and habitats.

Infrastructure

Desired conditions for infrastructure are to provide for a safe and effective transportation system that is sustainable and has minimal impacts on other resources. Other components establish objectives for decommissioning some roads while maintaining, reconstructing, or improving others. Standards and guidelines establish or constrain certain management practices for the purposes of limiting impacts to riparian and aquatic systems, soils, and some wildlife habitats. Roads and other infrastructure may impact wildlife by occupying former habitat. Activity associated with roads, bridges, and other infrastructure may displace wildlife and may inhibit connectivity. Standards and guidelines regarding placement, decommissioning, and other management of roads, bridges, and other infrastructure may help to limit those impacts.

Livestock grazing

Desired conditions for livestock grazing are to provide for sustainable grazing opportunities while supporting stable soils, diverse plant species composition, and wildlife habitat and forage needs. Standards and guidelines for grazing management would maintain or improve riparian and aquatic habitats, consider the forage and other habitat needs of wildlife species, and support coordination with Montana Fish, Wildlife and Parks. Although livestock grazing can impact wildlife through direct competition for forage or through displacement from some habitats, plan components for management of grazing would help to ensure that adequate forage and other habitat needs for native wildlife species would be met.

Timber harvest

Desired conditions for timber harvest are to contribute to sustainable harvest, improve resilience of the timber resource, and contribute to local and area economies. Objectives establish anticipated sale quantities by alternative, with alternative E generally offering more timber and wood sale quantity. Standards and guidelines for management of timber harvest would constraint harvest activities to protect soils and watersheds, promote restocking, limit clearcutting and even-aged harvest, manage opening sizes, and promote the achievement of vegetation desired conditions. Although activities associated with timber harvest may displace wildlife, and harvest alters habitat used by wildlife, plan components relating to timber harvest would limit some impacts to wildlife, particularly those tied to certain harvest practices that create openings or even-aged stands. Plan components for timber harvest would also move vegetation toward desired conditions, which are generally consistent with the estimated NRV.

Special Uses

Plan components for special uses support authorizing uses of NFS lands and resources for public benefit. The impacts of these components would vary in their effects to wildlife or habitats, depending on the type and nature of uses authorized. Most activities associated with special use permits would also be subject to additional plan components relating to the specific activity authorized.

Geology, energy and minerals

Plan components relevant to wildlife and relating to management of caves and mines are discussed above in the section on species associated with cave, cliff, and rock habitats.

Desired conditions for management of energy and minerals include contributions to the economy as well as contributing to the supply of mineral and energy resources. Standards and guidelines direct management of superfund sites, and constrain management actions to minimize impacts to aquatic and riparian resources and wildlife habitats. Extraction or production of minerals or energy resources could impact wildlife or habitats through direct displacement due to infrastructure or activities associated with those activities, but plan components for managing minerals and energy resources would help to limit those impacts.

Effects of alternative A

Aquatic, wetland, and riparian habitats

The aquatic ecosystems section summarizes the management direction for aquatic and riparian systems in the existing Helena National NF and Lewis and Clark NF plans, and discusses potential impacts to aquatic and riparian systems of continuing to implement those plans. Briefly, the current Lewis and Clark NF plan includes forestwide direction for riparian management areas (MA-R); MA-R is not specifically delineated nor mapped, and would likely continue to be identified and managed on a site-specific basis during project planning. The existing Lewis and Clark NF plan also includes standards that would guide or limit certain management actions in order to maintain water quality, sustain soil and site productivity, and revegetate some disturbed areas. The current Helena NF plan includes general guidelines to delineate and buffer riparian areas on a site-specific basis prior to management activities; west of the continental divide (the Upper Blackfoot GA and a portion of the Divide GA) the INFISH would continue to apply. Management Areas established in the Helena NF plan include standards and goals for protecting watershed, soil, water quality, and fisheries and riparian areas.

Under alternative A, aquatic, wetland, and riparian habitats would mostly be identified and managed on a site-specific basis, because the existing plans do not incorporate a watershed approach to management of hydrology and watershed processes, Desired conditions for these habitats would not be as clearly identified as in the action alternatives. The likely result of continuing to implement these plans would be the continued protection of areas currently in satisfactory condition, while areas in unsatisfactory condition would likely remain unchanged. Lack of watershed-level desired conditions and plan components could lead to disruptions in existing connectivity, or to not restoring connectivity within and among these habitats. These two factors would likely result in variability in the long-term integrity of these types of habitats. West of the Continental Divide, direction provided under INFISH would provide somewhat more protection for water quality and riparian habitat conditions than areas east of the divide.

Plan components for managing identified riparian areas, implementation of existing BMPs, and plan components for protecting some wildlife species and sensitive habitats would likely minimize impacts on a project-by-project basis, with the result that species dependent on aquatic, wetland, and riparian habitats would persist over the long term, as they have during the thirty years of implementing the forest plans.

Grass and shrub habitats

Standards, guidelines, and recommendations to minimize impacts of various human activities on identified big game winter range, which includes this vegetation type, are found throughout the existing forest plans. Both existing plans identify certain management areas where management emphasis is on maintaining big game winter range or other foraging habitat, both of which include the grass/shrub vegetation type. The existing plans, however, lack specific desired conditions or objectives for the amount and distribution of the grass/shrub vegetation type, that could result in variability or unpredictability in the degree to which these types would be maintained or restored in the future. During the thirty years in which the current plans have been in place, grass and shrub types appear to have decreased somewhat in overall acreage from the historic condition due at least in part to lack of specific desired conditions for this type, and lack of emphasis on certain natural processes, such as fire, that historically maintained this type. Conversely, a warming climate could result in an increase in grass and dry shrublands in some areas.

Both the Helena NF and the Lewis and Clark NF plans include standards and guidelines intended to ensure presence of big game, especially elk, during the hunting season. These plan components are largely aimed at providing hiding cover or other security from disturbance by humans in order to maintain hunting opportunities. A detailed discussion of the effects of these plan components on elk can be found in the elk section.

Gray wolves, listed currently as a RFSS, would continue to be considered sensitive under this alternative. Wolves may prey on a variety of mammals found in a variety of habitats, but ungulate prey is likely key to wolf presence. Under this alternative, the continued presence of ungulate species, supported in part by grass and shrub habitats, would continue to support wolves in the plan area.

Bighorn sheep are identified as a RFSS under the current plan, and would continue to be considered as such under the no-action alternative. The current plans do not have components specific to bighorn sheep; there are no standards or guidelines regarding separation of bighorn sheep from domestic sheep and goats in the existing plans. Although policy could be created to address this issue, the lack of plan standards or guidelines could make it less likely that effective separation of bighorn sheep and domestic sheep is created or maintained, presenting a slightly higher risk of disease transmission and consequent impacts to bighorn sheep herds than that of the action alternatives.

Hardwood tree habitats

The existing plans lack specific desired conditions or objectives for the amount and distribution of the hardwood tree vegetation types, which could result in variability or unpredictability in the degree to which these types would be maintained or restored in the future. Aspen and other hardwood tree habitats appear to be below historic levels, particularly in some GAs (Big Belts, Snowies, and Upper Blackfoot), although the wide variance in the estimated NRV makes it difficult to discern whether current levels are below the NRV. Forestwide, aspen distribution is below NRV, especially in the Little Belts, Snowies, and Upper Blackfoot GAs. These declines relative to historic levels have likely occurred over a long time period, but have included the time in which current plans have been in place. The estimated declines in aspen and hardwood types have likely been a result of fire exclusion and changing climate, but the absence of desired conditions or plan components for this vegetation type does not provide managers with specific guidance to maintain or restore hardwood habitats.

Species that use this habitat group for all or part of their life cycle continue to exist in the plan area, and habitat would continue to be provided, albeit possibly at lower levels than under other alternatives.

Dry conifer habitats

Mature ponderosa pine appears to have declined over time relative to its historic presence (refer to the terrestrial vegetation section), although this trend likely began well before the current plans were implemented. The existing plans lack specific desired conditions or objectives for the amount and distribution of the dry conifer vegetation types, which could result in variability or unpredictability in the degree to which these types would be maintained or restored in the future. The lack of specific desired conditions for certain cover types also could result in continued declines in some tree species (such as ponderosa pine or limber pine) or certain age or size classes of some species within this group. Modelling of the estimated trend of limber pine, ponderosa pine, and Rocky Mountain juniper shows a slight increase in these cover types and tree species presence under this alternative that would be likely indistinguishable from the trend estimated for the action alternatives, although estimated trend varies somewhat by GA.

Species that use this habitat group for all or part of their life cycle continue to exist in the plan area, and habitat would continue to be provided. Refer to the terrestrial wildlife species at-risk section for a discussion of impacts of the alternatives to flammulated owls and to Lewis's woodpeckers.

Mixed conifer habitats

The lack in the existing plans of specific desired conditions for certain cover types could result in forest composition and structure that is not reflective of the historic or natural range. Some cover types in this group, such as lodgepole pine and spruce/fir, are above the natural range for those types; refer to terrestrial vegetation section and the assessment (U.S. Department of Agriculture, Forest Service, Northern Region, 2015). Without specific desired conditions or other direction to move these types toward the NRV, this trend could continue. This could benefit some species that rely on this vegetation group, but would potentially decrease habitat for species relying on other types, such as dry conifer forest or open grasslands and shrublands.

Species that use this habitat group for all or part of their life cycle continue to exist in the plan area, and habitat would continue to be provided. Refer to the terrestrial wildlife species at-risk section for a discussion of impacts of the alternatives to Canada lynx.

High elevation habitats

The existing plans do not have specific desired conditions for non-forested habitat types such as alpine ecosystems or whitebark pine. Nevertheless, high elevation habitats are relatively un-influenced by forest management. Therefore habitat would continue to be available for species that use high-elevation ecosystems.

Late successional forests

In addition to the estimated trend of size class and vertical structure predicted under all alternatives, the existing plans include components for managing large trees and old growth. The existing plan for the Helena NF requires a percentage of each third-order drainage to be maintained in old growth, whereas the plan for the Lewis and Clark NF requires a percentage of the commercial forest in each timber compartment to be maintained in old growth. Evaluation of compliance with this requirement occurs during project-level analysis, because old growth is most accurately identified in the field. Forestwide modelling or estimation of old growth is not possible because of the complexity of characteristics that define old growth stands. Therefore, under alternative A the total amount and distribution of old growth would continue to be measured and applied on a site-specific basis, without an overall desired condition based on historic range or on ability of a GA or vegetation type to produce old growth. Compliance with forest plan standards would continue to be difficult to measure, and therefore it could be difficult to predict the amount and spatial arrangement of these habitats that would occur under this alternative. Modelling of some of the components of old forest, as described in the old growth section, indicates that old forest may increase over time under this alternative.

Snags

The existing forest plans have specific standards or guidelines for retention of snags. The Helena NF plan specifies the number of snags per acre to be achieved by third-order drainage, identifies preferred species to be retained as snags, and provides numeric standards for snag retention in "cutting units". The Helena NF plan also recommends that snag standards be met on lands other than those identified for timber production. The Lewis and Clark NF plan recommends the number of snags per acre to be achieved within specified size classes and timber types, and provides guidance about the distribution and location of snags to be retained during harvest or vegetation management activities. Although these plan components provide direction that requires stand retention and management, they have been found to be difficult to implement due to lack of clarity regarding scale of the requirements. Components regarding snag management in the existing plans also are in conflict with plan components or other requirements regarding safety management and desired conditions for certain developed recreation sites. Nevertheless, snag management under the current forest plans has helped to retain snags where management activities occur that could reduce or eliminate snags. In combination with the fact that much of the HLC NF would continue be subject to natural forces such as wildfire, insect and disease (see effects common to all alternatives above), continued implementation of the current plans would ensure that snag habitat would continue to be available in the plan area.

Coarse woody debris

The majority of the HLC NF is in wilderness, RWAs, or IRAs where natural processes, including those acting on the amount and distribution of coarse woody debris, would predominate.

The existing Helena NF Plan does not include components specifically regarding coarse woody debris. The existing Lewis and Clark NF Plan includes only one forestwide standard related to coarse woody debris as wildlife habitat, providing general recommendations for retaining "down trees" for wildlife. Without specific guidance to retain coarse woody debris, the abundance and distribution of this habitat may continue to be driven primarily by other resource needs (i.e., soil development and fuels management) without specifically addressing wildlife habitat values. As noted above, however, the large proportion of the HLC NF that is in areas where natural processes would predominate would likely ensure that coarse woody debris continues to occur throughout the plan area, providing habitat for those species that use this habitat feature for all or a portion of their life history needs.

Cave, cliff, rock or other geologically-determined habitats

The existing Helena NF Plan includes a component requiring managers to identify nesting territories and roosting sites for peregrine falcons and to protect them from "habitat alteration". The plan also includes a requirement that powerlines constructed within peregrine falcon nesting habitat be designed to "protect raptors from electrocution". Plan components for mineral development (including hard rock mining) include only general references to protection of resources, and there are no plan components that specifically address mines as habitat, mine closures, or caves. Under this alternative, therefore, on the Helena NF portion of the HLC NF, there would continue to be lack of specific guidance regarding these habitats, particularly cave and cave-like habitats that may be used by bats.

The existing Lewis and Clark NF plan includes a standard requiring managers to maintain peregrine falcon "essential habitat (currently unoccupied)"; at the time the plan was written, peregrine falcons were listed as threatened under the ESA but have since recovered, re-occupied many former habitats, and been removed from that list. The Lewis and Clark NF plan also includes standard requiring inventory and evaluation of found "caves, sinkholes, and other connected geological features", with protections "based on their resource values and classification". The plan requires development of individual cave management plans for caves classified as significant, and evaluation of those caves before ground-disturbing activities to determine effects on "the cave structure and its ecosystem". The plan includes a standard stating that caves with high resource values may be withdrawn from mineral entry. The cave-related standards on the Lewis and Clark NF portion of the HLC NF would increase the likelihood of caves used by bats being identified and those habitats potentially protected, as compared to the Helena NF portion.

Current standard practice on the Helena NF portion of the HLC NF is to conduct bat monitoring surveys (e.g., visual, acoustic, or live trapping) at individual inventoried abandoned mine features before closure, to determine whether RFSS (fringed myotis, long-eared myotis, and Townsend’s big-eared bat) may be present. Similar surveys on the Lewis and Clark NF side are often, but not always carried out. The type and extent of survey conducted by Forest staff is dependent on factors such as extent of mine workings, timing of mine activity, proximity to water and forage opportunities, timing of closure, method of closure (i.e., grate, culvert, hard closure) and review of past area or site specific bat surveys. These practices, although not mandated by current plans, would likely continue under this alternative.

Because most cave, cliff and rock habitats are relatively inaccessible, and are affected primarily by geologic forces, habitat for species that use them for all or a portion of their life history needs would likely continue in the plan area under this alternative.

Cumulative Effects

The cumulative effects analysis area for terrestrial wildlife diversity considers management of adjoining lands. Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 64, for those plans applicable to terrestrial wildlife diversity.

Table 64. Summary of cumulative effects to terrestrial wildlife diversity from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. The Flathead and the Custer Gallatin plans are currently being revised under the 2012 Planning Rule; plan components are similar and complementary to the revised HLC NF plan, with components to maintain wildlife species diversity. The existing plans for all adjacent forests provide for wildlife diversity and include components specific to particular wildlife species or habitats, depending on concerns or needs specific to those areas.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. Primary issues for the Butte area plan included vegetation communities, wildlife and wildlife habitat, wildlife and plan species with special status or identified as priority for management, travel and access management, recreations, and special designations. Components for the revised Missoula plan are expected to be similar to those in the Butte plan but specific to needs of that resource management area.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. The philosophy is to manage for the wild character and integrity of the natural heritage of the park, while providing for visitor services and facilities in areas managed for those uses. Management for natural vegetation and processes on lands that are immediately adjacent to lands on the Rocky Mountain Range GA of the HLC NF provides relatively consistent management of wildlife habitat across a large area.
Natural Resources Conservation Service – Montana Sage Grouse Initiative 2016	Portions of the eastern part of the HLC NF adjoin identified general habitat for sage grouse. Conservation focus is on private lands. Primary threats include cultivation of grazing lands, exurban development, improper grazing, nonnative plants, range management infrastructure, mesic area loss and degradation, conifer encroachment, and

Resource plan	Description and Summary of effects
	fence collisions. Conservation of sage grouse habitat also provides habitat for grass/shrub associated species that use HLC NF lands for part of life history needs.
Montana Statewide Forest Resource Strategy (2010)	MT conducted a Statewide assessment of forest resources and identified issue-based focus areas with implementation strategies and deliverables for each. Focus areas include biodiversity and resilience, including management and recovery of species diversity. Strategies supporting this focus area are consistent with management to provide for native species diversity on adjoining or nearby NFS lands. Focus areas also include changing ownership patters, and include strategies to minimize fragmentation of habitat, by prioritizing “at-risk” areas for management. This would complement HLC NF draft plan components to work with other entities to maintain or restore connectivity among landscapes.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, and are generally focused on specific recreational, historic, cultural, or scenic values, depending on the specific park. Goals include managing for those values in a manner consistent with available resources; these goals could be consistent with maintaining wildlife diversity on NFS lands, but would not necessarily contribute to the desired conditions as described for the HLC NF.
Montana’s State Wildlife Action Plan	Identifies community types, focal areas, and species in Montana with significant issues that warrant conservation attention. Communities include aquatic and terrestrial habitats. Specific regional focus areas found in proximity to the plan area include the North Fork of the Blackfoot (Scapegoat Wilderness). Several of the amphibian, bird, fish, mammal, and reptile species identified of greatest conservation need that may be found in the HLC NF plan area. This plan is complementary to, and provides information in support of desired conditions to maintain wildlife diversity, and supports recovery and conservation of species identified as ‘at-risk’ in the HLC NF plan.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.
County Growth Policy Plans	The HLC NF comprises 10 counties, each of which has individual growth plans of varying complexity. In general, most include support for recreation and tourism opportunities, many of which are based on natural landscapes and resources, including wildlife resources. Some plans include focus on access to public lands, and some focus on economic development through resource extraction. As such, plans may support some aspects of wildlife diversity while potentially having a negative impact on others.

Conclusions

Desired conditions for a variety of vegetation systems would bring habitat conditions throughout the HLC NF closer to the estimated NRV, and would provide a diversity of habitats used by native wildlife species. Plan components to maintain ecological integrity and ecosystem diversity would be sufficient to support all non-at-risk species on the landscape. Plan components for management of other resources would limit impacts to wildlife species and habitats by constraining certain activities that could have negative impacts on wildlife or habitats. Components in the draft plan (action alternatives) provide more specific desired conditions and other guidance that would better help managers achieve those conditions than components in the existing forest plans and alternative A.

3.15 Terrestrial Wildlife Species at Risk

3.15.1 Introduction

This section addresses the impacts of the draft plan, including alternatives, to at-risk species. The directives (USDA, 2015) for implementing the 2012 Planning Rule define ‘at-risk species’ as federally recognized threatened, endangered, proposed, and candidate species, and SCC (FHS 1909.12, Chapter 20, 23.12).

The planning directives describe the context for assessing plan components affecting at-risk species: "Plan components that provide for ecological conditions for ecosystem integrity and ecosystem diversity…are the primary context for the evaluation of at-risk species". For most species, the only practical quantitative evaluation of their required ecological conditions is an assessment of habitat conditions. Additional information is provided in the terrestrial wildlife section, organized by vegetation groups.

The 2012 Planning Rule (USDA, 2012a) states that, where plan components designed to provide for ecosystem integrity do not sustain the ecological conditions required by an at-risk species, species-specific plan components may be needed. For some at-risk species, specific components have been included in the draft plan in order to sustain the ecological conditions (including but not limited to specific amount or distribution of habitat features, protection from human disturbance, etc.) required by that species.

At the time this report was prepared, there are five at-risk terrestrial wildlife species found on the HLC NF. Those species are as follows:

- Federally listed, proposed, or candidate species:
    - Grizzly bear – Threatened
    - Canada lynx – Threatened
    - Wolverine – Proposed
- Species of Conservation Concern (identified by Regional Forester for the DEIS and draft plan):
    - Flammulated owl
    - Lewis's woodpecker

Federally listed and proposed species will be analyzed in a Biological Assessment for consultation with the USFWS after a preferred alternative is chosen and concurrent with preparation of a FEIS.

3.15.2 Regulatory framework

Please refer to the introductory regulatory framework section of this chapter (3.3).

3.15.3 Assumptions

A key assumption in this section is rooted in the 2012 Planning rule and the directives for its implementation: "Plan components developed for ecosystem integrity and ecosystem diversity … are expected to provide for ecological conditions necessary to maintain the persistence or contribute to the recovery of native species within the plan area, including at-risk species identified in [the] assessment. … Ecological conditions include habitat and the effects of human uses (for example, recreation, grazing, and mining)." (FHS 1909.12, 23.13). The directives also state that "Plan components that provide for ecological conditions for ecosystem integrity and ecosystem diversity are the primary context for the evaluation of at-risk species." (FSH 1909.12, 23.13). We assume that the plan components for maintaining or restoring terrestrial ecosystems as described in the terrestrial vegetation section will provide for the basic habitat needs (foraging, denning, breeding, movement) of at-risk species, as they do for most terrestrial wildlife species (refer to the terrestrial wildlife diversity section). That information will be summarized or referred to as needed in this section.

The Rule also states that species-specific plan components must be included when the coarse-filter plan components described in the above paragraph are insufficient to ensure conservation or recovery of at-risk species (USDA 2012).

3.15.4 Best available scientific information used

This section relies primarily on information in the scientific literature, and in published and unpublished reports regarding the presence, distribution, and requirements of at-risk wildlife species and potential impacts on them of existing and proposed management actions. Because of the programmatic level of this analysis, life histories and drivers of at-risk wildlife species and populations are generally not discussed in detail. Information provided here is relevant to the factors that put these species at risk, and that are the focus of plan components. The information in this analysis relies in part on information in the Assessment (U.S. Department of Agriculture, Forest Service, Northern Region, 2015), which contains extensive citations and bibliographies of the science used to determine life history, status, presence and distribution, threats, and drivers of at-risk wildlife species. Additional discussion of science regarding at-risk wildlife species is found in supporting materials in the project file. The BASI used in development of the Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy (U.S. Department of Agriculture, Forest Service, 2013c) and in development and implementation of the NRLMD (U.S. Department of Agriculture, Forest Service, 2007c) are incorporated in this analysis both directly and indirectly through reference to those documents and their supporting materials.

Where needed in the assessment and in this section, specific discussion may be included regarding contradictory science, why some information is used to the exclusion of others, and regarding areas for which scientific information is lacking.

The terrestrial wildlife diversity and terrestrial vegetation sections also provide information about the BASI used for those resource areas. Analysis for those resources forms the foundation of the coarse-filter level of analysis referenced in this section. Appendices B and D contain more BASI for grizzly bear and Canada lynx.

3.15.5 Grizzly bear, affected environment

Scale and Scope of Analysis

Most impacts of the draft plan and alternatives to the draft plan are discussed at the scale of the planning area (entire HLC NF), because most plan components are to be applied forestwide. However, the HLC NF plans to incorporate the “Forest Plan Amendments to incorporate relevant direction from the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy” into the existing Helena NF and Lewis and Clark NF plans (Grizzly Bear Amendments) (HLC NF Draft Plan appendix I). Management direction in the Grizzly Bear Amendment would subsequently be incorporated into the revised HLC NF forest plan. The Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy (USFWS, 2013b), hereafter referred to as the Draft Conservation Strategy, and the Grizzly Bear Amendments describe management zones that will be established with specific expectations regarding occupancy by grizzly bears. These management zones are based on available habitat, patterns of land ownership and management, proximity to the recovery zone and source population, existing grizzly bear distribution, and other factors that are relevant regardless of whether the Grizzly Bear Amendment were to be implemented. Therefore, the management zones provide an appropriate scale and reference point for describing some impacts to grizzly bears, particularly those that relate to components in the amendments or those that are specific to areas where grizzly bears occur. Some impacts may also be discussed at the scale of the GA, where appropriate to the specific issue.

The biology and ecology of grizzly bears in the Northern Continental Divide Ecosystem and on the HLC NF have been described extensively in several other documents (USFWS, 2013a); (U.S. Department of Agriculture, Forest Service, Northern Region, 2015); USDA 2017b), as has information on habitat use and availability on the HLC NF. Discussion here will focus on grizzly bear distribution on the HLC NF, and aspects of grizzly bear life history and habitat requirements that are relevant to analysis of the potential impacts to grizzly bears of the draft plan and alternatives to the draft plan.

Status

The grizzly bear is currently listed as a threatened species under the ESA. There are six Grizzly Bear Recovery Zones identified in the Grizzly Bear Recovery Plan (USFWS, 1993), five of which are currently considered occupied(C. M. Costello, R. D. Mace, & L. Roberts, 2016). The entire Rocky Mountain Range GA and the portion of the Upper Blackfoot GA that is north of Highway 200 are within the Northern Continental Divide Ecosystem Recovery Zone.

Distribution

Grizzly bears are widely distributed throughout the Northern Continental Divide Ecosystem, including on the Rocky Mountain Range and Upper Blackfoot GAs of the HLC NFs. The Northern Continental Divide Ecosystem is contiguous with the grizzly bear population in the Rocky Mountains of Canada. The grizzly bear population in the Northern Continental Divide Ecosystem appears to be expanding in distribution, with the most marked expansion occurring to the southwest, and to the east onto the short-grass prairie on non-NFS lands (Mace & Roberts, 2012; USFWS, 2013b). They have been observed occasionally in the Divide GA, and in September 2017 the USFWS updated information regarding where grizzly bears may be present to include the Elkhorn Mountains, Big Belt Mountains, Little Belt Mountains, and Highwood Mountains. At least one grizzly bear has been observed in the Elkhorn Mountains and one in the Big Belt Mountains, although it is not known whether those are separate bears, or whether they have remained in those areas. In June 2017 two subadult bears were captured and euthanized on private land in the vicinity of Stanford, Montana, several miles north of NFS lands in the Little Belt Mountains and southeast of NFS lands in the Highwood Mountains.

The Draft Conservation Strategy (USFWS, 2013b) and the Grizzly Bear Amendment describe expected occupancy by grizzly bears of the different grizzly bear management zones. The primary conservation area, which is the same as the existing recovery zone, is expected to continue to function as a source population with continual occupancy by grizzly bears. The Rocky Mountain Range GA and the north half of the Upper Blackfoot GA fall within this area. In zone 1 (south half of the Upper Blackfoot GA on the HLC NF) continual occupancy is expected, but at lower densities than in the primary conservation area. Grizzly bears in zone 1 are considered part of the Northern Continental Divide Ecosystem population for the purposes of demographic monitoring. Zone 2 includes the Divide, Big Belts, and Elkhorns GAs, and has an objective of maintaining existing resource management and recreation activities while maintaining the opportunity for grizzly bears to move between the Northern Continental Divide Ecosystem and other ecosystems to the south and southwest. Occupancy by grizzly bears may occur in zone 2, but at lower densities than in zone 1 and in the primary conservation area, and management would be focused almost entirely on conflict prevention. Zone 3 includes the Highwoods, Little Belts, Castles, and Crazies GAs and large areas of private and other lands. Long-term survival and occupancy of grizzly bears is not expected in zone 3, due to lack of sufficient suitable habitat (USFWS, 2013b).

Food Habits

Grizzly bears use a wide variety of habitats within the Northern Continental Divide Ecosystem, and on the HLC NF. Availability of food and forage has not been identified as a key issue with respect to grizzly bear recovery in the HLC NF portion of the Northern Continental Divide Ecosystem. More detailed information about grizzly bear food habits can be found in the Assessment (U.S. Department of Agriculture, Forest Service, Northern Region, 2015) and in other documents cited there and in this section.

Key Drivers and stressors

The Draft Conservation Strategy (USFWS, 2013b) identified population management and habitat management as the key factors needed to successfully manage and conserve grizzly bears in the recovery ecosystem. Secure habitat has been identified as important to the survival and reproductive success of grizzly bears, with motorized access identified as a stressor that may have a negative impact on the availability of secure habitat for bears (USFWS, 2011). Motorized access can affect bears by increasing human interaction and potential for conflict, displacing bears from important habitats, increasing the chance of habituation to humans, and increasing energetic requirements related to disturbance by humans (USFWS, 2011). This stressor (the amount and pattern of motorized access in grizzly bear habitat), can be influenced by FS management of NFS lands. This stressor also occurs on private lands that are not influenced by FS management.

Human developed sites have been identified as another potential stressor (USFWS, 2011) by contributing to habituation and food conditioning that may result in direct mortality of bears. Management of developed recreation sites on NFS lands is under FS control, but the activities occurring outside NFS boundaries are not.

Direct human-caused mortality, which can be associated with bear-human conflicts as well as with hunting (mistaken identity) and with illegal kills is another stressor (USFWS, 2011). Bear-human conflicts on private lands due to livestock depredation and due to conflicts related to attractants on private lands continues to be a primary source of mortality and is outside of NFS control. As the grizzly bear population expands, the availability of secure habitat outside NFS boundaries that is not heavily influenced by agriculture or other human activities may become an increasingly important driver of grizzly bear distribution and persistence outside the Northern Continental Divide Ecosystem and in management zones 2 and 3.

The Draft Conservation Strategy provides management recommendations intended to limit mortality and to provide secure habitat through actions or constraints that would be implemented across a number of resource management activities. Recommendations are specific to grizzly bear management zones and are based on goals and expected grizzly bear presence in those areas. Recommendations for the primary conservation area (recovery zone) are focused on the key issues of 1) limiting mortality by preventing or reducing bear-human conflicts, and 2) providing habitat security through limiting motorized access density and maintaining ‘secure core’ (see glossary) habitat in adequate amount and distribution. Habitat security is related to mortality, because habitats that are more accessible to humans have increased risk of bear-human encounters or other conflict situations that can result in mortality of bears. In addition to these issues, habitat connectivity was identified as a concern in the Draft Conservation Strategy (USFWS, 2013b) with respect to the health and trend of grizzly bear populations in other recovery zones. Connectivity it is not considered an indicator of the recovery or persistence of the grizzly population in the Northern Continental Divide Ecosystem or on the HLC NF.

The degree to which plan components address these key issues (mortality, habitat security, and connectivity) serves as indicators to how well the draft plan and alternatives achieve desired conditions related to grizzly bears, and contribute to recovery and long-term persistence of the population on the HLC NF.

Population Trend and Mortality

Research in 2004 (Kendall et al., 2009) estimated a total of 765 bears in the Northern Continental Divide Ecosystem as a whole. MTDFWP (C. M. Costello, R. D. Mace, & L. L. Roberts, 2016) estimates the population has been increasing at a rate of 2.3 – 3% annually since that time, leading to an estimate in 2016 of between 950 and 1,090 grizzly bears in the ecosystem.

Survival of reproductive females is considered a key issue in maintaining a stable or increasing population trend and in recovery and persistence of grizzly bears in the Northern Continental Divide Ecosystem. Human-caused mortality is the most significant factor influencing grizzly bear survival (Costello, 2016; Mace, 2012), with most mortality occurring as a result of conflicts with humans or property on non-NFS lands. To minimize the risk of conflicts related to food and attractants, food storage orders have been implemented on most NFS lands in the Northern Continental Divide Ecosystem. The

HLC NF is in the process of implementing a food storage order on zone 2 lands in the Divide, Big Belts, and Elkhorns GAs.

Habitat security

The Draft Conservation Strategy (USFWS, 2013b) and the 5-year review of grizzly bear status (USFWS, 2011) identified habitat security as a key issue in recovery. Existing levels of motorized route density are a useful and widely used expression of potential habitat security. In 1994 (updated in 1998) the Interagency Grizzly Bear Committee recommended maximum levels of motorized route density in recovery zones (IGBC, 1998), expressed as percentages of bear management unit subunits (see glossary). The existing Helena NF and Lewis and Clark NF plans do not include specific limits for motorized route density or secure core, but management actions on the HLC NF in the recovery zone and other parts of the NF where bears are known to occur have been guided by those recommendations. Motorized route densities and amounts of secure core for subunits on the HLC NF within the recovery zone are reported in the Draft Conservation Strategy (USFWS, 2013b). In September 2017 the USFWS added several GAs on the HLC NF to the area in Montana in which they recognize that grizzly bears may be present. These areas do not have delineated bear management unit subunits. Calculations of motorized route density therefore cannot be done the same way there as within the recovery zone (primary conservation area) nor as reported in the Draft Conservation Strategy, and can't be directly compared to route densities that are reported as recommended by the Interagency Grizzly Bear Committee.

In order to to allow comparison among all management zones and GAs and comparison with some published literature (e.g. (Boulanger & Stenhouse, 2014), motorized route densities were calculated for entire GAs as total miles per GA or portion of GA within each management zone, as shown in Table 65. Due to differences in datasets, the designations of routes included as 'open' or those in the 'total' calculation may not be exactly the same as those used for density assessments reported in the Draft Conservation Strategy (USFWS, 2013b) and elsewhere. Additional methods used for this estimation, including decisions about which routes to consider open or closed, are detailed in the project file. Estimates of motorized route density may differ from those reported in other documents, including other environmental assessments or decisions. These differences are due calculating over a slightly different total area, and/or different methods used. The numbers in Table 65 are intended solely for the purpose of broad comparison to published literature and other sources.

Table 65. Existing levels of open and total motorized route density, by GA and grizzly bear management zone HLC NF.

Grizzly bear management zone	GA	Open motorized route density[1] (mi/sq mi)	Total motorized route density[1] (mi/sq mi)
Primary Conservation Area	Rocky Mountain Range	0.1	0.2
	Upper Blackfoot (part)	0.4[2]	1.4[4]
Zone 1	Upper Blackfoot (part)	1.3[3]	1.4[4]
Zone 2	Divide	0.8	1.7
	Big Belts	0.9	1.6
	Elkhorns	0.7	1.2
Zone 3	Highwoods	0.6	0.7
	Little Belts	0.9	1.7
	Castles	2.1	2.7
	Crazies	0.6	1.6
	Snowies	0.3	0.6

1. Route densities calculated by dividing linear miles of open motorized road and trail by GA acreage, NFS lands only, to facilitate comparison among zones. Details of calculations, including which routes were included, are in the project file.

2. As reported in the Blackfoot non-winter travel management plan decision (USDA, 2013). The area reported for the PCA extends slightly south of the PCA as defined in the draft conservation strategy, and includes the area identified as the grizzly bear distribution zone in previous analyses for the Helena NF.
3. As reported in the FEIS for the Forest Plan Amendments: Incorporating Habitat Management Direction for the Northern Continental Divide Ecosystem Grizzly Bear Population (USDA 2017).
4. Total motorized route densities were calculated for the entire Upper Blackfoot GA and not separated into primary conservation area and zone 1.

Mace and others (Mace, Waller, Manley, Lyon, & Zuuring, 1996) found that female grizzly bears in northwest Montana used home ranges with lower road densities than other areas. They estimated a threshold of roughly 6 km/square km (1 mi/square mile) that differentiated between areas used and not used by female grizzly bears. That study has been used as the basis for management of motorized access route density throughout much of the Northern Continental Divide Ecosystem since that time. Lamb and others (2018) evaluated grizzly bear density relative to a 6 km/square km open road threshold in an area of British Columbia adjacent to the Northern Continental Divide Ecosystem. Their work supported that threshold as a point above which bear density tended to be lower. They noted, however, that other studies (e.g., (McLellan, 2015) found higher densities of bears occurred along with higher open road densities, influenced by road type and use as well as by habitat quality and food availability. Ruby (2014) found that in his study area in northwest Montana human development features, including roads, had little influence over grizzly bear habitat selection. In Alberta, Boulanger and Stenhouse (2014) found that most bears occurred in areas with open road densities below 1.5 km/sq km (2.4 mi/sq mi), and that most mortalities occurred at road densities above 1 km/sq km (1.6 mi/sq mi). They noted that mortality risk associated with roads appeared to be higher for females with cubs or yearlings than for other classes of females. Differences in the effects observed and the recommendations made among these and other studies are important, with differences among methodologies, definitions of roads and differences among classification of roads as open or not, different use types and levels, whether legal hunting of grizzly bears occurs, and different habitat type and quality. Therefore extrapolating precisely from any one study to the HLC NF is not possible. Rather, the range of studies and results provides general context for understanding the potential influence of motorized travel on grizzly bears.

Both the open and total motorized route densities calculated for each GA in its entirety across the HLC NF are well below the threshold road densities at which Boulanger and Stenhouse (Boulanger & Stenhouse, 2014) described decreased occupancy by grizzly bears, including reproducing females. Open road densities in all GAs except the Castles GA are also below that threshold as well as below the threshold identified by Mace and others (Mace et al., 1996) where use by females may decline or be precluded.

The amount and distribution of motorized travel that is allowed on NFS lands is regulated by travel management plans, but recreation settings also provide an indication and description of the amount and pattern of motorized and nonmotorized uses, along with other uses, on the landscape. Recreation settings are the attributes of a place that in combination provide a distinct set of recreation and access opportunities. The semi-primitive non-motorized, and primitive ROS categories differ in a variety of attributes, but are similar in not including motorized travel and in minimizing many types of human influence or development. Therefore, the amount and arrangement of these ROS categories provides another means to describe existing potential habitat security and connectivity for grizzly bears and other wildlife. The amount of those settings that occur under current management is shown by grizzly bear management zone in Table 66.

Table 66. Acres of summer primitive and semi-primitive recreation settings by grizzly bear management zone

Grizzly bear management zone[1]	Total acreage in nonmotorized recreation setting categories	Percent of total management zone on HLC NF
Primary conservation area	878,470	91%
Zone 1	90,464	61%
Zone 2	348,582	52%
Zone 3	378,849	39%

1. The primary conservation area includes the Rocky Mountain Range GA and the north half of the Upper Blackfoot GA. Zone 1 includes the south half of the Upper Blackfoot GA. Zone 2 includes the Divide, Elkhorns, and Big Belts GAs. Zone 3 includes the Highwoods, Little Belts, Castles, and Crazies GAs.

These recreation settings comprise NFS lands that may include areas with specific management designations, such as RWAs, IRAs and others. While motorized travel may be allowed in some designated areas, overall management in some designated areas increases the value of those areas as secure habitat for bears and other wildlife. Both motorized and mechanized travel are prohibited in Congressionally-designated Wilderness Areas ("Wilderness act - public law 88-577 (16 u.S. C. 1131-1136)," 1964). Motorized travel is minimized in WSAs, and is generally restricted to what was allowed prior to the area's designation. RWAs, identified in forest plans, provide areas where the influence of humans is minimal. The law creating the Conservation Management Area (Public Law 113-291), which is entirely on the Rocky Mountain Range GA, does not allow creation of new permanent motorized routes, and allows creation of new temporary motorized routes only for specific purposes and only within one quarter of a mile of existing main roads. Roads may not be constructed or reconstructed and timber may not be harvested in IRAs except under limited circumstances specified in the 2001 Roadless Rule (USDA, 2001). Although portions of some IRAs may have been substantially altered by construction of roads and by harvest of timber prior to enactment of the Roadless Rule in 2001, these areas generally provide security for grizzly bears, as well as connectivity within those landscapes for bears to move among different habitats and areas. The overlap of these designations throughout many areas of the HLC NF creates multiple layers of management requirements or guidance that cumulatively ensure these areas remain relatively free of human disturbance, providing substantial habitat security for grizzly bears and other wildlife. Table 67 shows the acreage of each type of designated area, by grizzly bear management zone. It also shows the acreage of each type overlapping with secure core, which is identified only in the primary conservation area. There is some spatial overlap among area designations, particularly among IRAs, WSAs, RWAs, and the conservation management area (refer to appendix A).

Table 67. Acres of designated areas and percent of total management zone on HLC NF by grizzly bear management zone

Grizzly bear management zone[1]	Designated wilderness[2]	WSA	Recommended wilderness	Conservation management area	IRA[2]
Primary conservation area	537,718 (56%)	0	0[3]	195,073 (20%)	425,647 (44%)
Zone 1	0	0	0	0	86,255 (58%)
Zone 2	28,440 (4%)	0	34,226 (5%)	0	285,895 (42%)
Zone 3	0	82,127 (8%)	0	0	548,982 (56%)

1. The primary conservation area includes the Rocky Mountain Range GA and the north half of the Upper Blackfoot GA. Zone 1 includes the south half of the Upper Blackfoot GA. Zone 2 includes the Divide, Elkhorns, and Big Belts GAs. Zone 3 includes the Highwoods, Little Belts, Castles, and Crazies GAs.
2. Designated wilderness does not overlap with any other categories of designation listed in this table except in small areas on the Rocky Mountain Range GA, where areas were added to Wilderness that are also

identified as IRA. Elsewhere and for most of the Rocky Mountain Range GA, designated Wilderness acres are in addition to acres listed under other designations.

3. The existing Lewis and Clark NF plan identifies RWAs on the Rocky Mountain Range GA. These areas were added to existing designated wilderness in 2014.

Habitat connectivity

Human activities such as roads and developments are the primary causes of grizzly bear habitat fragmentation (Servheen, Waller, & Sandstrom, 2001). Work has been done to assess both habitat and population connectivity within the Northern Continental Divide Ecosystem in terms of habitat, demographics, and genetics. Kendall and others (Kendall et al., 2009) concluded that there are few geographical barriers to the movement of grizzly bears within the ecosystem.

Occupancy by grizzly bears of lands outside the Northern Continental Divide Ecosystem is not identified as a recovery or management goal, but isolation of existing populations (USFWS, 1993) and the potential for ongoing fragmentation have been identified as concerns with respect to the health and recovery of grizzly bear populations in some ecosystems (USFWS, 2011). The Draft Conservation Strategy (USFWS, 2013b) identifies zone 2 bordering the south end of the ecosystem as having value for genetic connectivity between the Northern Continental Divide Ecosystem and the Greater Yellowstone Ecosystem (USFWS, 2013b). Peck and others (2017) provide information supporting that conclusion, noting that the western portion of zone 2 (including the Upper Blackfoot and Divide GAs) and adjoining areas to the west may be more important to grizzly bears moving from the Northern Continental Divide Ecosystem to the Greater Yellowstone Ecosystem than the reverse.

Although management in zone 2 is focused on reducing potential for grizzly bear-human conflict by implementation of food storage orders, the Draft Conservation Strategy acknowledged that existing blocks of HLC NF lands with low road densities or with no roads, such as IRAs and the conservation management area, contribute to potential use by bears. The nature of the island mountain ranges that make up the HLC NF, however, where blocks of NFS lands are separated by large landscapes of low-elevation generally nonforested private lands, often with multiple roads, towns and other human developments as well as extensive blocks of agricultural lands, all likely create some barriers to grizzly bear occupancy and movement between the Northern Continental Divide Ecosystem and the Greater Yellowstone Ecosystem, as well as among the Divide, Elkhorns, and Big Belts GAs.

There are several areas on the HLC NF that may be more likely than others to facilitate movement of grizzly bears and other large carnivores among isolated mountain ranges (GAs) by providing relatively high levels of habitat security on public lands that are immediately adjacent to large blocks of private land. These areas occur in IRAs, RWAs, WSAs, or other areas with low road densities or that have little or no motorized travel that are along the NF boundary. Such areas have greater potential connectivity value where they adjoin other public lands or private lands with little or no development.

3.15.6 Grizzly bear, environmental consequences

As discussed in the terrestrial wildlife diversity section and under the heading ‘assumptions’, plan components to maintain ecosystem integrity and diversity provide for most of the needs (foraging, denning, breeding, and movement) of grizzly bears on the HLC NF. The effects of these coarse-filter components in supporting recovery and sustaining a recovered grizzly bear populations will be discussed under the effects of alternatives, because plan components differ between the no action and action alternatives.

The 2012 Planning Rule states that species-specific, or fine-filter plan components may be required where coarse-filter plan components may not be adequate to ensure conservation or recovery of at-risk species. These fine filter plan components, guiding management of grizzly bear habitat and activities that could impact grizzly bears, are incorporated into all alternatives as the Amendment to Incorporate Management

Direction From the Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy into the Helena, Lewis and Clark, Kootenai, and Lolo NFs (Grizzly Bear Amendment) (HLC NF Draft Plan appendix I). The plan components found in the Grizzly Bear Amendment focus on minimizing human-caused mortality and on providing security from disturbance by humans, and are discussed under the 'effects common to all alternatives' section below. The potential consequences to grizzly bears of additional fine filter plan components are discussed for the alternatives in the appropriate sections below.

Effects common to all alternatives

Forest plan amendments to incorporate relevant direction from the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy

All alternatives, including the no-action alternative, incorporate the forest plan amendments to incorporate relevant direction from the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy into the existing Helena NF and Lewis and Clark NF plans (Grizzly Bear Amendment) (HLC NF Draft Plan appendix I). The amendments address the key issues of mortality, security and connectivity, so discussion of the consequences of that management direction is summarized here as a whole rather than separated into those categories.

A full analysis of the potential impacts of implementing the management described in the Grizzly Bear Amendment can be found in the Final Environmental Impact Statement, Volume 3: Forest Plan Amendments to incorporate relevant direction from the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy (USDA FS 2017b). The analysis in that document is separate for the Helena NF and the Lewis and Clark NF because there are two separate forest plans being amended. That analysis will not be repeated here, but key parts are summarized here as they relate to the analysis of consequences of the HLC NF draft plan and alternatives to the draft plan.

Grizzly Bear Amendment Alternative 2, with some modifications has been selected in the ROD for that analysis. The amended Helena NF plan under Alternative 2-modified would contribute to maintaining a well-distributed grizzly bear population across the Forest (USDA FS 2017b). The summary of consequences described for the portion of the HLC NF that was formerly the Lewis and Clark NF are nearly identical concluding that the "amended [existing] Lewis and Clark forest plan would maintain a well-distributed grizzly bear population on the Forest and contribute to supporting recovery of the NCDE population." (ibid).

Other management direction common to all alternatives – mortality

Currently, a food storage order exists for NFS lands throughout the primary conservation area, including the Rocky Mountain Range and Upper Blackfoot GAs on the HLC NF. The HLC NF is in the process of developing and implementing a food storage order for the Divide, Elkhorns, and Big Belts GAs (zone 2). A food storage order is also currently in place in specific developed recreation sites in the Little Belts GA (portion of zone 3). These orders are not part of the existing forest plans, but would be retained under all alternatives. The food storage orders minimize the risk of bear-human conflicts on NFS lands resulting from bears obtaining food at human use sites or developing an association between humans and available food.

Other management direction common to all alternatives – habitat security and connectivity

Under all alternatives, it is anticipated that travel management plans would remain the same as they currently are. Therefore in addition to the plan components requiring no net increase of open and total motorized route densities in the primary conservation area and zone 1 (Rocky Mountain Range and Upper Blackfoot GAs), motorized route densities as calculated for the entire HLC NF and displayed in Table 65 would remain the same. Under all alternatives, the amount and location of designated wilderness, WSAs, IRA, and conservation management area would remain as they are currently unless changed by Congress through separate actions. Where those designations exist, the layers of management that create relative habitat security and potential connectivity for grizzly bears would remain as they currently are.

Effects of alternative A, no action

Discussion of the potential effects of implementing alternative A is limited to those effects that differ from or are not already discussed above under the section 'effects common to all alternatives'.

Coarse filter

Grizzly bears are habitat generalists that use a wide variety of vegetation types and structures to obtain food, find mates, rear young, and den. Refer to the terrestrial vegetation report for a comprehensive discussion of the predicted trend and status of habitat and vegetation types under this alternative.

Grizzly bears rely on foods that may occur in any number of habitat types, with key foods in spring often found in low elevation riparian areas and forest openings, as well as on private lands outside of the NF boundary. Under this alternative, riparian and wetland habitats would persist, although a lack of watershed-level desired conditions and plan components could have a negative impact on connectivity within and among these habitats. Existing plan components for managing identified riparian areas, as well as those for wildlife species and sensitive habitats would likely minimize impacts on a project or site-specific basis, thereby maintaining habitat for species, including grizzly bears, that use or depend on riparian and wetland habitats. Refer also to the aquatic ecosystems, terrestrial vegetation (non-forested vegetation), plants at risk (riparian guilds), and the terrestrial wildlife diversity (species associated with aquatic, wetland, and riparian habitats) sections of this DEIS.

Summer foods may include berries found in a variety of forest types, as well as small mammals, insects, and other foods not confined to any particular vegetation type. These habitats would be maintained under this alternative, although specific desired conditions for particular vegetation types would not guide management toward or away from the natural range or any other abundance or distribution of key habitats. Refer to the terrestrial vegetation section for discussion of specific vegetation types, and to the terrestrial wildlife diversity report for discussion of impacts to species associated with grass/shrub, hardwood tree, mixed conifer, and high elevation habitats, all of which likely provide some elements of grizzly bear spring, summer and fall habitat.

Bears have been documented denning in high-elevation areas with steep slopes and deep snow, but historically bears also denned in the foothills and prairies, where some denning activity has been recently documented. As discussed in the terrestrial wildlife diversity section, high elevation habitats are relatively un-influenced by forest management, so species dependent on this type of habitat would be expected to persist over the long term in the plan area, as they have under the current forest plans.

Habitat Security

The following management direction for grizzly bears would be retained in the Helena NF plan (USDA 2017c):

- Much of the existing forest plan management that is based on the Interagency Grizzly Bear Guidelines (IGBC, 1986).
- Existing forest plan direction for individual management areas, some of which specify limits on open road density.
- The existing Helena NF standard stating that new developed recreation facilities would generally not be constructed.
- Existing forest plan direction to reduce livestock impacts and to minimize grizzly bear – livestock conflicts on NFS lands in the recovery zone (primary conservation area).
- Existing forest plan standards and guidelines for vegetation management.

- Existing forest plan standards requiring no surface occupancy for minerals or energy leases in the recovery zone (primary conservation area).

Similar direction would be retained in the Lewis and Clark NF plan. Differences from that retained in the Helena NF plan described above are (USDA FS 2017c):

- Standards that require coordination of road construction and use with grizzly bear habitat needs, including continuing to apply the Interagency Rocky Mountain Front Wildlife.
- Monitoring/Evaluation program recommendations on the Rocky Mountain Range GA.
- Standards that control the type and intensity of activities, including road management, to benefit other wildlife species such as elk, particularly in the Little Belts, Highwoods, Castles, and Crazies GAs (zone 3).
- A standard requiring that livestock grazing that affects grizzly bears and/or their habitat would be made compatible with grizzly bear needs or be eliminated, in addition to continuing to apply the Rocky Mountain Front Wildlife Monitoring/Evaluation program recommendations specific to grizzly bears and livestock grazing.
- Surface occupancy for minerals and energy development in the recovery zone (primary conservation area) could be allowed, but standards constrain exploration and development activities, and require application of the Rocky Mountain Front Wildlife Monitoring/Evaluation program recommendations specific to oil and gas exploration and development.

The distribution and timing of motorized travel that is allowed on the HLC NF is regulated by travel management plans. Travel plans were completed for most portions of the HLC NF between 2007 and 2017. Although travel planning is a site-specific decision tiered to forest plans, the pattern of motorized use in current travel plans defines the recreation settings in alternative A. The amount and distribution of non-motorized recreation settings, which provide potential habitat security for grizzly bears, would remain as shown in Table 66 above (refer to the ‘affected environment’ section under ‘habitat security’).

Habitat connectivity

The existing forest plans do not provide specific direction regarding connectivity, although as described under the ‘affected environment’ section, the mix of IRAs, conservation management area, and other unroaded or lightly roaded areas likely provides some potential for grizzly bears and other large, wide-ranging species to move among daily and seasonal habitats and potentially across larger landscapes.

Areas such as the Highway 200 corridor through the Upper Blackfoot GA, and the Highway 12 corridor through the Divide GA, in addition to private lands in those areas may provide some impediments to grizzly bear movements through those landscapes, and may limit connectivity between the Northern Continental Divide Ecosystem and the Greater Yellowstone Ecosystem. Without specific plan components to retain habitat security on NFS lands adjacent to those and other areas, connectivity through them could remain limited. However, the majority of fragmentation and impacts to connectivity in those areas occur on non-NFS lands that are not affected by FS management actions.

Effects of the action alternatives

Coarse filter

Under all action alternatives, plan components would guide managers to move most vegetation types toward the NRV identified for each type. This would move habitats toward conditions that have historically sustained a persistent population of grizzly bears.

As discussed in the terrestrial vegetation section, the predicted trend for most vegetation types and structural stages does not differ among any alternatives. Vegetation management, livestock grazing, and other activities would be constrained by plan components designed to protect watershed integrity, riparian habitats, and hydrologic function, thereby moving riparian habitats toward desired conditions that support functioning and resilient riparian and wetland ecosystems. Identification and management of RMZs, as well as conservation watershed networks, is likely to maintain or improve connectivity on NFS lands within and among these habitats.

Under all action alternatives, the vegetation types within grass/shrub, hardwood tree, and mixed conifer habitats would generally move toward the estimated NRV and toward desired conditions. These habitats currently provide sufficient food and other resources required by grizzly bears where grizzly bears exist, and would be expected to continue to do so under all action alternatives. Specific plan direction for whitebark pine in all action alternatives would conserve and potentially restore this grizzly bear food source in some areas, although the degree to which this occurs would be affected by the prevalence and spread of disease, as well as potential changes in climate.

Mortality

In addition to retaining food storage orders in the primary conservation area, zone 1 and zone 2, all action alternatives contain plan components to minimize the potential for impacts to wildlife resulting from various resource management activities or uses (FW-REC-DC-04, FW-RT-DC-06, RM-WL-STD-01) and to reduce wildlife-human conflicts (FW-WL-DC-04, FW-WL-GDL-02, FW-RSUP-GDL-01). These plan components would add to the benefits of the existing food storage orders by further reducing the risk of bear-human conflicts that may result in grizzly bear mortality.

Habitat security

In addition to law and policy guiding management of those areas, all alternatives include plan components for management of designated areas that would maintain or increase habitat security within those areas. Those include FW-WILD-DC-01 and FW-WSA-DC-01 which states that wilderness areas and WSAs will be dominated by natural processes and disturbances with a limited amount of human influence. FW-WSA-SUIT-02, 03 and 04 prohibit or limit human developments such as utility corridors, new roads, and developed recreation facilities. FW-IRA-DC-01 states that IRAs “provide for secure habitats for a variety of …wildlife species that are dependent upon large, undisturbed, unfragmented areas of land”. These components would maintain or enhance habitat security and connectivity for grizzly bears and other wildlife.

Although the draft plan identifies the desired condition of providing needed access to NFS lands (FW-LAND-DC-01, FW-LAND-OBJ-01, FW-LAND-GDL-01), other plan components emphasize removing or rehabilitating unneeded roads (FW-RT-GDL-15, FW-ACCESS-GDL-02), while components in specific GAs limit road building except for specific, limited purposes (EH-RT-STD-01, 02, EH-RT-GDL-01). Components for specific resources include provisions for limiting the impacts of roads and their use on wildlife (EH-EMIN-GDL-02, EH-RT-GDL-01). FW-LAND-GO-01 encourages the establishment of road user associations in order to limit the number of roads needed to access private land inholdings, and FW-RT-DC-06 states that the transportation system as a whole provides access while also protecting natural resources. While the Grizzly Bear Amendment sets limits on motorized route density in the primary conservation area and zone 1 (the Rocky Mountain Range GA and part of the Upper Blackfoot GA), these plan components would limit and guide road construction and use throughout the rest of the HLC NF. Additional plan components that would contribute to security for wildlife in general that would also contribute to grizzly bear habitat security are listed in Table 68 along with where they would apply. Descriptions in Table 68 paraphrase the actual components, to briefly illustrate the manner by which they may influence habitat security. Please refer to the draft plan for the actual text of plan components.

Table 68. Draft plan components that would contribute to providing habitat security for grizzly bears and other wildlife

Plan component	Grizzly bear management zone where applies	Description
FW-WL-DC-08	All	Low elevation non-forested provides forage intermixed with cover for wintering big game
FW-WL-DC-09	All	Nest and den sites relatively free of human disturbance
FW-WL-GDL-06	All	Vegetation management on big game winter range improves forage and retains cover
FW-ACCESS-GDL-02	All	To protect natural resources… unauthorized routes should be rehabilitated and restored to a natural condition
FW-WSA-GDL-03	All	To protect natural resources… unauthorized routes should be rehabbed and restored
FW-LAND-DC-03	All	Land adjustments enhance or protect resources including habitat for wildlife
FW-LAND-DC-02-05	All	Utility corridors, communication sites and the like occur within already disturbed areas, obsolete ones are removed, and authorizations are consistent with ecosystem desired conditions
FW-RT-DC-02	All	Transportation system has no unneeded roads
FW-RT-DC-06	All	Transportation system has minimal impacts on resources, including threatened and endangered species
FW-RT-GDL-15	All	Decommission unneeded roads, especially if doing so benefits fish and wildlife, including grizzly bears
DI-WL-GDL-01	Zone 2	Divide GA - manage lands to maintain or improve security and connectivity; vegetation management provides hiding cover, no increase in motor access, location of new trails doesn't impact wildlife habitats
DI-WL-GO-01	Zone 2	Divide GA - Acquire ownership and easement to intermingled lands for connectivity and security
EH-WL-DC-02	Zone 2	Elkhorns GA- Habitat provides for species requiring seclusion
EH-WL-GDL-01	Zone 2	Elkhorns GA- Permitted activities have conditions to reduce potential impacts to wildlife, including timing or other restrictions
EH-ACCESS-GDL-01	Zone 2	Elkhorns GA- Access to inholdings protects wildlife habitat through timing restrictions and or location
EH-WMU-GO-04	Zone 2	Elkhorns GA - Acquire private land inholdings when possible
EH-RT-STD-01	Zone 2	Elkhorns GA -New permanent roads allowed only for alleviating resource concerns
EH-RT-STD-02	Zone 2	Elkhorns GA -No trans-mountain road
RM-BTM-DC-01	Primary conservation area	Rocky Mountain Range GA - Maintains values of Badger-Two Medicine as large, undeveloped, non-motorized landscape
RM-CMA-DC-03	Primary conservation area	Rocky Mountain GA – CMA allows primarily non-motorized recreation providing primitive and semi primitive recreation opportunities
RM-CMA-STD-01	Primary conservation area	Rocky Mountain Range GA – In the CMA, no new or temporary roads except very limited purposes near other roads
RM-CMA-STD-02	Primary conservation area	Rocky Mountain Range GA – In the CMA, temporary roads must be restored within 3 years of project completion
UB-WL-GDL-01	Primary conservation area and Zone 1	Upper Blackfoot GA- Resource management activities in west-central and east-central should maintain or enhance wildlife habitat, movement areas, and connectivity; vegetation management provides

Plan component	Grizzly bear management zone where applies	Description
		cover, no increase in motorized use, locate new trails only where minimal impacts occur to wildlife

As described for alternative A, the amount of primitive and semi-primitive nonmotorized recreation setting under each alternative provides one means to measure and compare potential habitat security and connectivity for grizzly bears and other wildlife. The amount of those settings that would occur under the action alternatives is shown in Table 69. Alternative A is included in this table to facilitate comparison.

Table 69. Acres and percent of total management zone of summer primitive and semi-primitive recreation settings (nonmotorized categories) by grizzly bear management zone by alternative

Grizzly bear management zone[1]	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Primary conservation area	878,470 (91%)	884,018 (92%)	884,018 (92%)	884,018 (92%)	878,472 (91%)
Zone 1	90,464 (61%)	93,387 (63%)	93,387 (63%)	93,387 (63%)	90,427 (61%)
Zone 2	348,582 (52%)	349,705 (52%)	350,014 (52%)	356,127 (53%)	341,374 (51%)
Zone 3	378,849 (39%)	378,940 (39%)	378,995 (39%)	419,669 (43%)	378,805 (39%)

1. The primary conservation area includes the Rocky Mountain Range GA and the north half of the Upper Blackfoot GA. Zone 1 includes the south half of the Upper Blackfoot GA. Zone 2 includes the Divide, Elkhorns, and Big Belts GAs. Zone 3 includes the Highwoods, Little Belts, Castles, and Crazies GAs.

There is not much difference among alternatives in terms of the amount or proportion of area in non-motorized recreation setting in total or by management zone. Most of the primary conservation area would remain nonmotorized and therefore relatively secure for grizzly bears because it occurs largely on the Rocky Mountain Range GA within the overlapping layers of Congressionally-designated wilderness, IRA, and conservation management area. Appropriately, the amount of potential habitat secure from motorized use in all alternatives is less in the zones moving further from the primary conservation area. Zone 3, where continued occupancy by grizzly bears is not expected, however, would still have more than one third of its area in non-motorized recreation settings.

RWAs may also contribute to habitat security for grizzly bears and other wildlife. All action alternatives except alternative E would include several RWAs, with the amount and location varying by alternative. Table 70 shows the amount of RWA by grizzly bear management zone by alternative. Alternative A, which also represents the existing condition, is included to facilitate comparison among all alternatives.

Table 70. Acres and percent of grizzly bear management zones in RWA by alternative

Grizzly bear management zone[1]	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Primary conservation area	0	30,246 (3%)	30,246 (3%)	30,246 (3%)	0
Zone 1	0	23,315 (17%)	23,315 (17%)	25,315 (17%)	0
Zone 2	34,226 (5%)	47,726 (7%)	47,726 (7%)	98,227 (15%)	0
Zone 3	0	14,490 (1%)	14,490 (1%)	225,501 (23%)	0

1. The primary conservation area includes the Rocky Mountain Range GA and the north half of the Upper Blackfoot GA. Zone 1 includes the south half of the Upper Blackfoot GA. Zone 2 includes the Divide, Elkhorns, and Big Belts GAs. Zone 3 includes the Highwoods, Little Belts, Castles, and Crazies GAs.

The main difference among alternatives is that alternative E would have no RWAs, which is less than even the no-action alternative. Alternatives B, C, and D are similar in terms of the amount and proportion of RWA in the primary conservation area and zone 1, but alternative D would have more than twice as much area in RWA within zone 2 as compared to alternatives A, B and C. Alternative D would have more than fifteen times more RWA than alternative E and the no-action alternative.

Currently, travel management plans provide direction for the amount, distribution, timing, and specific routes where motorized travel is or is not allowed in areas identified in the alternatives as RWA. In alternatives B and D, both motorized and mechanized means of transport would be considered unsuitable in RWA. Implementing either of these alternatives would result in a reduction of the available mileage of motorized routes by 11.8 miles (alternative B) or 82.2 miles (alternative D, which includes roads and motorized trails), and would remove mechanize uses, including mountain bike use, from 205.7 miles (alternative B) or 360.2 miles (alternative D) of nonmotorized trails where mechanized uses are currently allowed. These impacts are not large, but would reduce the overall density of motorized routes very slightly in some areas (refer to congressionally designated areas section for area-specific information) compared to the existing situation and compared to the no-action alternative and alternatives C and E.

Connectivity

In all action alternatives, plan components would help to ensure habitat is maintained that would facilitate movements of grizzly bears and other large, wide-ranging wildlife among seasonal habitats, as well as among larger landscapes, including from one GA to another. Grizzly bear movements are often associated with riparian habitats, although this may be more important in nonforested habitats off NFS lands (Wilson et al., 2005). Nevertheless, plan components that maintain the integrity of riparian habitats (e.g., FW-WTR-DC-02, 04; FW-RMZ-DC-01; FW-RMZ-STD-03, 04; and FW-RMZ-GDL-04, 07, 08, 09, 11) may contribute to habitat connectivity at a watershed or sub-watershed scale. Other plan components (FW-RT-GO-03, FW-WL-DC-03, FW-WL-GO-03, and FW-VEGT-DC-03) guide management of roads and vegetation to facilitate wildlife movement, and to work with landowners and other agencies to identify and manage key areas for wildlife linkages among habitats and areas.

DI-WL-DC-01, DI-WL-GO-01, UB-WL-DC-01, UB-WL-GDL-01, LB-WL-DC-01, RM-WL-DC-01, and HW-WL-DC-01 all set desired conditions or guidance for specific GAs to maintain or enhance connectivity for wildlife species such as grizzly bears. The Upper Blackfoot and Divide GAs are likely potential routes for movement of male bears that may provide genetic connectivity between the Northern Continental Divide Ecosystem and the Greater Yellowstone Ecosystem (Peck et al., 2017). Plan components for the Divide and Upper Blackfoot areas identify specific areas where habitat security should be maintained or improved for grizzly bears and other wide-ranging wildlife species to move along the continental divide and surrounding areas that connect public lands in northern Montana with those in south and southwestern Montana.

Peck et al., 2017 also identified the Big Belts and Elkhorns GAs as possible routes of grizzly bear genetic connectivity between the two ecosystems, noting that the western areas (including the Divide and Upper Blackfoot GAs) may be more important for southward movement of bears from the Northern Continental Divide Ecosystem, and the eastern areas (including the Elkhorns and Big Belts GAs) may be more important for bears moving northward from the Greater Yellowstone Ecosystem. The location of RWAs in alternative D was informed by assessing which areas might provide potential connectivity among island mountain ranges, where habitat on NFS land remains relatively intact and intervening lands either provide minimal disturbance or distances between island mountain ranges are shortest. Alternative D would therefore have slightly increased potential to maintain connections among separate GAs for some wildlife species, although that potential would continue to be greatly affected by land management and uses on intervening non-NFS lands.

Effects of plan components associated with:

Aquatic ecosystems

Plan components for management of aquatic ecosystems support desired conditions to "provide the distribution, diversity, and complexity of landscape-scale features including natural disturbance regimes and the … ecosystems to which native species, [and] populations are uniquely adapted" (FW-WTR-DC-01), to maintain spatial connectivity within and among watersheds (FW-WTR-DC-02), sustain the ecological function of aquatic and riparian ecosystems, and retain their resilience in the face of disturbance (FW-FAH-DC-01). Most of the plan components relating to aquatic ecosystems provide constraints to maintain or enhance aquatic, riparian, wetland, and associated upland habitats. The effect of these plan components would be to maintain or enhance habitats that are used periodically by grizzly bears, particularly during the early spring and late summer periods.

Fire and fuels

Plan components for fire and fuels management are intended to achieve the desired condition to maintain and enhance resources and allow fire to function in its natural ecological role (FW-FIRE-DC-01). Specific plan components are designed to provide for public and firefighter safety, reduce risk to high value resources such as adjacent communities, and minimize impacts to designated wilderness, RWAs, and other areas that are managed to allow natural processes to predominate. Grizzly bears evolved in ecosystems largely shaped by fire, so allowing fire to play its natural role, to the extent possible, would be expected to sustain ecosystem components and characteristics on which grizzly bears depend. Some fire management activities could affect individual bears, through temporary displacement from areas where and when activities (such as fire suppression or fuels reduction) are taking place.

Terrestrial vegetation; plants at risk, and invasive species

Plan components for management of terrestrial vegetation are designed to maintain or move toward the NRV for ecosystem composition, structure, and function, and to maintain resilience in the face of disturbance (FW-VEGT-DC-01). Vegetation-related plan components also are intended to "provide habitat requirements to support … threatened or endangered species… based on the inherent capability of lands" (FW-VEGT-DC-02) and to "provide connectivity and allow genetic interchange to occur" (FW-VEGT-DC-03). Specific objectives, standards, and guidelines for vegetation, including forested and non-forested vegetation types, are designed to maintain or move toward desired conditions within the NRV for cover types, species or community presence, and vegetation structure. Plant species at risk, including whitebark pine, are to be recovered or sustained. Invasive species are to be contained, controlled, suppressed, or eradicated (FW-INV-DC-03). In sum, plan components for management of vegetation would sustain healthy, resilient plant communities on which grizzly bears depend for food and cover. Refer also to analysis in the Forest Plan Amendments to incorporate relevant direction from the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy (USDA 2017c) for discussion of additional plan components for management of vegetation.

Recreation settings, opportunities, access, and Scenery

The effects of plan components relating to recreation on NFS lands are discussed in part under the headings "Effects of alternative A - no action" and "effects of action alternatives" above. Certain recreation activities have the potential to impact grizzly bears by the simple fact of humans recreating in grizzly bear habitat, which creates potential for grizzly bear-human conflicts. Plan components for management of recreation include desired conditions and constraints designed to minimize impacts of recreation facilities on wildlife, including threatened and endangered species (FW-REC-DC-04, FW-REC-GDL-01, FW-REC-GLD-07), minimize or mitigate conflicts with other resources, including wildlife-human conflicts (FW-RSUP-GDL-01), and minimize and remove unauthorized recreation routes (FW-ACCESS-GDL-02). Overall, plan components for management of recreation would potentially result in some impacts to some individual bears where specific facilities or activities occur, but would minimize impacts to individual bears and to the grizzly bear population by including constraints designed to reduce conflict and potential displacement of bears. Refer also to analysis in the Forest Plan Amendments to incorporate relevant direction from the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy (USDA 2017b) for discussion of additional plan components for management of access and of developed recreation.

Designated areas

Potential impacts of plan components for management of designated areas are incorporated into the discussion under "effects of alternative A - no action" and "effects of action alternatives".

Land status and ownership, and land uses; infrastructure-roads and trails, bridges and facilities

Potential impacts of plan components for management of land and of infrastructure are incorporated into the discussion under "effects of alternative A - no action" and "effects of action alternatives".

Public information, interpretation, and education

Plan components for public information would overall increase forest users' understanding of forest policies, activities, services, and issues (FW-CONNECT-DC-01), including regulations and safety practices for recreating in grizzly bear habitat.

Livestock grazing

Plan components for the management of livestock grazing are designed to maintain the integrity of ecological systems where grazing occurs (FW-GRAZ-DC-02, FW-GRAZ-STD-01) to minimize adverse impacts to wildlife and habitats (FW-GRAZ-GDL-01, 03, and 05). Although livestock presence on NFS lands presents a risk of depredation by individual grizzly bears, that risk is minimal (USFWS, 2013b) and would not necessarily result in adverse impacts to those bears. Refer also to analysis in the Forest Plan Amendments to incorporate relevant direction from the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy (USDA 2017b) for discussion of additional plan components for management of livestock grazing.

Timber

Plan components for the management of timber are intended to support the production of timber on lands identified as suitable for that use, as well as to manage timber harvest for other purposes. Standard FW-TIM-STD-04 would limit clearcutting and require interdisciplinary review of site specific conditions and desired conditions for habitat before clearcutting could be used. Standard FW-TIM-STD-08 would limit the maximum opening size of harvest units, and FW-TIM-GDL-01 would guide harvest activities to "contribute to ecological sustainability and ecosystem health" and to achieve desired vegetation conditions. Timber harvest activities have the potential to temporarily displace individual bears, but plan components would minimize impacts, and would move vegetation conditions toward desired conditions discussed in the terrestrial vegetation section. Some timber harvest could result in improved or increased foraging opportunities for grizzly bears. Refer to the timber section for information on projected harvest acres by alternative.

Fish and wildlife

These plan components pertain to the management of hunting, fishing, viewing, and other recreational opportunities provided by fish and wildlife on NFS lands. Plan components are designed to influence distribution and availability of wildlife for hunting and other uses, while balancing those opportunities with "desired conditions for wildlife populations and habitat security" (FW-FWL-DC-04). Management of habitat to influence distribution of wildlife is focused on providing adequate habitat security for elk (FW-FWL-GDL-01, 02) and other big game species where needed, which would contribute to habitat security for grizzly bears.

Energy and minerals

Plan components for the management of energy and minerals are focused on the desired condition of "supplying mineral and energy resources while assuring that the sustainability and resiliency of other resources are not compromised or degraded" (FW-EMIN-DC-01). Refer also to analysis in the FEIS, Volume 3: Forest Plan Amendments to incorporate relevant direction from the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy (USDA 2017b) for discussion of additional plan components for management of energy and mineral resources.

Cumulative Effects to Grizzly Bears

Table 71 summarizes the cumulative effects to grizzly bears from other resource management plans.

Table 71. Summary of cumulative effects to grizzly bears from other resource management plans

Resource plan	Description and summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. The Flathead NF plan is currently being revised under the 2012 Planning Rule. The existing plan includes amendments that provide habitat security for grizzly bears, and the revised plan would incorporate management direction in the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy (USFWS, 2013b), making it consistent with management discussed above in the Environmental Consequences of All Alternatives section. The Lolo NF plan is currently being amended to also incorporate that direction. Therefore, management of grizzly bear habitat throughout NFS lands in the Northern Continental Divide Ecosystem will be consistent across NF boundaries. Plans for the Beaverhead-Deerlodge and Custer-Gallatin NFs have been amended to incorporate the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy, which provides adequate regulatory mechanisms to sustain a recovered grizzly bear population in the Greater Yellowstone Ecosystem. The cumulative effects of these forest plans would be to recover and sustain a recovered grizzly bear population in the Northern Continental Divide Ecosystem, while providing for connectivity among grizzly bear populations and recovery ecosystems throughout Montana.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components consistent with those identified in the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Plan, for BLM lands, and would therefore likely be complementary to the plan components for the HLC NF, and provide consistency in management of federal lands within the Northern Continental Divide Ecosystem to support recovery and sustaining a recovered grizzly bear population.
National Park Service - Glacier National Park General Management Plan 1999 and National Park Service – Glacier National Park Bear Management Plan 2010	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Glacier National park makes up 20% of the Northern Continental Divide Ecosystem, and is within the primary conservation area. Goals of the Bear Management Plan are to provide for long-term survivability of the grizzly bear in the park and in the Northern Continental Divide Ecosystem, which are consistent with those in the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Plan, which includes recommended management for grizzly bears In Glacier National Park. Management of grizzly bear habitat in Glacier National Park is expected to be complementary to and consistent with management on the HLC NF, and would support recovery and sustaining a recovered grizzly bear population.
Blackfeet Integrated Resource Management Plan (in progress)	In development – documentation not available. The Blackfeet Tribe participated in development of the Northern Continental Divide Ecosystem Draft Grizzly Bear Conservation Strategy, including recommended management of grizzly bears and habitat on the Blackfeet Indian Reservation adjacent to the Rocky Mountain Range GA of the HLC. Intent during development of the Draft Conservation Strategy was to provide management on Blackfeet lands that is consistent with grizzly bear management throughout the Northern Continental Divide Ecosystem as identified for those lands in the strategy.

Resource plan	Description and summary of effects
Montana Statewide Forest Resource Strategy (2010)	MT conducted a statewide assessment of forest resources and identified issue-based focus areas with implementation strategies and deliverables for each. Focus areas include such varied things as achieving ecological integrity through recovery of species diversity, managing for wildfire and public safety, supporting forest products infrastructure, and addressing changing forest ownership patterns. Management for these focus areas on state lands would adhere to management plans for specific state-owned lands; within the NCDE most state lands incorporate measures related to management for grizzly bear habitat.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Goals include managing significant, relevant, and accessible parks and programs in a manner consistent with available resources, as well as emphasizing visitor experience, partnerships, and awareness of the state parks system. These goals are compatible with or do not preclude management for a sustained population of grizzly bears.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the MT Statewide Forest Resource Strategy (above). The vegetation conditions described would be complementary to the conditions being managed for with the HLC NF revised forest plan.
Montana State Wildlife Management Areas	Plans are specific to management areas and their established purpose. Most in the plan area were established to conserve big game winter range, with goals to maintain forage, cover, and security during winter use periods. Management is generally compatible with grizzly bear management. Some areas have implemented food storage orders and compliance with management outlined in the Draft NCDE Grizzly Bear Conservation Strategy.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	The City of Helena manages 1,718 acres of open space that lie between the city limits and NFS lands in the Divide GA. The plan includes goals and recommendations for recreation use and trail management; noxious weed management; forest management; interpretive opportunities; wildfire mitigation; wildlife protection; and boundary identification. Could contribute to connectivity in zone 2, but may also contribute to bear-human encounters through management for recreation activities.

Conclusions

Alternative A – no-action

The FEIS for the Grizzly Bear Amendments (USDA 2017c) stated that continuing to implement the existing Helena NF and Lewis and Clark NF plans without the amendments "would be compatible with contributing to a recovered grizzly bear population", but would not allow for de-listing because of a lack of regulatory mechanisms to manage motorized access. Under this no-action alternative, the amendments would be combined with retained direction that provides management for grizzly bears and their habitat, as analyzed in alternatives 2 and 3 in the DEIS for the Grizzly Bear Amendments. The FEIS for the Grizzly Bear Amendments (USDA 2017c) concluded that although some activities could have minor effects on individual bears, implementing either alternative, and therefore implementing this no-action alternative, would contribute to sustaining a recovered population and would provide the necessary regulatory mechanisms to potentially allow grizzly bears to be removed from listing under the ESA. The information here that we have added to that analysis supports that conclusion. A determination of effect will be made in a BA for consultation with USFWS on a preferred alternative, after that alternative has been selected.

Action alternatives

The FEIS for the Grizzly Bear Amendments (USDA 2017c) stated that implementation of the Grizzly Bear Amendment, which would occur under all action alternatives, would contribute to sustaining a recovered grizzly bear population. In addition to the Grizzly Bear Amendments, plan components included in all action alternatives would:

- contribute to reducing grizzly bear-human conflicts;
- provide specific desired conditions and other guidance for management of designated areas such as RWAs, IRAs, and the Conservation Management area as relatively intact, un-fragmented landscapes where natural processes predominate;
- provide clear constraints on road-building and clear direction for removing unneeded roads;
- identify specific areas in the Upper Blackfoot and Divide GAs to manage for habitat security and potential connectivity; and
- maintain or increase total area in nonmotorized recreation settings as compared to the existing situation.

The sum of that management direction would be to provide additional reduction in mortality risk and increased habitat security that would contribute to grizzly bear recovery and to sustaining a recovered grizzly bear population. The increased area in nonmotorized recreation settings as compared to the existing situation and no-action alternative would be largest in zone 3, providing more security for grizzly bears than may be available currently on HLC NF lands there. Alternatives B, C, and D provide more RWA, but because those areas largely overlap with existing IRAs, there would likely be very little difference among alternatives in terms of potential habitat security. In alternatives B and D, habitat security would be enhanced by removal of motorized travel in RWAs. Alternatives B and D could, therefore, contribute slightly more to grizzly bear recovery and to sustaining a recovered grizzly bear population than the other alternatives. A determination of effect will be made in a BA for consultation with USFWS on a preferred alternative, after that alternative has been selected.

3.15.7 Canada lynx, affected environment

Scale and scope of analysis

As discussed in the terrestrial wildlife diversity section, ‘assumptions’, plan components to maintain ecosystem integrity and diversity provide for most of the needs (foraging, denning, breeding, and movement) of Canada lynx on the HLC NF. Species-specific plan components for management of Canada lynx habitat and activities that could directly impact Canada lynx are incorporated into all alternatives as the NRLMD (hereafter referred to as the Lynx Direction) (USDA, 2007a). The plan components found in the Lynx Direction focus on maintaining sufficient amount and distribution of boreal forest habitat of the type and structural stage that provide foraging habitat for Canada lynx. A full analysis of the potential impacts of implementing the management described in the Lynx Direction can be found in the NRMLD Final Environmental Impact Statement (USDA, 2007b), Biological Opinion (USFWS, 2007) associated with it, and the Biological Assessment (USDA 2017d) and the Biological Opinion (USDI 2017) regarding Designated Critical Habitat for Canada lynx. This report will refer to those analyses and incorporate them into evaluation of the potential consequences to Canada lynx, and its designated critical habitat, of the HLC NF draft plan and alternatives to the draft plan.

The biology and ecology of Canada lynx in the Northern Rocky Mountains and on the HLC NF have been described extensively in several other documents (Ruediger et al., 2000) (U.S. Department of the Interior, Fish and Wildlife Service, 2000); USDI Fish and Wildlife Service 2003, 2006, 2009, 2014).

Ecology and management

Distribution

The plan area is within the Northern Rocky Mountain Range GA for lynx (Interagency Lynx Biology Team 2013). In Montana, lynx are primarily restricted to northwestern Montana. The majority of the plan area is outside of the current known distribution.

In the plan area, Canada lynx occur as a resident population throughout the Rocky Mountain Range and Upper Blackfoot GAs, and in the northern portion of the Divide GA. This portion of their range within the Northern Rocky Mountain Range GA is considered to be within the Northwestern Montana/Northeastern Idaho core area (Interagency Lynx Biology Team 2013, (U.S. Department of the Interior, Fish and Wildlife Service, 2005a). A “core area” is an area “with the strongest long-term evidence of the persistence of lynx populations supported by a sufficient quality and quantity of habitat” (U.S. Department of the Interior, Fish and Wildlife Service, 2005a), which consists of boreal forests with dense horizontal cover supporting snowshoe hare populations (refer to ‘Habitat Status and Connectivity’ section for a detailed description of lynx habitat). More specifically, core areas have verified evidence of long-term historical and current presence of lynx populations that are persistent despite periodic fluctuations, have evidence of reproduction within the past 20 years, and have boreal forest vegetation types, as described above, of the quality and quantity to support lynx and snowshoe hare (ibid). The northwestern Montana/northeastern Idaho area coincides with the area in which Canada lynx Critical Habitat has been designated and is protected under the ESA.

According to the Lynx Conservation and Assessment Strategy (Interagency Lynx Biology Team 2013) and the Recovery Outline (U.S. Department of the Interior, Fish and Wildlife Service, 2005a), the remainder of the plan area occurs within secondary areas, with the exception of the Highwoods and Snowies GAs, which are considered peripheral. Secondary areas are defined as having “fewer and more sporadic current and historical records of lynx”, and no documentation of reproduction (ibid). Peripheral areas have sporadic historical records of lynx, generally corresponding to cyclic population highs in populations in Canada (ibid), and have no records or evidence of reproduction. Both these areas “may contribute to lynx persistence by enabling successful dispersal and recolonization of core areas, but their role in sustaining lynx populations remains unknown” (Interagency Lynx Biology Team, 2013).

The Rocky Mountain Range, Upper Blackfoot, and Divide GAs are currently considered ‘occupied’ habitat per an amendment (U.S. Department of Agriculture, Forest Service, 2006) to the Canada Lynx Conservation Agreement (U.S. Department of Agriculture, Forest Service & U.S. Department of the Interior, 2005). The island mountain ranges, comprising the remaining seven GAs, are currently considered ‘unoccupied’ by lynx (see appendix A). An area is considered occupied when there are at least two verified observations or records since 1999 of individuals that are not transient, or by evidence of reproduction (U.S. Department of Agriculture, Forest Service, 2006). This distinction differs from the ‘may be present’ determination made by the USFWS, which reflects the possibility of individual lynx occurring as either transients or as resident individuals, for the purpose of consultation under the ESA.

Most of the research on lynx in Montana has occurred west of the Continental Divide, so more detailed information regarding lynx distribution in the occupied portion of the planning area is not available. More work has been done to delineate lynx habitat within the plan area, as described under “Habitat Status and Connectivity.”

Population trend

No reliable information is available regarding the number of lynx or trend of the lynx population in the plan area or region-wide. Efforts in the region to maintain lynx populations have focused on maintaining habitat (see “Habitat Status and Connectivity” section).

Key drivers and stressors

Food habits

Snowshoe hares are the primary prey of lynx throughout their range (Mowat, Poole, & O'Donoghue, 2000) (Interagency Lynx Biology Team, 2013). Summer diets may contain a broader range of prey species, based on their availability (John R. Squires, Decesare, Kolbe, & Ruggiero, 2010). Red squirrels are an important secondary prey species in many areas, while grouse, northern flying squirrel, ground squirrels, porcupine, beaver, mice, voles, shrews, weasels, fish, ungulates, and ungulate carrion have all been reported in the diets of lynx in various portions of their range ((Interagency Lynx Biology Team, 2013). Lynx diets are limited primarily to snowshoe hare in winter due to snow characteristics and to the ecology of various alternate prey species.

Habitat status and connectivity

Lynx use habitats where their primary prey species are available. Broadly, Canada lynx habitat is defined as boreal forest. More specifically, snowshoe hares occur in boreal forests with dense horizontal cover that reduces their exposure to predators and provides access to food and thermal protection (Interagency Lynx Biology Team, 2013). In western Montana, winter snowshoe hare density was highest in dense, mature forests, and in summer was highest in both dense young and dense mature forest (ibid). Habitat types in the Northern Rockies capable of dense horizontal cover on the forest floor provide habitat for snowshoe hare (Ruediger et al., 2000); ((Interagency Lynx Biology Team, 2013); (John R. Squires et al., 2010); Holbrook et al. 2016), and consist of cover types that include Engelmann spruce, subalpine fir, mixed spruce-fir, mixed aspen and spruce-fir, mixed lodgepole and spruce-fir, and lodgepole pine. Generally snowshoe hare and lynx do not use drier habitats, including lodgepole pine habitat types occurring on drier sites, or dry Douglas-fir habitat types, because these do not provide dense horizontal cover. Habitat used by red squirrels, an important secondary prey species, overlaps snowshoe hare habitat extensively but does not generally extend to young forests that are not yet producing cones.

Lynx habitat maps for the plan area have been created to serve a number of purposes, and have used existing vegetation data derived from remote sensing, aerial photo interpretation, stand exams, or combinations thereof. Those maps were inconsistent across the plan area due to the varied availability of data sources, as well as to slightly different methodology, between and even within the two forests. In 2010 the east-side Forests of the Northern Region (Helena, Lewis and Clark, Custer, and Gallatin NFs) began collaborating on a uniform method to map lynx habitat, along with habitat for some other species. This effort, referred to as the “East Side Assessment”, was intended to develop reliable, consistent habitat mapping and modelling protocols that could be used for mid to large scale assessments of forest and habitat conditions.

Using the methods established in the East Side Assessment but updated to incorporate Regional direction (USDA FS Regional Forester habitat clarification memo Sept 6 2016) and the most recent vegetation data available, Canada lynx habitat was mapped for the plan area (refer to project file for details on mapping methods). Specific vegetation types were selected as potential lynx habitat across the plan area. Mapping also included information on recent disturbances, using assumptions developed by the East Side Assessment team regarding the impacts of those disturbances on lynx habitat. As of the publication of this draft, the mapping method is undergoing some corrections, and results shown below are preliminary and subject to change. Nevertheless, the map and table provide an idea of the overall amount of Canada lynx habitat in the plan area and the relative amounts in the GAs comprising the plan area. This gives a broad picture of the ability of the plan area and GAs to potentially sustain lynx. This also gives a general idea of the amount of habitat forestwide and within each GA to which the standards and guidelines of the Northern Rockies Lynx Managemetn Direction apply.

Table 72 summarizes lynx habitat into categories identified as ‘potentially suitable for snowshoe hare’ or ‘not currently suitable for snowshoe hare’ but that may provide habitat at another time. Categorization of lynx habitat as 'suitable' or 'not currently suitable' is based on vegetation composition and structure, whether habitat is a vegetation type that may produce snowshoe hare habitat but is not currently in a stage to do so, and by past disturbances. Currently suitable habitat includes multi-storied and stand-initiation stages of the forest types described above. Habitat categorized as not currently suitable includes the same types in the early stand-initiation and stem exclusion stages. Habitat identified as not currently suitable is expected to become suitable in time, as succession proceeds and horizontal cover develops.

Table 72. Canada lynx habitat on the HLC NF, by GA

GA	Total potential habitat	Potential habitat – snowshoe hare habitat	Potential habitat – not currently snowshoe hare habitat	Percent of total habitat potentially suitable for hares	Percent of GA that is potential habitat	Percent of GA that is nonhabitat
Big Belts	84,900	16,200	68,700	19%	27%	73%
Castles	33,200	7,400	25,800	22%	48%	52%
Crazies	37,400	19,800	17,600	53%	65%	35%
Divide	111,000	30,300	80,700	27%	55%	45%
Elkhorns	55,500	14,000	41,500	25%	34%	66%
Highwoods	7,200	1,700	5,500	24%	17%	83%
Little Belts	501,500	171,200	330,300	34%	62%	38%
Rocky Mountain Range	465,900	78,000	387,900	17%	60%	40%
Snowies	30,000	8,200	21,800	27%	25%	75%
Upper Blackfoot	246,900	70,300	176,600	28%	74%	26%
Forestwide	1,573,500	417,100	1,156,400	27%	55%	45%

Female lynx home range sizes estimates vary from less than 10 mi2 (6,400 acres) in northern Minnesota, to over 50 mi2 (32,000 acres) in the southern Canadian Rockies (Interagency Lynx Biology Team, 2013), with female home range size in northwestern Montana estimated at over 40 mi2. These estimates vary due to differences in methods of measurement and calculation, as well as due to habitat and prey abundance and distribution. The amount of area required to sustain persistent occupation of a female lynx year-round depends on a variety of factors, including the structural quality and arrangement of habitat within the home range, abundance of hares, cycling of hare populations, availability and use of alternate prey species, etc. The Lynx Conservation Assessment and Strategy (Interagency Lynx Biology Team, 2013) suggests that in the western U.S. at least 10 mi2 (6,400 acres) of primary vegetation (e.g., spruce/fir) must be present to support a female lynx year-round.

Table 72 provides some idea of the amount of lynx habitat within each GA, and provides a rough point of comparison to the home range sizes and amount of habitat required by female lynx. It appears that the Castles, Crazies, Elkhorns, Highwoods, Big Belts, and Snowies GAs do not contain enough potential habitat to support more than a few individual lynx. Furthermore, these GAs are each isolated mountain ranges, separated from each other and from other lynx habitat by significant stretches of low elevation, often agricultural landscapes that do not support lynx or their primary prey species. Their size, isolation, and habitat characteristics likely preclude them currently or historically sustaining lynx populations. The degree to which those areas supported lynx historically remains unknown, as does the possible contribution of those areas to the overall lynx population.

The Castles, Crazies, and Elkhorns GAs fall within the broadly drawn 'secondary area' in the Lynx Recovery Outline (U.S. Department of the Interior, Fish and Wildlife Service, 2005a). Secondary areas contain boreal forest, but it may be inherently patchier and/or drier, and have snow or habitat conditions that are not favorable to lynx (ibid). In peripheral areas, such as the Snowies and Highwoods GAs, habitat may occur in small patches not well connected to larger patches of high quality habitat (ibid), such as in island mountain ranges (Interagency Lynx Biology Team 2013). Peripheral areas "are considered to be incapable of supporting self-sustaining populations of lynx" (ibid). It is possible that secondary and peripheral areas may play a role in sustaining lynx populations during times of population fluctuation (ibid), but that possibility remains unclear and speculative. All of the above GAs are also considered currently unoccupied by lynx (U.S. Department of Agriculture, Forest Service, 2006).

The Little Belts GA, also within the secondary area (U.S. Department of the Interior, Fish and Wildlife Service, 2005b), contains more potential lynx habitat than the other GAs that occur east of Interstate 15, but this GA is also an isolated mountain range, and the nearest neighboring mountain ranges (Big Belts and Castles) do not appear capable of sustaining persistent lynx presence. The lack of connectivity with the area of lynx distribution and core habitat in western Montana, combined with the patchiness of currently suitable lynx habitat at any given time in this GA makes it unlikely that lynx would persist over the long term in the Little Belts GA. The Little Belts GA is currently considered unoccupied.

The Divide GA does not contain a large amount of lynx habitat, but what occurs is largely west of the Continental Divide, and is contiguous with the Upper Blackfoot GA and adjoining the Garnet Range, which has the southernmost lynx habitat in Montana known to be currently occupied (Interagency Lynx Biology Team 2013). Core areas identified in the Recovery Outline which include the Rocky Mountain Range and Upper Blackfoot GAs, contain larger patches of boreal forest and more lynx habitat in total. These areas are also well connected to large areas of Canada lynx habitat on the Flathead and Lolo NFs to the west, and Glacier National Park to the north. They may also provide some level of connectivity with the identified core area in the Greater Yellowstone area to the south. The Divide, Upper Blackfoot, and Rocky Mountain Range GAs are all currently considered occupied (U.S. Department of Agriculture, Forest Service, 2006).

The primary factor causing Canada lynx to be federally listed as threatened was the lack of guidance for conservation of lynx and snowshoe hare habitat in NF Land and Resource Plans and BLM Land use plans, since a large amount of lynx habitat occurs on lands managed by those agencies (U.S. Department of the Interior, Fish and Wildlife Service, 2000). Consequently, NFs in Region One amended their forest plans with the NRLMD (U.S. Department of Agriculture, Forest Service, 2007a), which applies to NFs that are considered occupied by lynx (U.S. Department of Agriculture, Forest Service, 2006) (U.S. Department of Agriculture, Forest Service & U.S. Department of the Interior, 2005). The purpose of the NRLMD is to "incorporate management direction in land management plans that conserves and promotes recovery of Canada lynx, by reducing or eliminating adverse effects from land management activities on NFS lands" (U.S. Department of Agriculture, Forest Service, 2007a). The NRLMD established standards and guidelines for managing lynx habitat and for managing projects or activities that occur within occupied lynx habitat. The NRLMD also includes objectives and standards to maintain habitat connectivity within lynx analysis units (LAUs) as well as within and among linkage areas. Potential linkage areas were identified in the NRLMD (USDA 2007b), and included areas connecting the GAs where lynx are found or that are considered either core or secondary areas. Linkage areas between GAs may be somewhat limited by the type of habitat and extent of human development existing between these GAs. Discussion of the relative connectedness or isolation of the GAs within the plan area is incorporated into the paragraphs above.

Forests having lynx habitat in Region One have delineated LAUs to facilitate project-level assessment and impact analysis. LAUs approximate the size of a female home range and were drawn using original habitat maps for each forest, capturing enough year-round habitat (approximately 10 mi^2 or roughly 6,430 acres of primary vegetation, such as spruce-fir forest) to support one female lynx. The Lynx Conservation Assessment and Strategy (Interagency Lynx Biology Team 2013) recognizes that new vegetation databases and mapping efforts, such as the East Side Assessment, may result in adjustments or redrawing of LAUs, to preserve the original analysis and management intent.

Changes to LAU boundaries based on updated mapping

Canada lynx was listed as a Threatened species under the ESA in March 2000. In August of that same year, the Canada Lynx Conservation Assessment and Strategy (Ruediger et al., 2000) was published. In compliance with the Conservation Strategy, NFs mapped lynx habitat using available vegetation information, and delineated Lynx Analysis Units (ibid). At the time LAUs were delineated the HLC NFs were separate forests, and the vegetation information available for mapping lynx habitat varied in quality and availability across both forests. In an effort to provide an up–to-date and uniform lynx habitat map across the entire combined HLC NF, lynx habitat was re-mapped in 2017. The re-mapping used the same habitat descriptions from the LCAS (ibid) as the original mapping, but used updated vegetation mapping (VMAP 2014, from 2011 satellite imagery) and the potential vegetation layer developed by Jones (2004).

As described in the Lynx Conservation Assessment and Strategy (Ruediger et al., 2000), the NRMLD ((U.S. Department of Agriculture, Forest Service, 2007a), and multiple documents (Holbrook et al. 2017; (Ruediger et al., 2000), (J. R. Squires, Olson, Turner, DeCesare, & Kolbe, 2012) (John R. Squires et al., 2010); (Kosterman, 2014), lynx habitat on the east side of the Continental divide is composed of subalpine fir forests (primary vegetation) dominated by cover types of spruce/fir, Douglas-fir, and seral lodgepole pine. Moist Douglas-fir habitat types (secondary vegetation) may contribute to lynx habitat where intermingled and immediately adjacent to primary vegetation. The HLC NF queried our current vegetation map product (VMAP 2014) and identified all subalpine fir and Engelmann spruce habitat types (abla1, abla2, abla3, abla4, and picea) as primary vegetation, and moist Douglas-fir types (psme2) within 300 meters of primary vegetation as secondary.

After mapping the habitat, we reviewed the existing LAU boundaries for consistency with the conservation measures identified in Chapter 7 of the original Lynx Conservation Assessment and Strategy (Ruediger et al., 2000) and Chapter 5 of the 3rd Edition (Interagency Lynx Biology Team 2013), which states that LAUs should: 1) be 16,000 to 25,000 acres in size (larger in less contiguous habitat), 2) follow watershed boundaries, and 3) contain at least 6,400 acres of primary vegetation. The guidance regarding LAU boundaries also suggests that their spatial arrangement be evaluated and LAUs with insignificant amounts of lynx habitat may be discarded or the habitat may be incorporated into neighboring LAUs.

Based on the updated lynx map, and following the guidance for evaluating LAUs as described above, the HLC NF has adjusted LAU boundaries as follows (see maps by GA in appendix A). These adjustments follow Standard LAU S1 of the NRLMD (USDA Forest Service 2007). The standards and guidelines found in the NRMLD, and incorporated into Forest Plan direction, apply to lynx habitat within LAUs.

- Remove DR-01 in the Big Belts GA from the plan area LAUs. There are only 18 acres of primary vegetation in this LAU on private land, and neighboring LAUs are not close enough to this small area of habitat to incorporate it into those LAUs.
- Remove BB-03 within the Big Belt GA and incorporate the habitat into BB-02. LAU BB-03 had only 4,009 acres of mapped primary vegetation. That primary vegetation is closest to BB-02. In addition, redraw BB-02 boundaries to align with watersheds and exclude areas with patchy or no primary vegetation. This brings the amount of primary vegetation in BB-02 to 10,065 acres and reduces the size of the LAU from 248,195 acres (the combined BB-02 and BB-03) to 77,353 acres.

- Remove HW-01 in the Highwoods GA from the plan area LAUs. There are only 1,092 acres of primary vegetation in this LAU, and 1,317 acres in the entire GA. The Highwoods GA is completely isolated from other GAs by intervening low-elevation private lands that are not lynx habitat, so it is not possible to incorporate the small acreage of primary habitat in this GA into the nearest LAUs.
- Within the Rocky Mountain Range GA, incorporate approximately 1000 acres of primary vegetation in the Jones Creek area that was not originally within an LAU into the RM-09 LAU.
- Remove SM-02 and SM-04 within the Snowies GA. Incorporate the habitat into SM-01 and SM-03, and adjust the boundary between the two to provide approximately 6400 acres of primary vegetation in each of the remaining two LAUs. There are only 13,007 acres of primary vegetation within the Snowies GA, therefore only two LAUs should be delineated.
- Within the Little Belt GA, there is over 41,000 acres of primary vegetation outside the current LAU boundary. In some areas that primary vegetation is isolated; however in a number of areas there are concentrated patches near existing LAUs. Create a new LAU in the northeast area, and adjust the boundaries of the new LAU (LB-22) and LB-11 to follow watershed boundaries. LB-11 currently incorporates 17,038 acres of primary vegetation. With the addition of LB-22 the two LAUs would incorporate 28,966 acres of primary vegetation. In addition, several other LAUs (LB-03, LB-05, LB-06, LB-12, LB-15, and LB-19) will be expanded to capture primary vegetation near their existing boundaries.
- In all LAUs, boundaries were adjusted to match current watershed boundaries. This is primarily a mapping cleanup exercise intended to remove slivers in the GIS mapping. In a few cases, the boundary adjustment resulted in changes of less than 100 acres where the watershed boundaries used in the current mapping effort differed slightly from those used in 2000 for the original habitat and LAU maps.

The changes in LAU boundaries occur across a total of approximately 358,300 acres of mapped lynx habitat in 5 GAs. Approximately 35,233 acres of primary vegetation would be added into new or existing (adjusted) LAUs; although the total acres within LAUs would decrease by 141,146 acres. Roughly 10,900 acres on the Rocky Mountains GA are added into LAUs. The Rocky Mountain Range GA is the only GA where adjustments are being made that is currently considered “occupied habitat” (U.S. Department of Agriculture, Forest Service, 2007b); (U.S. Department of Agriculture, Forest Service, 2006), and is within designated Critical Habitat. An additional 29,019 acres of mapped lynx habitat, and 46,435 acres total, will be incorporated into LAUs in the Little Belts, which is currently considered “unoccupied habitat” (ibid.). The management direction in the NRMLD would apply to the added acres on the Rocky Mountain Range GA, and would be considered in all planning and management proposed on the added acres in the Little Belts GA. Slightly more than 3,500 acres of mapped habitat spread across two widely separated GAs (Big Belts and Highwoods) would no longer be within an LAU. These acres occurred within habitat considered “unoccupied” (ibid.), are identified by the USFWS as occurring within secondary and/or peripheral areas (U.S. Department of the Interior, Fish and Wildlife Service, 2005a), and are in isolated areas not connected to other lynx habitat. Mapped lynx habitat that is not within an LAU (secondary vegetation and limited amounts of primary vegetation) would be managed as described in the terrestrial vegetation report, to achieve desired conditions that include components regarding species composition and forest structure (refer to the draft plan components for Terrestrial Vegetation, and to the terrestrial vegetation section). Most desired conditions for vegetation would move forest composition and structure toward or within the estimated NRV. Management to achieve those desired conditions would maintain the ecological conditions necessary to support native wildlife species, including lynx and their prey.

Canada lynx critical habitat

Canada lynx is the only federally listed wildlife species on the HLC NFs that also has designated critical habitat. The Rocky Mountain Range and Upper Blackfoot GAs, and the northern portion of the Divide GA are within Unit 1 of designated Canada lynx Critical Habitat (USFWS, 2014). Critical habitat receives protection under Section 7(a)(2) of the ESA. Areas identified as critical habitat contain the primary constituent elements, which are specific biological or physical features that provide for a species' life history processes and are essential to the conservation of the species (USFWS, 2014). The primary constituent element for lynx is boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:

a) Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs, or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface;
b) Winter conditions that provide and maintain deep fluffy snow for extended periods of time;
c) Sites for denning with abundant coarse woody debris, such as downed trees and root wads; and
d) Matrix habitat…that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

The Assessment (U.S. Department of Agriculture, Forest Service, Northern Region, 2015) discusses each of the components above to some extent. Component (a) is addressed in the 'habitat status and connectivity' section, and is modelled as described above. Component (b) is less well-defined and not something that can be realistically modelled. Lynx may use a wide variety of habitats for travel among more suitable patches, depending on proximity to patches of foraging habitat, size, shape, and topography of intervening patches, quality of nearby foraging habitat, etc. Component (c) is not discussed or modelled here, but is addressed broadly in the snags and downed wood section. Component (d) is highly variable in some portions of the plan area (refer to the terrestrial vegetation sections on vertical structure, density, and forest pattern), and may be changing due to climate change (refer to chapter 4, climate change and baseline assessment of carbon stocks) (ibid).

Stressors under Forest Service control

Vegetation Management and Fire

Canada lynx rely on snowshoe hare, which require boreal forest that contains dense, horizontal cover. Therefore, disturbances that alter or remove horizontal cover or convert forest to unsuitable structural stages that have the potential to impact Canada lynx. These disturbances include vegetation management and fire, which can be considered as both stressors and drivers of Canada lynx habitat. In general, treatments used in vegetation management remove trees and/or reduce horizontal cover through thinning or burning. Fires also have this effect, to varying degrees depending on fire intensity and severity.

Fire and certain types of vegetation management can also promote development of Canada lynx habitat by returning a stand or area to an earlier successional stage that may eventually provide habitat (such as dense, young regenerating forest), or by creating openings within existing forest canopies that promote development of multiple canopy layers. Therefore, maintaining a habitat mosaic of different successional stages within the forest types likely to be used by lynx is a key strategy for maintaining lynx presence. Squires et al. (2010) state, "Managers should prioritize retention of a habitat mosaic of abundant and spatially well-distributed patches of mature, multilayer spruce-fir forests and younger forest stands". Vegetation management activities, including prescribed fire, can be designed to increase potential future lynx habitat, to promote or restore connectivity among patches of existing lynx habitat, and to create a mosaic of successional stages as recommended by Squires et al. (2010). Fires that burn with varying intensity and severity also help to perpetuate the mosaic of stages. Vegetation management can be used as a tool to help manage future wildfires by creating breaks or inconsistencies in fuels, thereby altering fire spread rate and direction. Care must be taken in core areas to maintain enough habitat to support a reproductive population of lynx. Managing vegetation within delineated LAUs, as described above and in the Lynx Conservation Assessment and Strategy (Interagency Lynx Biology Team, 2013), helps to realize that management goal. The NRLMD specifies the degree to which lynx habitat can be altered in an area.

Stressors not under Forest Service control

Illegal and incidental mortality

Currently trapping and snaring of lynx is prohibited across the contiguous U.S., including Montana. Accidental trapping may still occur, although it appears to have declined since 2000 (MFWP, 2016). A total of three lynx were reported captured between 2008 and 2015 by trappers targeting other species, and all were released uninjured. Overall, lynx mortality related to trapping averaged 1.6 lynx per year, and declined to 0.4 per year after 2008, when more protective regulations were put in place (MFWP, 2016).

Wildfires

Wildfire is one of the primary forces that historically shaped the structure and composition of vegetation on the HLC NF. The HLC NF fire history (refer to fire and fuels section) discusses the amount of fire that occurred historically on each GA since the 1800s. The NRV range of acres burned varies by PVT. The cool-moist type, which includes most lynx habitat, appears to average nearly 200,000 acres of stand-replacing fire, over 50,000 acres of mixed severity fire, and over 25,000 acres of low severity fires per decade forestwide. In recent years, fires have occurred with increasing frequency, size, and severity. Fires can alter lynx habitat by removing canopy or vegetation completely or partly, and by 'resetting' succession such that young regenerating forests occur within a period of years after certain fires. Size, pattern, severity, and vegetation type all play a role in determining the degree to which a given fire may impact lynx habitat. Therefore, fire can be a stressor or a driver of lynx by altering habitat to either make it not suitable, or by creating changes that will result in an increase in suitable habitat in an area. FS managers often influence fire size, location and severity through a variety of practices that include suppression and fuels management, with the result that many ignition have been suppressed or extinguished. Many, however, are not suppressed or extinguished, and burn largely influenced by weather/climate, vegetation, and terrain. Furthermore, the location of wildfire starts is entirely outside NF control.

Climate Change

The Lynx Conservation Assessment and Strategy (Interagency Lynx Biology Team, 2013) addresses several possible effects of climate change on lynx. These include potential shifts in lynx distribution in terms of elevation and latitude, changes in hare population cycles, reductions in the amount of lynx habitat due to changes in snow suitability and persistence, and changes in the frequency and severity of disturbances such as wildfire and insects that impact habitat. Rates and magnitude of these changes and the manner in which they may interact are difficult or impossible to predict.

Specific to the HLC NFs, tree species that are key components of snowshoe hare, and therefore lynx habitat, including Engelmann spruce and subalpine fir, may decrease at lower elevations, possibly expand upward in elevation, and potentially become less resilient to disturbance (U.S. Department of Agriculture, Forest Service, Northern Region, 2015). This, combined with likely increased fire frequency and duration, may result in overall decreases in habitat suitable for lynx. For the HLC NFs on the edge of current and historic lynx distribution, lynx habitat could decrease to the point that portions of the plan area that currently support lynx either permanently or as transients are no longer capable of doing so. Areas where habitat is limited or marginal, such as at the edge of a species' distribution are often the first areas to become uninhabited.

3.15.8 Canada lynx, environmental consequences

Effects common to all alternatives

Northern Rockies Lynx Management Direction

All alternatives, including the no-action alternative, incorporate the NRLMD. The amendment incorporates goals, objectives, standards, and guidelines into 18 National Forest plans, including the HLC

NF Plans that conserve and promote recovery of Canada lynx. The direction applies to mapped lynx habitat that is considered occupied by Canada lynx (U.S. Department of Agriculture, Forest Service, 2006) as described in the section above on habitat status and connectivity. Areas currently occupied are the Rocky Mountain Range, Upper Blackfoot, and northern portion of the Divide GAs. The remaining mapped lynx habitat in the planning area is considered unoccupied (ibid), where lynx management direction provided in the NRLMD is to be considered when designing management actions. The lynx direction addresses risk factors affecting lynx productivity (timber management, wildland fire management, livestock grazing, recreational uses, forest backcountry roads and trails, and other human developments) (U.S. Department of Agriculture, Forest Service, 2007c), as originally identified in the Lynx Conservation Assessment and Strategy (Ruediger et al., 2000).

A full analysis of the potential impacts of implementing the NRLMD can be found in the FEIS (U.S. Department of Agriculture, Forest Service, 2007a), the associated BA (USDA 2007d), and the recently completed BA for Canada Lynx Designated Critical Habitat: NRLMD (USDA 2017d). The analyses will not be repeated here, but key parts are summarized here as they relate to the analysis of consequences of the HLC NF draft plan and alternatives to the draft plan.

Under all alternatives the lynx direction would conserve habitat within the plan area and ensure sufficient habitat through time by limiting vegetation management actions that result in newly regenerated forest (Standard VEG S1 and Standard VEG S2). Snowshoe hare habitat is conserved through limits on pre-commercial thinning and treatment in multi-story mature or late successional hare habitat (Standard VEG S5 and Standard VEG S6). Exemptions to these standards for fuel treatment within the WUI are limited to 6 percent of the lynx habitat in the plan area. In addition, no more than 6 percent of the lynx habitat within designated Critical Habitat may be treated under this exemption. Pre-commercial thinning and treatment in multi-story mature or late successional hare habitat are allowed to remove snowshoe hare habitat for a limited number of exceptions outside of the WUI. These acres are counted within the 6 percent limit. Habitat connectivity within and between patches of lynx habitat are controlled by Standard ALL S1 and Standard LINK S1. There are also a number of guidelines that provide for alternate prey species and denning habitat, managing grazing to be compatible with maintaining lynx habitat, and managing human uses to maintain lynx and snowshoe hare habitat, habitat connectivity, and limit snow compaction.

Effects to designated critical habitat are similar to those described for lynx. Primary Constituent Element 1a (snowshoe hare habitat) would be adversely affected as a result of implementing WUI exemptions and limited exceptions from vegetation management standards VEG S5 and VEG S6. Effects to Primary Constituent Element 1b (deep, fluffy snow), 1c (denning habitat) and 1d (matrix habitat) would be insignificant because expansion of areas of snow compaction are limited, and activities that increase snow compaction are discouraged; denning sites have been located in a wide variety of habitat conditions and does not appear to be limited on the landscape; and matrix is not thought to be limiting to lynx (USFWS, 2014).

The NRLMD results in beneficial effects for lynx by providing for and conserving lynx and snowshoe hare habitat in occupied areas (U.S. Department of Agriculture, Forest Service, 2006). The direction is also considered in currently unoccupied areas, thereby conserving habitat across the plan area. However, the exceptions and WUI exemptions described previously would result in reductions in snowshoe hare habitat and temporary adverse effects on up to 6 percent of lynx habitat acres in the plan area and within designated critical habitat.

Effects common to all action alternatives

There are a number of components in the draft plan that would affect lynx habitat. These plan components are consistent through all the action alternatives. The majority of the plan components complement the standards and guidelines of the NRLMD to protect and provide for lynx and snowshoe hare habitat.

Effects of plan components associated with:

Aquatic ecosystems

The desired condition for RMZs (FW-RMZ-DC-01) provides benefits to lynx and lynx critical habitat by providing for habitat needs for lynx, which would include providing snowshoe hare habitat where the potential exists and providing movement corridors both within and between potential habitat (Primary Constituent Element 1d, matrix habitat).

Fire and fuels

Plan components include a desired condition to have low severity fires in the WUI, with an objective to treat 15,000 acres in the WUI a year. This objective would be met by using the WUI exceptions to the NRLMD on up to six percent of occupied lynx habitat. Because we consider the NRLMD in unoccupied lynx habitat, up to six percent of the unoccupied habitat could also be treated. These exceptions allow for temporary reductions of snowshoe hare habitat following treatments in the WUI which can result in reduced prey availability in the area, affecting both lynx and Primary Constituent Element 1a of designated critical habitat. The reduction in available habitat would be temporary, with summer hare habitat re-establishing within approximately 5 years on most sites, and winter hare habitat re-establishing within 15 to 40 years, depending on tree species and site condition. The acres of prescribed burning by decade and alternative are displayed in appendix B.

Terrestrial vegetation

Forestwide vegetation desired conditions and other components in all action alternatives would guide managers to move toward vegetation conditions that are consistent with the estimated NRV. These include components regarding the amount and distribution of cover types (FW-VEGF-DC-01), tree species presence (FW-VEGF-DC-02) , size class (FW-VEGF-DC-03, FW-VEGF-DC-05, FW-VEGF-DC-06, FW-VEGT-GDL-01), density (FW-VEGF-DC-04), and structure (FW-VEGF-DC-08, FW-VEGF-DC-09, FW-VEGT-GDL-06). Plan components for individual GAs would guide managers to move toward vegetation composition and structure that is consistent with the estimated NRV for those GAs (refer to the draft plan), which may differ in some respects from forestwide conditions.

These desired conditions for vegetation could result in adverse impacts to potential lynx habitat and designated critical habitat, although they may be offset by requirements of the NRLMD that would limit the potential impacts of forest management, particularly vegetation management actions, to lynx habitat. The forestwide desired conditions include maintaining or decreasing the Engelmann spruce and subalpine fir cover types (FW-VEGF-DC-01), and decreasing the Engelmann spruce and subalpine fir tree species presence (FW-VEGF-DC-02). The desired conditions for the Divide and Elkhorn GAs are to decrease the spruce/fir cover type (DI-VEGF-DC-01 and EH-VEGF-DC-01), and decrease the Engelmann Spruce and subalpine fir species presence (DI-VEGF-DC-02 and EH-VEGF-DC-02). For most of the GAs the desired condition is to decrease the Engelmann spruce and/or subalpine fir species presence. Desired conditions for the Rocky Mountain Range and Upper Blackfoot GAs, which are the two occupied GAs that are also within designated critical habitat for lynx, specifically call for providing the amount, distribution, and structural conditions of spruce and subalpine fir to ensure that lynx habitat continues to be present (RM-VEGF-DC-03, UB-VEGF-DC-03).

Although the desired conditions described above generally call for decreases in spruce and fir presence, the results of modelling (appendix B) indicate that these conditions may not be met in all GAs in the five decades modelled. In the Divide GA spruce/fir cover increases slightly and in the Elkhorn GA the spruce/fir cover type decreases to within the NRV range. Figures in appendix B also show that spruce species presence decreases in the Elkhorn and Little Belt GAs, but increases in the remaining GAs, including those currently considered occupied by lynx. Modelling shows that while subalpine fir decreases in the Crazies, Divide, and Elkhorn GAs it maintains or increases everywhere else, including areas currently occupied by lynx. Forest wide the spruce/fir cover type increases; Engelmann spruce species presence maintains or increases slightly; and subalpine fir species presence maintains or increases slightly.

Terrestrial wildlife

The wildlife desired condition plan components are beneficial to lynx and lynx critical habitat. The desired conditions are for lynx habitat to be available throughout the species potential natural range so that life history requirements are met and movement within and between NFS parcels is allowed. The forestwide goal that interagency identified linkage areas facilitate wildlife movement compliments the NRLMD Standard ALL S1, Objective LINK 01, Standard LINK S1, Guideline LINK G1 and Guideline LINK G2.

Designated areas

Designated areas with plan components that affect lynx and designated critical lynx habitat include IRAs, designated wilderness, RWAs, and WSAs.

Desired conditions for IRAs include providing large, undisturbed, and unfragmented areas of land...where natural ecological processes and disturbances are the primary focus affecting vegetation. Within IRAs no permanent roads or trails are allowed to be constructed. However, temporary roads and maintenance and reconstruction of existing roads and trails may be allowed. Vegetation treatment is allowed in limited circumstances, and prescribed fire is allowed. There would be no changes in IRA boundaries from the existing condition, and effects to lynx and designated critical habitat are as described for the NRLMD (U.S. Department of Agriculture, Forest Service, 2007b);USDA 2007a; (USFWS, 2007), USDA 2017d, USDI 2017).

The desired condition for WSAs (FW-WSA-DC-01) benefit lynx and lynx habitat because natural processes are the primary forces; vegetation management is not conducted in the WSA. Plan components for the WSA would not affect designated critical habitat as the WSA does not occur in critical habitat.

Both the desired condition (FW-WILD-DC-02) and the legal requirements for managing designated Wilderness would benefit lynx, lynx habitat, and designated critical habitat because they require that natural forces are the primary factors affecting vegetation. Vegetation management activities are not allowed, except that prescribed fire may be used as a tool in order to allow fire play its natural role in the ecosystem. Prescribed fire can affect snowshoe hare habitat by reducing horizontal cover.

The acres of RWA vary by alternative, as described below. The desired conditions are constant in all alternatives, and like wilderness and WSA, natural processes are the primary forces at work (FW-RECWILD-DC-02). Effects to lynx and habitat are the same as in wilderness. Other differences in plan components between alternatives are described below.

Land status and ownership, and land uses; infrastructure – roads and trails, bridges and facilities

The plan component goal to cooperate with highway managers and other landowners to implement wildlife crossings where needed (FW-RT-GO-03) benefits lynx and PCE 1d by maintaining habitat connectivity and linkage. There would be no direct or indirect effects resulting from plan components for the remaining resources.

Livestock grazing

Plan components for the management of livestock grazing are designed to maintain the integrity of ecological systems where grazing occurs (FW-GRAZ-DC-02), and to minimize adverse impacts to wildlife and habitats (FW-GRAZ-GDL-01). Livestock presence on NFS lands presents a risk of vegetation reductions and changes, and could result in adverse impacts to snowshoe hare habitat and winter lynx habitat by reducing horizontal cover. Refer also to analysis in the NRLMD FEIS (U.S. Department of Agriculture, Forest Service, 2007b) for discussion of additional plan components for management of livestock grazing.

Timber

Plan components for the management of timber are intended to support the production of timber on lands identified as suitable for that use, as well as to manage timber harvest for other purposes. Standard FW-TIM-STD-04 would limit clearcutting and require interdisciplinary review of site specific conditions and desired conditions for habitat before clearcutting could be used. Standard FW-TIM-STD-08 would limit the maximum opening size of harvest units, and FW-TIM-GDL-01 would guide harvest activities to "contribute to ecological sustainability and ecosystem health" and to achieve desired vegetation conditions. Timber harvest activities have the potential to reduce Canada lynx habitat and temporarily displace individual lynx, but plan components, including the NRLMD, would minimize impacts. Timber harvest activities would move vegetation conditions toward desired conditions. Some timber harvest could result in decreased snowshoe hare habitat, and therefore reduced foraging opportunities for lynx. The acres of timber harvest by decade and alternative are displayed in the timber section and appendix B.

Effects by alternative

The primary difference between alternatives is the acres of RWAs and the activities that are suitable to occur within the RWAs in regards to motorized and mechanized equipment. The vast majority of lands selected for RWAs are in IRAs. Therefore, regardless of alternative, natural disturbances are the primary drivers of vegetation change on these lands. Prescribed fire may occur in RWAs, but may be constrained by access as well as limitations on pre-burn fuel preparation techniques, and is therefore somewhat less likely to occur in these areas than if they are not in RWAs. Some harvest of small trees is permissible in IRAs, but would not be allowed in RWAs. Alternative D contains the most RWAs, followed by alternatives B/C and A. Alternative E contains no RWAs. Prescribed burning and harvest activities would therefore be most likely to occur in these areas under alternative E. However, they would be constrained by IRA regulations. Because of this, in the case of timber harvest especially, the difference in potential effects across alternatives in these areas is small.

Timber harvest is generally most likely to occur on lands suitable for timber production, but may also occur on other lands. The acres suitable for timber production vary slightly by alternative. Modeling to show differences in timber outputs by alternative were influenced by the acres of land suitable for timber production as well as other land allocations and the theme of the alternative. The timber and other forest products section displays the acres of lands suitable for timber production within potential lynx habitat by alternative. Alternative A contains the most acres of land suitable for timber production that overlaps with potential lynx habitat, followed by alternative E, B/C, and D. The overall difference across alternatives is relatively small; regardless of alternative, at least half of the land suitable for timber production lies in potential lynx habitat. The timber and other forest products section describes how lynx management would influence the types and amounts of harvest that may occur in those areas.

Modeling was done to project future vegetation conditions. The modeling showed very little variance in future vegetation conditions across alternatives because the primary driver of change is natural disturbances. Figure 12 displays the projected proportion of lynx habitat structural stage forestwide, as an average of all alternatives across five decades in the future, based on this modeling. The proportion of each structural stage varies by one percent, as described below by GA, when viewed by alternative. Figures in appendix B display this data by GA, and also display the habitat categories over time by alternative, compared to the NRV.

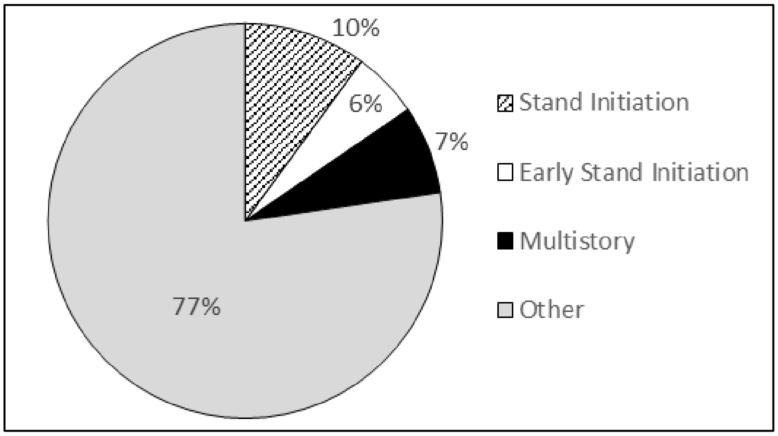


Figure 12. Forestwide proportion of potential lynx habitat by habitat category, average conditions of decades 1-5, average of alternatives

Figure 13 displays the changes, by decade, to the proportion of each habitat category, averaged across all alternatives. In general, mature, multistory habitat increases through decade 3, then decreases slightly. Early stand initiation habitat decreases through time. Stand initiation habitat increases through decade 4, then drops slightly. Habitat in the other category decreases through decade 4, with a slight increase in the fifth decade.

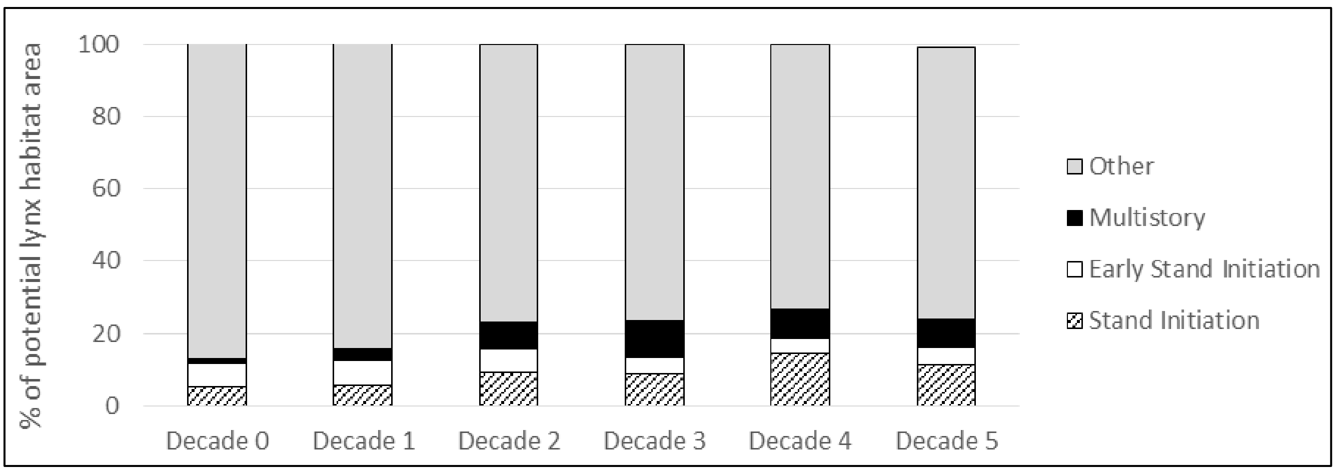


Figure 13. Lynx habitat by type, forestwide over time, average of all alternatives

Model results are used to indicate how vegetation may change over time. Models are one tool to help inform the analysis, and are useful for understanding relative differences between alternatives. These models are for comparative value, and are not predictive. For this analysis, SIMPPLLE modeling shows that the differences between alternatives are very small, and are within the model output variability. The modelling also shows that in all alternatives the amount of early stand initiation habitat decreases over time, while the amount of snowshoe hare habitat in the form of stand initiation structural stage and mature, multistory structural stage increases over time. Differences by alternative are described below.

Alternative A, no action

Alternative A includes few RWAs (three areas totaling just over 34,000 acres). Table 73 shows the proportion of each structural stage by decade from SIMPPLLE habitat modeling. Figures in Appendix B display this information by GA.

Table 73. Alternative A proportion of potential lynx habitat by structural stage by decade (%)

	Decade 0	Decade 1	Decade 2	Decade 3	Decade 4	Decade 5
Stand Initiation	5	6	9	9	15	11
Early Stand Initiation	7	7	7	5	4	5
Multistory	1	3	7	10	8	8
Other	88	84	77	76	74	76

Alternatives B and C

Alternatives B and C include 9 RWAs totaling just over 213,000 acres. In addition to the RWAs, in the Upper Blackfoot GA identified as potential connectivity to the south (east and west ends of Lincoln Valley), were removed from the lands suitable for timber production in order to provide connection to south across the fragmented valley. Table 74 shows the proportion of each structural stage by decade from SIMPPLLE habitat modeling. Figures in appendix B display this information by GA.

Table 74. Alternatives B and C proportion of potential lynx habitat by structural stage by decade (%)

	Decade 0	Decade 1	Decade 2	Decade 3	Decade 4	Decade 5
Stand Initiation	5	6	9	9	14	11
Early Stand Initiation	7	7	6	4	4	5
Multistory	1	3	7	10	8	8
Other	88	84	77	77	74	73

Alternative D

Alternative D has the most RWA, with almost 474,000 acres in 16 areas. These areas were chosen considering large scale connectivity and could facilitate movement of lynx across the landscape. Table 75 shows the proportion of each structural stage by decade from SIMPPLLE habitat modeling. Figures in appendix B figures display this information by GA.

Table 75. Alternative D proportion of potential lynx habitat by structural stage by decade (%)

	Decade 0	Decade 1	Decade 2	Decade 3	Decade 4	Decade 5
Stand Initiation	5	6	9	9	14	11
Early Stand Initiation	7	7	6	4	4	6
Multistory	1	3	7	10	8	8
Other	88	84	77	77	74	76

Alternative E

Alternative E does not include any RWAs. Table 76 shows the proportion of each structural stage by decade from SIMPPLLE habitat modeling. Figures in appendix B display this information by GA.

Table 76. Alternative E proportion of potential lynx habitat by structural stage by decade (%)

	Decade 0	Decade 1	Decade 2	Decade 3	Decade 4	Decade 5
Stand Initiation	5	6	10	10	15	12
Early Stand Initiation	7	7	7	5	4	5
Multistory	1	3	7	10	8	8

	Decade 0	Decade 1	Decade 2	Decade 3	Decade 4	Decade 5
Other	88	84	76	76	73	76

Cumulative effects

Table 77 summarizes the cumulative effects to Canada lynx from other resource management plans.

Table 77. Summary of cumulative effects to Canada lynx from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All plans were amended to include the NRLMD in 2007. Management of Canada lynx and lynx Designated Critical Habitat is consistent across all NFs. The cumulative effect would be that the management of lynx and lynx critical habitat would be the same, and effects would be similar. This includes specific adjacent landscapes that cross Forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
MTDNRC Forested State Trust Lands Habitat Conservation Plan (HCP) 2010.	The HCP applies to state trust lands in areas occupied by Canada lynx (the Upper Blackfoot GA) and includes a Lynx Conservation Strategy (MTDNRC and U.S. Fish and Wildlife Service 2010b, pp. 2-45–2-61) consisting of a suite of lynx habitat commitments that apply to all lands in the HCP project area supporting lynx habitat and additional commitments that apply to Lynx Management Areas. This strategy minimizes impacts of forest management activities on lynx. The goal of the lynx conservation strategy is to support federal lynx conservation efforts by managing for habitat elements important for lynx and their prey that contribute to the landscape scale occurrence of lynx, particularly in key locations for resident populations. This plan provides protection to important components of lynx habitat and cumulative benefits lynx and lynx habitat. These lands are not included in designated critical habitat.
Montana’s State Wildlife Action Plan 2015	The SWAP identifies community types, Focal Areas, and species in Montana with significant issues that warrant conservation attention. The plan is not meant to be an FWP plan, but a plan to guide conservation throughout Montana. The SWAP does not identify lynx as a species of greatest conservation need. However, *Conifer-dominated Forest and Woodland (xeric-mesic)* is identified as a Terrestrial Community Type of Greatest Conservation Need within the Ecoregion that includes the Forest. This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy. The vegetation conditions described would be complementary to the conditions being managed for with the HLC NF revised forest plan.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components related to lynx, primarily following guidance found in the Canada Lynx Conservation Assessment and Strategy (Interagency Lynx Biology Team, 2013), and would therefore likely be complementary to the plan components for the HLC NF.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the lynx habitat and critical habitat characteristics in this area are therefore likely similar to the wilderness areas in the adjacent Rocky Mountain Range GA and would likely complement these conditions.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily nonforested, and therefore does not contain much if any lynx habitat.

Resource plan	Description and Summary of effects
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Due to their location and elevation, lynx habitat does not occur as a component of these parks, and would not contribute to the desired conditions as described for the HLC NF.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and the NRLMD has guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	This plan is relevant to an area that lies adjacent to NFS lands in the Divide GA, in proximity to the City of Helena. The plan emphases forest management and wildfire mitigation. Due to the location and elevation, lynx habitat does not occur as a component of this area, and would not contribute to the desired conditions as described for the HLC NF.

Conclusions

Alternative A, no-action

The NRLMD provided management direction that conserves and promotes the recovery of Canada lynx while preserving the multiple use direction in existing forest plans (U.S. Department of Agriculture, Forest Service, 2007b). The direction applies to mapped lynx habitat occupied by Canada lynx, and is to be considered when designing management actions in unoccupied mapped lynx habitat. The NRLMD provided the regulatory mechanism to alleviate the main threat to lynx; “the lack of guidance for conservation of lynx and snowshoe hare habitat in NF Land and Resource Plans and BLM Land Use Plans” (U.S. Department of the Interior, Fish and Wildlife Service, 2000). The BA completed for the NRLMD concluded that while management direction would provide for lynx conservation, the plans amended by the NRLMD would still be likely to adversely affect lynx because individuals could be adversely affected as a result of the exemptions and exceptions to the vegetation standards for fuel treatment projects and pre-commercial thinning (U.S. Department of Agriculture, Forest Service, 2007b). The information here that we have added to that analysis supports that conclusion. A determination of effect will be made in a BA for consultation with USFWS on a preferred alternative, after that alternative has been selected.

Action alternatives

The action alternatives all include the NRLMD, which would continue to conserve and promote recovery of Canada lynx by reducing or eliminating adverse effects from land management activities on NFS lands. In addition to the NRLMD, plan components included in all action alternatives would:

- contribute to maintaining spruce/fir habitat on the forest;
- provide specific desired conditions and other guidance for management of designated areas such as RWAs, IRAs, and the conservation management area as relatively intact, un-fragmented landscapes where natural processes predominate;
- identify specific areas in the Upper Blackfoot and Divide GAs to manage for potential connectivity across landscapes; and
- increase the amount of available snowshoe hare habitat over time in the GAs.

The sum of that management direction would be to provide additional protections for lynx habitat and promote habitat conditions that provide for snowshoe hare. Alternatives B, C, and D provide more RWAs, which could limit potential treatments in lynx habitat more than in the alternatives A and E. A determination of effect will be made in a biological assessment for consultation with USFWS on a preferred alternative, after that alternative has been selected.

3.15.9 Wolverine, affected environment

Status and distribution

The wolverine is currently proposed as threatened under the ESA (USFWS 2016). Wolverine are found in the northern portion of the western hemisphere, largely in northern Canada and Alaska but extending southward in the mountainous western portion of North America into Montana, Idaho, and the northern portion of Wyoming. Wolverine have been documented in all GAs in the plan area except the Highwoods, Snowies and Castles. There is a single trapping record from the Crazies from over 40 years ago.

Population trend

Wolverines were nearly extinct in Montana during the early 1900s, but have been increasing in numbers and range since. Wolverines likely exist as a metapopulation, with intermittent exchange of individuals among semi-isolated subpopulations that maintains genetic diversity and possibly demographic function. Because of their food and space requirements, wolverines appear to exist at naturally low densities.

Food habits and habitat use

Wolverines are food generalists, preying on small animals and birds, scavenging carrion, and consuming fruits, berries, and insects (Banci, 1994; Hornocker & Hash, 1981). Wolverines require a great deal of space, with home ranges in Montana (Glacier National Park) and northern Wyoming (Yellowstone National Park) estimated at 55 to 128 square miles for females, and 193 to 311 square miles for males. Wolverines use a wide variety of habitats, with their primary requirement apparently being areas with enough winter precipitation to reliably maintain deep, persistent snow into late spring, during the denning period (Copeland et al., 2010). Therefore in Montana, at the southern periphery of their range, wolverines are generally restricted to high elevations where deep snow persists, resulting in the metapopulation structure described above. Wolverines appear to choose areas of high structural diversity for dens, including components such as logs or boulders.

Two separate models were developed to map wolverine habitat in Region One. One is based on from studies of radio-collared wolverine in the Greater Yellowstone Ecosystem (Inman, Brock, et al., 2013; Inman et al., 2012). The second is based on research showing that wolverine appear to require snow cover that persists into May for successful reproduction (Copeland et al., 2010). The largest acreage of potential primary wolverine habitat is on the Rocky Mountain Range GA. Only the Rocky Mountain Range and Upper Blackfoot GAs appear to have snow that reliably (every year for 7 or more years in a row) persists through May. These two GAs are also connected to the Flathead NF and Glacier National Park, both of which also contain wolverine habitat. The other GAs on the HLC NF do not reliably have persistent snow, suggesting that wolverine may not be consistently present or be reproducing in those areas. The Highwoods and Castles GAs may not have enough potential habitat to support even a single wolverine, in addition to being isolated from larger GAs with more habitat. Neither the Highwoods nor the Castles GA has any records of wolverine presence. Based on habitat models the role of GAs other than the Rocky Mountain Range and Upper Blackfoot in contributing to the larger wolverine population is questionable.

Key drivers and stressors

Factors not under FS Control

Loss of or reduction in size of areas with persistent spring snow as a result of climate change is likely the most important threat to wolverine populations (U.S. Department of the Interior, Fish and Wildlife Service, 2013).

Harvest, usually in the form of trapping, can be a key factor affecting wolverine survival (Banci, 1994; Hornocker & Hash, 1981; J. R. Squires, Copeland, Schwartz, & Ruggiero, 2007), and consequently could affect population trend. Wolverine trapping in all four wolverine management units in Montana is currently closed (MTDFWP 2017c). Mortality of wolverines caught incidental to trapping for other species may occur.

Factors affected by FS management

Wolverine do not appear to be dependent on specific vegetation or habitat features that may be altered by land management activities and may not be heavily affected by recreation activities (U.S. Department of the Interior, Fish and Wildlife Service, 2013)). Heinemeyer et al. (Heinemeyer et al. 2017), however, found that although wolverine home ranges may include areas with high levels of winter recreation, some wolverines may be displaced from portions of their home range by recreational activities, and that displacement may reduce the total amount of habitat available to them. FS management actions do not threaten wolverines or their primary habitat, and activities on NFS lands do not appear to pose a threat to the long-term persistence of the species (U.S. Department of the Interior, Fish and Wildlife Service, 2013), although population-level impacts of recreation on wolverines are not yet fully understood (Heinemeyer et al. 2017).

Habitat loss due to factors other than climate change is less likely to occur, largely because much of wolverine habitat in the contiguous U.S, is in a management status, such as designated wilderness, IRA, or national park, that provides some protection from management, industrial, and certain recreational activities (U.S. Department of the Interior, Fish and Wildlife Service, 2013). Maintaining those large blocks of un-fragmented wolverine habitat could help mitigate, to some extent, habitat fragmentation caused by climate change. Specific vegetation conditions appear to be relatively unimportant to this species, so although there may be some avoidance of vegetation management activities while they are being implemented, vegetation management in general is unlikely to have measurable effect on wolverines.

Table 78 shows the acreage of mapped wolverine habitat on the HLC NF currently in conservation management area, IRA, or designated wilderness. Acreages in conservation management area, which only occurs on the Rocky Mountain Range GA, overlaps with acreage in IRAs. Habitat was mapped following both the Inman et al methodology (Inman, Brock, et al., 2013; Inman et al., 2012), which incorporates topographic features, and the Copeland methodology (Copeland et al., 2010), which focuses on areas of persistent spring snow. Percentages shown are the proportion of the total of each type of mapped habitat that is within the designated area type. For example, 7% of all mapped wolverine primary habitat on the HLC NF is within the Conservation Management Area, and 1% of all areas mapped as having persistent spring snow in seven out of seven years is within the Conservation Management Area.

Table 78. Acres in conservation management area, IRA, and designated wilderness by wolverine habitat category and percent of total habitat on HLC NF

Wolverine habitat[1]	Conservation management area	IRA	Designated wilderness
Primary	197,957 (20%)	503,504 (50%)	412,404 (41%)
Maternal	12,715 (4%)	123,442 (34%)	231,841 (65%)
Persistent Spring Snow 1 of 7 years	39,082 (10%)	217,978 (55%)	101,351 (26%)
Persistent Spring Snow 7 of 7 years	252 (1%)	11,164 (24%)	35,664 (76%)

1. Primary and maternal habitats were mapped using methods described by Inman (Inman, Bergen, & Beckman, 2013); spring snow habitat was mapped using methods described by Copeland (Copeland et al., 2010) and includes areas with persistent snow in at least 1 of 7 years, and in 7 of 7 years, to display a possible range.

The relatively large percent of areas with persistent spring snow in at least one of seven years that are also in designated areas compared to the percent of areas with persistent spring snow in all seven years, is largely a function of the relatively larger amount of area with snow persisting in at least one year. In other words, the total area with spring snow in only one year (over 395,000 acres, see project file) is much larger than the total area with spring snow in seven years (47,000 acres, see project file). That makes is more likely that areas with snow persisting for only one of seven years will overlap with a designated area. The areas of mapped wolverine habitat and persistent spring snow that are within designated areas varies by GA, with the majority on the Little Belts and Rocky Mountain Range GAs, as well as on the Upper Blackfoot GA.

Wolverines in Idaho were found to use use drainage bottoms, riparian areas, and forested edge habitats, and appear to use those more in winter than in summer (Heinemeyer et al. 2017). Maintaining landscapes that are relatively un-fragmented by human development between areas of high-elevation wolverine habitat may be important to maintain wolverine use of an area, and help to maintain both genetic and demographic connectivity among wolverine sub-populations.

3.15.10 Wolverine, environmental consequences

Effects common to all alternatives

Climate change and its predicted impacts on high-elevation, persistent spring snow are not likely to be affected by management actions on the HLC NF. Management of HLC NF lands will also not impact trapping-related mortality.

Under all alternatives the acreage and distribution of Congressionally-designated wilderness, conservation management area, and IRA would not change from the existing situation. These areas all provide large acreages that are undeveloped and occur in relatively contiguous large blocks, and where natural processes predominate. These areas also remain relatively undisturbed by human development and by many types of human activity. The acreage of these areas that overlap with mapped wolverine habitat would be as shown in Table 78 above. Outside of identified wolverine habitat, these areas may also contribute to potential connectivity among wolverine subpopulations within the plan area and with adjoining areas.

Under all alternatives, the plan components in the Grizzly Bear Amendment (appendix I of the Draft Plan) for management of grizzly bear habitat would result in limits on motorized access and on developed recreation sites in the Rocky Mountain Range and Upper Blackfoot GA. These limits could benefit wolverine by minimizing the potential for impacts due to motorized travel and human activities associated with overnight developed recreation sites.

Effects of alternative A, no action

Management of HLC NF lands under this alternative would not have an impact on high-elevation, persistent spring snow, nor would it affect potential trapping-related mortality.

The existing Helena NF and Lewis and Clark NF plans contain a number of plan components that provide general direction for maintenance of wildlife habitat values while carrying out other management actions. Among those that influence management of habitat used by wolverines are, in the Lewis and Clark NF plan:

- C-1(10): Cooperate with other entities to implement programs for land acquisition, exchanges, and easements;
- C-1 (6) and L-4: Manage motorized use through travel plans to reduce impacts to wildlife during periods of high stress, and generally minimize impacts of roads on wildlife;

- C-2: Several standards requiring consultation, analysis, research, coordination and contributions to recovery of listed species; would apply to wolverine if they become listed;
- C-5: Monitor populations of Management Indicator Species, including wolverine. Although Management Indicator Species will no longer be identified under the 2012 Planning Rule, identification of them in the Lewis and Clark NF plan would likely mean continued adherence to applicable standards and guidelines.;
- G-1 and G-2: Standards requiring stipulations to minimize potential disturbance and displacement of wildlife during oil and gas exploration and development operations.

Plan components in the existing Helena NF plan that relate to management of habitats used by wolverines include:

- Standards requiring consultation, analysis, research, coordination and contributions to recovery of listed species; would apply to wolverine if they become listed;
- Standards primarily relating to grizzly bear, but that require minimizing impacts of roads on wildlife; and
- Standards requiring analysis and mitigation of potential impacts to wildlife of oil and gas exploration and development operations.

Both plans include components for maintaining areas of secure habitat for elk and other big game; these areas could benefit wolverine by providing areas with minimal human disturbance in which to travel between areas of high-elevation preferred habitats.

The existing forest plans do not provide specific direction for wolverine habitat, and much of the direction relating to management activities occurring in wolverine or other wildlife habitat is somewhat general. The plans refer to the need to minimize impacts to wildlife when carrying out travel management planning, but are not specific regarding over-snow travel in high-elevation areas used by wolverines. Plan direction to maintain habitat security in some areas, and to minimize the potential impacts to wildlife from roads and other management may provide some benefit to wolverines. Nevertheless, FS management actions and activities occurring on NFS lands are unlikely to have impacts to wolverine populations (U.S. Department of the Interior, Fish and Wildlife Service, 2013), which will continue to be affected primarily by the effects of climate change on the amount and distribution of persistent spring snow.

Effects of the action alternatives

Management of HLC NF lands under these alternatives would not have an impact on high-elevation, persistent spring snow, nor would it affect potential trapping-related mortality.

Plan components for terrestrial vegetation (e.g., FW-VEGT-DC-01 and FW-VEGT-DC-02, 03) are intended to maintain the integrity of alpine ecosystems, and to provide vegetation conditions that would support at-risk species and provide connectivity. These plan components provide the coarse filter that would maintain the integrity of systems on which wolverine are dependent.

Maintaining large blocks of un-fragmented wolverine habitat could help mitigate, to some extent, habitat fragmentation caused by climate change. Primitive and semi-primitive nonmotorized recreation settings are areas in which motorized travel would not occur, and in which human development and the influence of humans is minimal. Similarly, RWAs also provide blocks of unfragmented habitat where natural processes predominate, and human influence is minimized. Table 79 shows the amount of mapped wolverine habitat that would occur in the combined primitive and semi-primitive non-motorized recreation settings, and in RWAs, by alternative. Alternative A is included in the table to provide comparison with the no-action alternative.

Table 79. Acres of RWAs, and combined primitive and semiprimitive nonmotorized ROS, by wolverine habitat category by alternative

Area designation or category	Wolverine habitat[1]	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Recommended Wilderness[2]	Primary	11,792 (1%)	85,229 (8%)	85,229 (8%)	160,866 (16%)	0
	Maternal	1,384 (<1%)	16,033 (4%)	16,033 (4%)	29,060 (8%)	0
	Persistent Snow 1 of 7 years	6,407 (2%)	24,486 (7%)	24,486 (7%)	61,266 (16%)	0
	Persistent Snow 7 of 7 years	0	3,007 (6%)	3,007 (6%)	3,007 (6%)	0
Combined Primitive and Semi-Primitive Non-Motorized Recreation Setting (Summer)	Primary	845,157 (84%)	846,107 (84%)	846,110 (84%)	854,130 (84%)	845,328 (84%)
	Maternal	339,764 (95%)	339,821 (95%)	339,821 (95%)	340,285 (95%)	339,761 (95%)
	Persistent Snow 1 of 7 years	288,564 (73%)	289,668 (74%)	289,685 (74%)	295,865 (75%)	288.085 (73%)
	Persistent Snow 7 of 7 years	46,479 (100%)	46,479 (100%)	46,479 (100%)	46,479 (100%)	46,479 (100%)
Combined Primitive and Semi-Primitive Non-Motorized Recreation Setting (Winter)	Primary	814,301 (80%)	819,780 (81%)	825,319 (82%)	827,489 (82%)	814,975 (81%)
	Maternal	330,985 (93%)	331,736 (93%)	331,796 (93%)	332,101 (93%)	331,059 (93%)
	Persistent Snow 1 of 7 years	297,742 (76%)	301,648 (77%)	306,204 (78%)	310,268 (79%)	297,378 (75%)
	Persistent Snow 7 of 7 years	44,945 (96%)	44,945 (96%)	44,945 (96%)	44,945 (96%)	45,015 (96%)

1. Primary and maternal habitats were mapped using methods described by Inman (Inman, Bergen, et al., 2013); spring snow habitat was mapped using methods described by Copeland (Copeland et al., 2010).
2. A zero means that data showed there were not 7 sequential years with persistent spring snow in any of the RWAs for that alternative. There may have been up to 6 sequential years; see project file for model details.

Alternative D, which features the largest number and acreage of RWAs, has the most area of mapped wolverine habitat of all types in RWAs, while alternative E has the least. Note that an even larger acreage and proportion of mapped wolverine habitat and areas of persistent snow are within IRAs, and that most RWAs areas overlap with IRAs. RWAs, however, would be managed specifically to maintain a natural environment where ecological processes function as the primary forces affecting the environment (FW-RECWILD-DC). The location of RWAs in alternative D was informed by assessing which areas might provide potential connectivity among island mountain ranges, where habitat on NFS land remains relatively intact and intervening lands either provide minimal disturbance or distances between island mountain ranges are shortest. Alternative D would therefore have slightly increased potential to maintain connections among separate GAs for some wildlife species, including wolverine, although that potential would continue to be greatly affected by land management and uses on intervening non-NFS lands.

The amount of primitive, and semiprimitive nonmotorized recreation settings in wolverine habitat would not be markedly different among alternatives, and the large majority of wolverine of all habitats is and would continue to be within either primitive or semi-primitive non-motorized settings under all alternatives, including the no action. That is a reflection of the relatively inaccessible nature of most key wolverine habitat. Plan components for these two recreation settings stress limited presence and evidence of human activity (FW-ROS-DC 02, 03, 04, and 05 and associated standards and guidelines. The largest area of habitat that is relatively free of human disturbance occurs on the Rocky Mountain Range GA (refer to project file for acreages by GA), which also has the most mapped potential wolverine habitat and also is contiguous with wolverine habitat on the adjoining Flathead NF, and is adjacent to wolverine habitat in Glacier National Park.

Cumulative Effects

Table 80 summarizes the cumulative effects to wolverines from other resource management plans.

Table 80. Summary of cumulative effects to wolverines from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. The Flathead NF plan is currently being revised under the 2012 Planning Rule. All forest plans must adhere to requirements of the ESA, as amended, for species listed as threatened or endangered and those identified as proposed or candidate species for listing. Wolverines on the HLC NF are likely part of a connected population extending across NF boundaries. Plans on adjoining NFs include varying amount and pattern of winter motorized use that could have varying effects on wolverine.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. The Butte plan includes components that are similar and complementary to the HLC NF revised plan; components in the plans under revision are anticipated to be similar to those in the Butte plan. BLM lands near the HLC NF include likely relatively small amounts of wolverine habitat. All land use plans must adhere to requirements of the ESA, as amended, for species listed as threatened or endangered and those identified as proposed or candidate species for listing.
National Park Service - Glacier National Park General Management Plan 1999	Similar in scope to a forest plan. Philosophy is to manage the park for its wild character and integrity of natural heritage, while traditional visitor services and facilities remain. Guiding principles include providing for such things as biosphere reserve, proposed wilderness, interpretive, educational, and outreach programs, preservation of natural and cultural resources. Winter recreation in the park is limited to non-motorized travel, providing large expanses with little or no potential human disturbance.
Montana Statewide Forest Resource Strategy (2010)	MT conducted a statewide assessment of forest resources and identified issue-based focus areas with implementation strategies and deliverables for each. Focus areas include such varied things as achieving ecological integrity through recovery of species diversity, managing for wildfire and public safety, supporting forest products infrastructure, and addressing changing forest ownership patterns. Management for these focus areas on state lands would adhere to management plans for specific state-owned lands.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Goals include managing significant, relevant, and accessible parks and programs in a manner consistent with available resources, as well as emphasizing visitor experience, partnerships, and awareness of the state parks system. State parks near or adjacent to the HLC NF likely contain very little wolverine habitat.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy (above). The vegetation conditions described would be complementary to the conditions being managed for with the HLC NF draft plan.
Montana State Wildlife Management Areas	Plans are specific to management areas and their established purpose. Most in the plan area were established to conserve big game winter range, with goals to maintain forage, cover, and security during winter use periods. Likely very little wolverine habitat on these lands, but they could contribute to large-scale connectivity.

Conclusions

It is unlikely that forest plan direction has the potential to impact recovery or persistence of wolverine in the plan area or in Montana (U.S. Department of the Interior, Fish and Wildlife Service, 2013). The most serious threat to wolverine is reduction in the abundance, distribution, and persistence of late spring snow as a result of climate change, which would not be affected by FS management actions. Harvest of wolverines, although currently closed in Montana, has the potential to impact survival, which could affect population trend if at high enough levels. FS management does not affect harvest nor does it affect potential mortality related to trapping for other species.

All alternatives provide some area of relatively un-fragmented habitat in the form of designated wilderness and IRAs, as well as RWAs and primitive and semi-primitive non-motorized ROS settings, where natural processes predominate or where human influence is minimized. All of these areas, where they overlap with wolverine habitat, would prevent fragmentation of existing wolverine habitat. Elsewhere, these areas could contribute to maintaining connectivity among wolverine sub-populations in Montana. The largest area of mapped wolverine habitat on the HLC NF, on the Rocky Mountain Range GA, is within designated wilderness or the overlapping management designations of Conservation Management Area and IRA. This habitat would remain connected, to the extent it is not reduced or altered by climate change, to wolverine habitat on the adjoining Flathead NF and Glacier National Park. All alternatives would contribute to maintaining persistence of wolverines in the plan area.

3.15.11 Species of conservation concern

The Regional Forester has identified two SCC for the HLC NF: flammulated owl and Lewis's woodpecker. This list has changed from the one identified at the time the Proposed Action was released; information regarding the changes and rationale for those and for identifying these species as SCC can be found on the Region 1 SCC web page at: http://bit.ly/NorthernRegion-SCC.

The 2012 Planning Rule states that if plan components to maintain ecosystem integrity and diversity are insufficient to provide ecological conditions to "maintain a viable population of each SCC within the plan area", then additional species-specific plan components are to be included to provide such ecological conditions. The rule acknowledges that it may be beyond FS authority or the inherent capability of the plan area to maintain or restore ecological conditions that would maintain a viable population of a species in the plan area. In such case, the FS must document the basis for that determination, and include plan components that would provide ecological conditions to contribute to maintaining a viable population of the species within its range.

This section uses the BASI to demonstrate how the plan components (species-specific or otherwise) of each alternative would provide the ecological conditions to maintain those species in the plan area over the long term. Analysis of the effects of the alternatives is provided for each SCC. Analysis of the impacts of plan components for management of other resources, as well as cumulative effects, are discussed for both species together at the end of this section.

Flammulated owl, affected environment

Status and distribution

The breeding range of flammulated owls extends from southern British Columbia southward into Mexico (MTNHP field guide), corresponding strongly with the distribution of ponderosa pine and Jeffrey pine (M. D. Nelson, Johnson, Linkhart, & Miles, 2009). A 2006 evaluation (Samson, 2006) found no evidence of population decreases on NFS lands in Montana. However there are ongoing concerns about the availability and trend of stands of large, open ponderosa pine in the plan area. Flammulated owls have been detected both historically and recently in the Upper Blackfoot, Divide, Big Belts and Elkhorns GAs (Cilimburg, 2006), but not elsewhere on the HLC NF. The plan area crosses the eastern edge of the mapped distribution of flammulated owls in Montana (MNHP, 2014), with the Little Belts, Highwoods, Castles, Crazies, and Snowies GAs outside the known range of the species. The Rocky Mountain Range GA of the LCNF is included in coarse scale map of flammulated owl distribution in Montana (MNHP, 2014), but lacks ponderosa pine. There are no historic records of flammulated owls on the Rocky Mountain Range GA, and flammulated owls were not detected during surveys for several owl species (G.Frye, Rocky Mountain Front Institute of Natural History, Pers. Com.) between 2000 and 2005.

Habitat Use

Detailed information about flammulated owl habitat use can be found in the Assessment (U.S. Department of Agriculture, Forest Service, Northern Region, 2015), and in literature cited there and in this section. In this section we will summarize information directly relevant to analysis of the consequences of the HLC NF draft plan on flammulated owls.

Flammulated owls appear to prefer dry, open, mature and old-growth forests usually with ponderosa pine or Jeffrey pine (McCallum, 1994; M. D. Nelson et al., 2009) . In Montana, flammulated owls are associated with mature and old-growth xeric ponderosa pine and ponderosa pine/Douglas-fir stands (USDA 2011d). These birds require large snags with cavities, commonly excavated by pileated woodpecker, northern flicker, or sapsuckers (Climburg, 2006).

Flammulated owls have relatively small home ranges (Linkhart & McCallum, 2013) and often nest in groups, possibly due at least in part to the often clumped distribution of snags. The amount of current habitat on the HLC NF would likely provide for persistence of flammulated owls on the HLC NF. Maintaining habitat on the HNF portion of the HLC NF may be important to preventing contraction of the species' range in Montana.

Nelson et al. (M. D. Nelson et al., 2009) estimated that that there were about 18,533 mi^2 of potential breeding habitat in the United States. Samson (Samson, 2006) mapped flammulated owl habitat habitat throughout the Region and by NF; Bush and Lundberg (Bush & Lundberg, 2008) updated Samson's mapping and estimated that there are approximately 10,200 acres of potential flammulated owl nesting habitat on the HNF, and approximately 8,800 acres on the LCNF (total of roughly 19,000 acres on the combined HLC NF). Using the same queries with updated vegetation data, estimates were made using in 2015 for the plan area by GA as shown in Table 81. The SIMPPLLE model was used to estimate the NRV of a variety of vegetation characteristics and several wildlife habitats (refer to terrestrial vegetation section and project file) and to estimate the amount of currently existing habitat. The SIMPPLLE model uses somewhat different methods and parameters than those used by Samson (Samson, 2006) and Bush and Lundberg (Bush & Lundberg, 2008); the estimates of existing habitat and NRV are also displayed in Table 81. Refer to appendix B of the Assessment (U.S. Department of Agriculture, Forest Service, Northern Region, 2015) for a summary of the methodology and data used to estimate habitat for that assessment, and to the project file for information about the methods and data used in the SIMPPLLE model.

Table 81. Estimated flammulated owl nesting habitat on the HLC NF, by GA with 90% confidence interval

GA	2015 Estimated Habitat Acres: Mean (Range)[1]	2017 SIMPPLLE Estimated Current Habitat Acres	SIMPPLLE Estimated NRV: Min-Max
Big Belts	9,525 (4,098 – 15,757)	1,670	13,045 – 124,497
Divide	4,608 (1,158 – 8,666)	6,170	2,446 – 22,757
Elkhorns	1,828 (0 – 5,330)	2,500	833 – 25,974
Upper Blackfoot	9,284 (3,963 – 15,263)	3,210	2,123 – 51,295

GA	2015 Estimated Habitat Acres: Mean (Range)[1]	2017 SIMPPLLE Estimated Current Habitat Acres	SIMPPLLE Estimated NRV: Min-Max
Total	25,245 (9219 – 45,016)	28,181	18,447 – 224,523

1. 2015 estimate made using the parameters and methodology of Samson (Samson, 2006)

The 2015 estimates differ in some GAs from the SIMPPLLE estimates for current habitat based on differences in model parameters and in methodologies. For most GAs the NRV is fairly broad, reflecting variability in model outcomes that may represent large-scale disturbances, such as fire, climate, and insect infestation, over time. For the GAs within known flammulated owl distribution, the amount of estimated current habitat by either method is at the lower end, or in the case of the Big Belts GA, below the low end of the estimated NRV. This parallels the current estimates for both ponderosa pine and large and very large diameter trees (refer to appendix B and the terrestrial vegetation section), both of which are components of flammulated owl habitat, forestwide and in the Big Belts GA. With the exception of the Little Belts GA it appears that the GAs with the least potential habitat currently and by estimated NRV correspond to areas where flammulated owls have not been detected. Elsewhere on the HLC NF (primarily in the Little Belts GA) there are over 15,000 acres of areas with ponderosa pine that do not appear to be current or historic range, and that may continue to be unoccupied in the future.

Key drivers and stressors

Although habitat appears to be well-distributed and relatively abundant in Region One, ponderosa pine forests have decreased in abundance and distribution, and their structure has changed over the last century. Changes in flammulated owl habitat may be due to factors affected by FS management, as well as those not under FS management control.

The ponderosa pine cover type is less prevalent on the HLC NFs than the dry Douglas-fir/mixed mesic conifer and lodgepole pine cover types, and is probably less abundant than it was historically (U.S. Department of Agriculture, Forest Service, Northern Region, 2015). Nelson et al. (M. D. Nelson et al., 2009) noted that logging and wildfire exclusion, both of which can be affected by FS management, have resulted in a loss of ponderosa pine forest habitat. Fire exclusion allows growth of young Douglas-fir and may reduce the amount of open understory needed for flammulated owl foraging (Samson, 2006). A lack of low-intensity disturbance may have caused a decrease in the larger size classes of trees in some cover (U.S. Department of Agriculture, Forest Service, Northern Region, 2015) in the plan area. Samson (Samson, 2006) stated that “[t]imber management is an insignificant influence on the landscape in comparison to suppression of fire”, in terms of its influence on flammulated owl habitat.

Ponderosa pine has been impacted by recent heavy insect infestation on the HNF. While insect infestations may be influenced indirectly by factors related to forest management, they are a stressor that is not under FS management control. Similarly, human settlement and development on non-NFS lands may reduce mature ponderosa pine habitat through direct removal of habitat.

Flammulated owl, environmental consequences

This analysis focuses on potential impacts to the specific combination of vegetation type (tree species) and structural stage that appears to be required for nesting by flammulated owls.

Effects common to all alternatives

A general discussion of the ecological conditions that support flammulated owls (i.e. the coarse filter analysis of the species’ needs) is incorporated into the terrestrial wildlife diversity sections (Species Associated with Dry Conifer Habitats and Species Associated with Snags). Forestwide over the next five decades, ponderosa pine is predicted to increase under all alternatives (but refer to action alternatives section below, including discussion of trend by GA). The large tree size class as well as concentrations of large trees would also likely increase under all alternatives. Very large tree abundance would likely remain static.

Estimates made using the SIMPPLLE model (refer to appendix B) predict that at a forestwide scale, the average acreage of flammulated owl habitat forestwide would increase over the five decades modelled, moving into the lower end of the estimated NRV within about three decades.

Effects of alternative A, no action

The effects of alternative A on the ecological conditions that support flammulated owls are discussed in the terrestrial vegetation section regarding ponderosa pine and large and very large trees, and are summarized from there into the terrestrial wildlife diversity section, in the sections on dry conifer habitats, and late successional forests.

The existing forest plans do not include desired conditions or other plan components specific to ponderosa pine forests, large and very large trees, or management of flammulated owl habitat. Without specific desired conditions for this forest type and tree size there is no guidance for management of habitat conditions required by flammulated owls. Existing plan standards for retaining snags, particularly large snags, would provide some habitat for flammulated owls where large and very large snags occur in ponderosa pine habitats. This species is currently listed as a RFSS, so it would continue to be considered in forest management planning and implementation at a site or project specific level.

As discussed above under ‘effects of all alternatives’, modelled estimates of flammulated owl habitat at a forestwide scale show some increase under this alternative, and would be predicted to move into the estimated NRV during the third decade. Results by GA are discussed in the section below along with the action alternatives to facilitate comparison.

Effects of the action alternatives

All action alternatives include a number of plan components that set desired conditions for vegetation management that would maintain or improve potential flammulated owl habitat (Table 82) or the ecological conditions (coarse filter) required to support flammulated owls. Plan components for GAs are included only for those where flammulated owls have been observed or that are within the known distribution of flammulated owls. Additional plan components that may directly or indirectly maintain or improve potential habitat for flammulated owls may also be included in other GAs. Descriptions in Table 82 paraphrase the actual components, to briefly illustrate the manner by which they may influence habitat. Please refer to the draft plan for the actual text of plan components.

Table 82. Draft plan components that would contribute to providing habitat for flammulated owls

Plan Component	Area Where Plan Component Applies	Brief Description of Plan Component
FW-VEGF-DC-01	Forestwide	Distribution of cover types, based on NRV includes increasing ponderosa pine and maintaining or increasing non-forested inclusions. See HLC NF Draft Plan for details by broad PVT; and see individual GAs.
FW-VEGF-DC-02	Forestwide	Distribution of tree species presence, based on NRV: includes increasing ponderosa pine. See HLC NF Draft Plan for details by broad PVT, and see individual GAs.
FW-VEGF-DC-03	Forestwide	Distribution of size classes, based on NRV: includes increasing abundance and distribution of large and very large size classes. See HLC NF Draft Plan for details by broad PVT, and see individual GAs.

Plan Component	Area Where Plan Component Applies	Brief Description of Plan Component
FW-VEGF-DC-04	Forestwide	Distribution of density classes, based on NRV: includes increasing low/medium density class and decreasing high density class. See Table 7 in HLC NF Draft Plan for details by broad PVT, and see individual GAs.
FW-VEGF-DC-09	Forestwide	Desired conditions of snags by size class, to maintain or increase large and very large snags in Warm Dry type; see HLC NF Draft Plan for details.
FW-VEGF-STD-01	Forestwide	Standards to retain a minimum amount of large and very large trees based on DC. See HLC NF Draft Plan for details.
FW-VEGF-GDL-02	Forestwide	Guideline to retain a minimum amount of snags, specified by size and R1 Broad PVT. See HLC NF Draft Plan for details.
BB-VEGF-DC-01	Big Belts	Distribution of tree species presence, based on NRV: includes increasing ponderosa pine.
DI-VEGF-DC-02	Divide	Divide -Distribution of tree species presence, based on NRV - increase limber pine, maintain juniper, increase ponderosa pine, maintain Douglas-fir, maintain aspen
EH-VEGF-DC-02	Elkhorns	Elkhorns -Distribution of tree species presence, based on NRV - increase limber pine, maintain juniper, increase ponderosa pine, maintain Douglas-fir, maintain aspen.

In addition to the coarse-filter plan components listed above that would provide ecological conditions needed by flammulated owls, the revised plan includes a component specific to flammulated owls that would be applied in the Upper Blackfoot, Divide, Big Belts, and Elkhorns GAs. These GAs are within the known distribution of flammulated owls, and have documented observations. The species-specific plan component for flammulated owls is as follows:

> Ponderosa pine-dominated forests have concentrations of large (greater than 15” dbh) ponderosa pine and Douglas-fir trees and snags with relatively open canopy available for nesting by flammulated owls. These areas occur within a larger mosaic of closed-canopy forest and shrub-dominated openings that serve as flammulated owl roosting and foraging areas. (BB-WL-DC-02, DI-WL-DC-02, EH-WL-DC-03, UB-WL-DC-02)

Although elements of this plan component are also addressed in the plan components for terrestrial vegetation, the purpose of the desired condition is to ensure specific effort to provide for the mix of vegetation components (ponderosa pine, large-diameter trees and snags, open understory, in proximity to other habitats) that characterize flammulated owl habitat. This desired condition would ensure that lands managed by the HLC NF would provide conditions necessary for persistence of flammulated owls in the plan area over the long term.

Estimates of flammulated owl habitat under all alternatives by GA were made using the SIMPPLLE model (refer to appendix B) for those GAs within the known distribution of flammulated owls in Montana. The predicted acreage of flammulated owl habitat would increase in the Big Belts over the modelled five decades, moving into the lower end of the estimated NRV by the third decade. The increase would be slightly greater under alternative E. The predicted acreage of flammulated owl habitat would decrease slightly in the Divide GA over the modelled five decades, but would remain at the lower end of the estimated NRV. For the Elkhorns and Upper Blackfoot GAs, the model estimates that flammulated owl habitat would remain approximately the same or decrease very slightly over the five decades modelled, and remain at the lower end of the estimated NRV. The predicted trends for flammulated owl habitat in the Divide, Elkhorns, and Upper Blackfoot GAs appear to be the same for all alternatives, including the no-action alternative.

The modelling process is complicated and involves a large number of assumptions (refer to appendix B), which make some outputs difficult to specifically interpret. Although ponderosa pine is predicted to increase and large/very large trees are predicted to increase or remain near current abundance under all alternatives, flammulated owl habitat is predicted to remain stable or decrease slightly in three GAs. The reason for this modelled outcome is not clear, but may be due to the structural components of that habitat as modelled. Tree density is predicted to decrease slightly in the warm dry potential vegetation group (refer to appendix B and the terrestrial vegetation section). Some of that decrease in density could occur in the ponderosa pine type in those GAs, bringing it below the range identified in the scientific literature and incorporated into the model as used by flammulated owls. The species-specific plan component for flammulated owls (BB-WL-DC-02, DI-WL-DC-02, EH-WL-DC-03, UB-WL-DC-02) could help offset the predicted habitat trend by guiding managers to promote development of the specific mix of habitat components required by flammulated owls.

Cumulative effects

Cumulative effects for flammulated owls would be the same as those addressed for other wildlife species in the terrestrial wildlife diversity section. Please refer to that section.

Conclusions

The HLC NF appears to have enough habitat currently to maintain persistence of the species in the plan area, based on the density and home range size reported for this species in the literature. The draft plan includes components designed to maintain or increase the presence and distribution of habitat components (stands of large, old ponderosa pine trees and large snags) used by flammulated owls.

Because of its location crossing the edge of the known distribution of this species, the HLC NF makes a key contribution to flammulated owl habitat by potentially preventing or reducing range contraction of the species. All alternatives would contribute to maintaining flammulated owls in the plan area. By including desired conditions for the habitat components and ecological conditions required by flammulated owls, and by including species-specific desired conditions for flammulated owls, the action alternatives) would likely provide greater assurance of flammulated owls persisting in the plan area over the long term than would be provided under the no-action alternative. Alternative E may provide slightly more flammulated owl habitat in one GA (the Big Belts) than provided by other alternatives. However, given the relatively minimal differences among alternatives in terms of the trend and amount of predicted habitat, it seems likely that flammulated owl habitat may be affected at the forestwide and GA scales more by natural processes (fire and insects) than by management actions.

Lewis’s woodpecker, affected environment

Status and distribution

Lewis's woodpeckers have been detected in recent years only in the Big Belts GA and on private land adjacent to the Elkhorns and Divide GAs. A few historic records exist from the Divide, Little Belts, Castles, and Highwoods GAs. The plan area occurs at the eastern edge of the mapped distribution of Lewis’s woodpecker (MNHP-MTFWP) with the Snowies GAs at the northeastern edge of the known range of the species in Montana. Concern over declines in mature to old ponderosa pine forest as well as large, old riparian cottonwood, combined with the impact of long-term fire exclusion on availability of large, soft snags has led to some concern about the long-term persistence of this species in Montana.

Habitat use

Detailed information about Lewis's woodpecker habitat use can be found in the Assessment (U.S. Department of Agriculture, Forest Service, Northern Region, 2015). Briefly, Lewis's woodpeckers are not good excavators and rely on other woodpeckers to create cavities they use for nesting or using snags in advanced stages of decay (Abele, Saab, & Garton, 2004). They glean insects from shrubs or on the ground, therefore requiring open-canopy forest that allows for development of an understory that will maintain certain insect populations (Abele et al., 2004). Lewis's woodpeckers also use stands of large, old cottonwood in riparian areas (Abele et al., 2004; MNHP-MTFWP). Distribution of this species is strongly associated with fire-maintained old-growth ponderosa pine, and they appear to favor areas that have experienced fire in the past 2-20 years (Abele et al., 2004; MNHP-MTFWP; Saab & Dudley, 1998). Their requirement for stands of large, old, fire-maintained open ponderosa pine stands overlaps with requirements for flammulated owls.

Habitat for Lewis's woodpecker on the HLC NF has been estimated using modelling techniques similar to those used for flammulated owl. The SIMPPLLE model (see appendix B, and the project file for detailed information about habitat models and techniques) estimated slightly over 21,000 acres of Lewis's woodpecker habitat forestwide. The majority of modelled habitat is in the Divide, Little Belts, and Upper Blackfoot GAs, with over 5,000 acres estimated in each. The model estimated slightly more than 1,000 acres each in the Big Belts, Castles, and Elkhorns GAs, less than 400 acres in the Snowies, and fewer than 100 acres each in the Crazies, Highwoods, and Rocky Mountain Range GAs. All GAs appear to be at the lower end or below the estimated NRV. The forestwide NRV is estimated between 377,000 acres and 624,000 acres. Note that the model may not estimate the cottonwood component of habitat very accurately, because this tends to be limited along lower elevation riparian areas.

Key drivers and stressors

Although habitat appears to be well-distributed and relatively abundant in Region One, ponderosa pine forests have decreased in abundance and distribution, and their structure has changed over the last century. Changes in Lewis's woodpecker habitat are due to factors affected by FS management, as well as those not under FS management control.

The ponderosa pine cover type is less prevalent on the HLC NFs than the dry Douglas-fir/mixed mesic conifer and lodgepole pine cover types, and is probably less abundant than it was historically (U.S. Department of Agriculture, Forest Service, Northern Region, 2015). In their work on flammulated owls, which also rely on stands of large old ponderosa pine, Nelson et al. noted that logging and wildfire exclusion, both of which can be affected by FS management, have resulted in a loss of ponderosa pine forest habitat. Fire exclusion allows growth of young Douglas-firs and may reduce the amount of open or shrub-dominated understory used by Lewis's woodpeckers for foraging. A lack of low-intensity disturbance may have caused a decrease in the larger size classes of trees in some cover (U.S. Department of Agriculture, Forest Service, Northern Region, 2015) in the plan area. With respect to the prevalence of large-diameter, open-understory ponderosa pine, Samson (Samson, 2006) stated that "[t]imber management is an insignificant influence on the landscape in comparison to suppression of fire".

Ponderosa pine has been impacted by recent heavy insect infestation on the HNF. While insect infestations may be influenced indirectly by factors related to forest management, they are a stressor that is not under FS management control. Similarly, human settlement and development on non-NFS lands may reduce both mature ponderosa pine habitat and large old cottonwood stands through direct removal of habitat.

Stands of large old cottonwood are less prevalent on NFS lands, occurring in lower elevation riparian areas. These areas tend not to be included in vegetation management activities, although in some localized areas individual cottonwoods may be removed as hazard trees where they occur in close proximity to campsites or recreation residences. Prevalence of cottonwood stands may be most influenced by drought and changes in hydrology, particularly off NFS lands where stream flows may be regulated by dams and irrigation practices.

Lewis's woodpecker, environmental consequences

Effects common to all alternatives

The terrestrial vegetation and terrestrial wildlife diversity sections summarize the ecological conditions required by Lewis's woodpeckers (i.e. the coarse filter analysis of the species' needs). Ponderosa pine would increase over the course of five decades under all alternatives, as would cottonwood. The large tree size class as well as concentrations of large trees would also likely increase over that timeframe under all alternatives. Very large tree abundance would likely remain static. The increase in large ponderosa pine and in cottonwood would provide additional or improved habitat for Lewis's woodpeckers.

The SIMPPLLE model estimates that at a forestwide scale, Lewis's woodpecker habitat would increase over the five decades modelled, with no differences among alternatives. The total forestwide acreage of habitat would move into the lower end of the estimated NRV during the fourth decade modelled. Predicted habitat in most GAs appears to increase to within the lower end of the estimated NRV as well (see below).

Effects of alternative A, no action

The effects of alternative A on the ecological conditions that support Lewis's woodpeckers are discussed in the terrestrial vegetation section regarding ponderosa pine, hardwoods, and large and very large trees, and are summarized from there into the terrestrial wildlife diversity section, in the sections on dry conifer, hardwood, and riparian habitats, and late successional forests.

The existing forest plans do not include desired conditions or other plan components specific to ponderosa pine forests, large and very large trees, or management of Lewis's woodpecker habitat. Without specific desired conditions for this forest type and tree size there is no guidance for management of habitat conditions required by this species. Existing plan standards for retaining snags, particularly large snags, would provide some habitat for Lewis's woodpeckers where large and very large snags occur in ponderosa pine or cottonwood habitats. The SIMPPLLE model (see terrestrial vegetation section) estimates that the aspen/hardwood cover type, which includes cottonwood, would increase slightly over the next 50 years. The section also cautions, however, that the presence of cottonwood is not well-represented by plot data or modeling.

As discussed above under 'effects of all alternatives', modelled estimates of Lewis's woodpecker habitat at a forestwide scale show some increase under this alternative. Results by GA are discussed in the next section, for ease of comparison.

Effects of the action alternatives

All action alternatives include a number of plan components that set desired conditions for vegetation management that would maintain or improve potential Lewis's woodpecker habitat Table 83, or the ecological conditions (coarse filter) required to support Lewis's woodpeckers. Descriptions in Table 83 paraphrase the actual components, to briefly illustrate the manner by which they may influence habitat. Please refer to the draft plan for the actual text of plan components.

Table 83. Draft plan components that would contribute to providing habitat for Lewis's woodpeckers

Plan Component	Area where plan component applies	Brief description of plan component
FW-VEGF-DC-01	Forestwide	Distribution of cover types, based on NRV includes increasing ponderosa pine and maintaining or increasing non-forested inclusions. See HLC NF Draft Plan for details by broad PVT, and see individual GAs.

Plan Component	Area where plan component applies	Brief description of plan component
FW-VEGF-DC-02	Forestwide	Distribution of tree species presence, based on NRV: includes increasing ponderosa pine. See HLC NF Draft Plan for details by broad PVT, and see individual GAs.
FW-VEGF-DC-03	Forestwide	Distribution of size classes, based on NRV: includes increasing abundance and distribution of large and very large size classes. See HLC NF Draft Plan for details by broad PVT, and see individual GAs.
FW-VEGF-DC-04	Forestwide	Distribution of density classes, based on NRV: includes increasing low/medium density class and decreasing high density class. See HLC NF Draft Plan for details by broad PVT, and see individual GAs.
FW-VEGF-DC-09	Forestwide	Desired conditions of snags by size class, to maintain or increase large and very large snags in Warm Dry type; see HLC NF Draft Plan.
FW-VEGF-STD-01	Forestwide	Vegetation management projects shall retain a minimum amount of large and very large trees based on DC. See HLC NF Draft Plan.
FW-VEGF-GDL-02	Forestwide	Vegetation management projects should retain a minimum amount of snags, specified by size and R1 Broad PVT. See HLC NF Draft Plan.
FW-FIRE-DC-01	Forestwide	Wildfire is allowed, as nearly as possible, to function in its natural ecological role.
BB-VEGF-DC-01; CA-VEGF-DC-01; CR-VEGF-DC-01; DI-VEGF-DC-02; EH-VEGF-DC-02; HI-VEGF-DC-02; LB-VEGF-DC-01; RM-VEGF-DC-02; SN-VEGF-DC-02; UB-VEGF-DC-02	All GAs, specific, quantified DCs identified for each GA	Distribution of tree species presence, based on NRV: includes increasing ponderosa pine (maintain or increase in Snowies GA; also recognize that on Rocky Mountain Range GA there is little or none).
BB-WL-DC-02; DI-WL-DC-02; EH-WL-DC-03; UB-WL-DC-02	Big Belts, Divide, Elkhorns, Upper Blackfoot	Desired large, open, ponderosa pine and Douglas fir trees and snags within mosaic of other vegetation to provide nesting habitat for flammulated owls.

There are no species-specific plan components for Lewis's woodpecker. The plan components specific to flammulated owls (BB-WL-DC-02, DI-WL-DC-02, EH-WL-DC-03, UB-WL-DC-02) would help to ensure habitat is managed in some areas for Lewis’s woodpeckers, because the “landscape level-needs of the flammulated owl would probably accommodate any habitat-area needs of Lewis’s woodpeckers” (Casey, 2000; MNHP-MTFWP). Site-specific habitat components, including interspersed shrubby understory, would be addressed appropriately at the project planning level.

The combined effects of the desired conditions for increasing abundance of large, old ponderosa pine and cottonwood stands, along with plan components that would guide managers to allow fire to play its natural role to the extent possible in some areas, and the site-specific plan components for flammulated owl, would ensure that lands managed by the HLC NF would contribute to persistence of Lewis's woodpeckers in the plan area over the long term.

Although Lewis’s woodpeckers have been documented in recent years only in the Big Belts GA and on private land immediately adjacent to the Elkhorns and Divide GAs, the distribution of this species as mapped by the Montana Natural Heritage Program (MNHP-MTFWP) includes the entire HLC NF, with the possible exception of the Snowies GA. Estimates of Lewis’s woodpecker habitat under all alternatives by GA were made using the SIMPPLLE model. Habitat would increase to above the estimated NRV in the Castles, Crazies, and Divide GAs, although note that the estimated NRV range in these GAs is relatively narrow. Habitat would increase to within the estimated NRV in the other GAs. The rate of increase is predicted to vary by GA, with the most rapid increase predicted in the Castles, Crazies, and Divide GAs and slower rates of increase predicted in the remaining GAs. Model results are the same across all alternatives, with possibly a slightly higher acreage of habitat predicted under alternative E in the Big Belts GA.

Cumulative Effects

Cumulative effects for the Lewis’s woodpecker would be the same as those addressed for other wildlife species in the terrestrial wildlife diversity section. Please refer to that section.

Conclusions

The draft plan includes components designed to maintain or increase the presence and distribution of habitat components (stands of large, old ponderosa pine trees and large snags) used by Lewis’s woodpeckers. Because of its location along the eastern/northeastern edge of the known distribution of this species, the HLC NF makes a key contribution to Lewis’s woodpecker habitat by potentially preventing or reducing range contraction of the species. All alternatives would likely contribute to maintaining Lewis’s woodpeckers in the plan area. By including desired conditions for the habitat components and ecological conditions required by Lewis’s woodpeckers, and by including species-specific desired conditions for Lewis’s woodpeckers, the action alternatives (alternatives B, C, D and E) would likely provide greater assurance of Lewis’s woodpeckers persisting in the plan area over the long term than would be provided under the no-action alternative (alternative A). Given the apparent lack of measurable differences among alternatives in terms of the trend and amount of predicted habitat, it seems likely that Lewis’s woodpecker habitat may be affected at the forestwide and GA scales more by natural processes (fire and insects) than by management actions.

3.16 Elk

3.16.1 Introduction

This section addresses the status of elk in the planning area and the ability of the Draft Plan to provide habitat for elk on NFS lands. The 2012 Planning Rule (U.S. Department of Agriculture, Forest Service, 2012) requires that NFs maintain or work toward restoring the ecological integrity of the plan area. Doing so includes maintaining the diversity of plant and animal communities within the plan area. For most wildlife species, a “coarse filter” approach of maintaining key vegetation communities and characteristics also provides for habitat required to maintain a species or animal community. This is the case with elk, which are a habitat generalist. Viability of elk and the persistence of elk populations in Montana and in the plan area are not of concern in Montana or on the HLC NF (U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013). Information regarding the coarse filter ecological conditions in the plan area that would continue to support elk populations is described in the terrestrial wildlife diversity section.

The planning rule also requires that NFs provide for ecosystem services and multiple uses, which include habitat for fish and wildlife communities, as well as opportunities for recreation and other uses. In addition to being an important component of native wildlife diversity, elk are socially and economically important in Montana and in the planning area for a variety of reasons. Elk and the management of elk populations and habitat generate a great deal of public interest, and management of elk and elk habitat has generated comparable attention from land and wildlife managers. The MTDFWP manages elk populations, largely through establishing hunting seasons and limits. The FS manages some of the habitat used by elk. Forest management activities therefore have the potential to influence elk numbers or distribution, or elk hunting and viewing opportunities.

The planning rule acknowledges that some species, generally those considered ‘at-risk’ species, may require additional, species-specific plan components to ensure that the ecological conditions that provide for their persistence in the plan area are maintained or restored. Elk are not an at-risk species, but there is a great deal of public and agency interest in the distribution of elk and their availability on NFS lands, especially related to hunting opportunities. Public and agency concern has focused for many years on elk vulnerability to hunting, and more recently on elk use of adjoining private lands. Therefore we will briefly discuss these management issues and evaluate the effects of the draft plan and alternatives on elk distribution and availability for recreation opportunities, including hunting. For detailed information regarding elk status and management issues on HLC NF lands, refer to the Elk Background Report in the project file.

3.16.2 Regulatory framework

Please refer also to the introductory regulatory framework section of this chapter (3.3).

The Helena NF Plan (USDA 1986) provides standards that set the framework for current management of elk. Forest-wide standards providing direction for elk management are identified on pages II/17 – II/21 of the Plan. The Lewis and Clark NF Plan (USDA 1986) provides standards that set the framework for current management of elk. Forest-wide standards are identified on pages 2-30 to 2-31.

3.16.3 Assumptions

The primary assumption underlying the analysis in this section is based on the 2012 Planning rule and the directives for implementing the rule: that plan components developed for ecosystem integrity and ecosystem diversity will provide for ecological conditions necessary to maintain the persistence or contribute to the recovery of native species within the plan area (FHS 1909.12, 23.13). Therefore we assume that effects to vegetation systems and characteristics as described in the terrestrial vegetation section provide the basis for understanding most of the potential effects to wildlife species, including elk, associated with those systems. We also assume that the coarse filter approach as described in the Introduction above will retain representative habitats and seral stages important to elk habitat.

The analyses discussed in this section rely on an analytical model (SIMPPLLE), which is described in the terrestrial vegetation section and in appendix B. The SIMPPLLE model uses “numerous assumptions to simplify ecosystem processes as well as treatment implementation” (terrestrial vegetation section, Assumptions section). We have also relied on a set of parameters established by the FS and MTDFWP to estimate existing elk habitat (U.S. Department of Agriculture, Forest Service, 2013a).

In this analysis, we assume that elk habitat is best modeled using what scientific literature and field examination identify as “typical” habitat for elk. Although our habitat models are simplifications of complex biological systems and therefore cannot be perfectly predictive, we expect that use of these general models will be applicable across all geographic areas and that they will be useful in determining elk/habitat interactions ascribed to the draft plan. Refer to appendix B for a full description of the model and processes used to estimate and predict elk habitat for this analysis.

We assume that there is at least some relationship between management of elk habitat, elk population trend and distribution, and elk hunting opportunity as follows:

- Hunter days provide a proxy or index for hunting opportunity;
- Hunter-days given on statewide scale are reasonable proxy for what happens on the HLC NF; and
- Elk numbers by hunting district reflect habitat conditions on NF lands, even though elk spend only part of time there.

Last, we assume that the discussion and analyses related to the Helena NF plan address the Elkhorn portion of the Beaverhead-Deerlodge NF that are included in this revision effort. Habitat data for those herd units that occur on the B-D portion of the Elkhorns are included.

3.16.4 Best available scientific information used

A thorough review of the scientific information was completed, and the BASI was used to inform the planning process and develop plan components. Key information on the population, life history, status, and management issues of elk on and adjacent to the HLC NF was obtained from sources listed in the references section of this document, and in the Elk Background Report in the project file. Published, peer-reviewed articles and data in which reliable statistical or other scientific methods were used, where those were available. For best relevance, studies conducted in north-central or north-western Montana, western North America, or other areas with habitat conditions similar to those in the plan area where used, where those were available. When not available, articles that considered conditions and/or issues similar to those in the plan area were used. The planning rule acknowledges that the best available scientific information may include expert opinions, inventories, or observation data prepared and managed by the FS or other agencies, universities, reputable scientific organizations, and data from public and governmental participation. Those sources of information were relied upon when published, peer-reviewed information was not available or when needed to provide additional information specific to the plan area. Where needed in the assessment and in this section, specific discussion may be included regarding contradictory science, why some information is used to the exclusion of others, and regarding areas for which scientific information is lacking.

The information in this analysis relies heavily on information in the Assessment of the Helena and Lewis and Clark National Forests (U.S. Department of Agriculture, Forest Service, Northern Region, 2015) and in the Elk Background Report (project file).

3.16.5 Elk, affected environment

Indicators and scale of analysis

The issue being considered in this section is the extent to which the draft plan provides habitat on NFS lands to support elk for hunting, wildlife viewing, and for their contributions to ecological diversity and to animal communities per the 2012 Planning Rule (U.S. Department of Agriculture, Forest Service, 2012). This issue also serves as a proxy for assessing the availability of habitat for some other big game species with broadly similar requirements, such as white-tailed deer and mule deer.

The most direct measure of the effectiveness of elk habitat on NFS lands would be an evaluation of trends in elk numbers on NFS lands relative to specific measures of the quality and availability of seasonal habitats there. However, these data do not exist at a scale where those comparisons can be made, nor across the planning area as a whole. Information on elk numbers and population trend are available at statewide and hunting district scales; data from hunting districts that overlap with the HLC NF can be used as an indicator of the current general health of the elk population and availability of elk. Hunter-days by hunting district for those districts that include NFS lands can be used as an indicator of the opportunity to hunt elk. Neither population trend nor hunter-days can be predicted for the alternatives, however, because both depend on complex interactions among habitat, climate and weather, hunting, predation, elk behavior, human behavior, management of adjacent lands, and other factors. This section will therefore provide information regarding elk numbers and trend and hunter-days as an indication of the current status of the elk population and current availability of elk for hunting, but cannot estimate either of those for comparison among alternatives.

Elk security generally includes consideration of the amount or density of open roads. The pattern and density of open roads is determined by travel management plans. This would not be changed by the draft forest plan. Hiding cover and winter cover, however, are components of habitat security that may be affected by components of the draft plan, and could vary by alternative. These measures are discussed in this section as an indicator of habitat components that may contribute to the distribution and availability of elk on lands managed by the HLC NF. Other habitat characteristics, such as forage quality and availability, as well as management of adjoining lands and other factors also play key roles in influencing elk distribution and population trend. A more complete discussion of factors influencing elk population trend and distribution on NFS lands can be found in the Elk Background Report in the project file.

Elk population size and trend

Elk population numbers are dynamic, but throughout Montana elk have generally increased in numbers and spatial extent since the early to mid-1900s (Montana Fish and Wildlife and Parks, 2004), and have continued to do so since the current forest plans were written. Statewide, elk numbers have increased from 8,000 in 1922 to 55,000 in 1978 to about 160,000 in 2004 (Montana Fish, 2005) , to over 170,000 estimated in 2017 (http://fwp.mt.gov/fishAndWildlife/management/elk/).

Elk are counted by elk hunting districts or by elk management units, for which population and habitat objectives have been set (Montana Fish and Wildlife and Parks, 2004). The Helena NF is within 17 elk/deer hunting districts, and the Lewis and Clark NF is within 22 elk/deer hunting districts, all of which extend to varying degrees beyond the NF boundaries. Although elk counts include non-NFS lands, they represent the best available estimates of elk numbers and, cumulatively over time, of the trend in numbers of elk using NFS lands. Aerial surveys are not intended to be complete counts, but are designed to provide relative between-year comparison of total elk seen as well as of specific demographic segments.

Table 84 displays the estimated elk population and trend for 2017, by GA. The table also includes numbers by hunting district and elk management units, which are delineated in the Montana Statewide Elk Management Plan (MTFWP, 2004) and are the basis for population management and analysis used by MTDFWP.

Table 84. 2017 Estimated elk population and trend by (MTDFWP 2017b)

GAs included	Elk management unit	Hunting district(s)	Elk plan objective (observed elk)	2017 or most recent number elk observed	Status: over, at or below objective	Estimated elk numbers assuming 80% of elk are observed[1]
Rocky Mountain Range	Bob Marshall	415	200	266	Over	333
		422[2]	500	1,508	Over	1,885
		424, 425, 442	2,500	2,288	At	2,860
		441	500	580	At	725
Elkhorns	Elkhorn	380	2,000	2,100	At	2,625
Big Belts	West Big Belt	392	400	198	Below	248
	Bridger	390	900	2,252	Over	2,815
		391	975	1,844	Over	2,305
	East Big Belt	446	950	1,893	Over	2,366
	Devils Kitchen	445, 455	2,500	4,363	Over	5,454
Crazies	Crazy Mountains	315	1,000	1,186	At	1,483
		580	975	4,846	Over	6,058
Castles	Castle Mountains	449, 452	600	1,073	Over	1,341

GAs included	Elk management unit	Hunting district(s)	Elk plan objective (observed elk)	2017 or most recent number elk observed	Status: over, at or below objective	Estimated elk numbers assuming 80% of elk are observed[1]
Little Belts	Little Belt	413	500	610	Over	763
		416	475	913	Over	1,141
		418	150	241	Over	301
		420, 448	1,200	1,113	At	1,391
		432	325	443	Over	554
		454	250	364	Over	455
		540	600	2,046	Over	2,558
Highwoods	Highwood	447	700	1,828	Over	2,285
Snowies	Snowy	411 (north)	400	2,140	Over	2,675
		511 (411 west)	400	549	Over	686
		530	See 411 (north)	3,273	Over	4,091
Upper Blackfoot	Bob Marshall	281	500-700	872	Over	1,090
	Granite Butte	293[3]	750	587	Below	734
		339, 343	1,400	1,617	At	2,021
	Garnet	298	600	845	Over	1,056
	Birdtail Hills	421, 423	500	783	Over	979
Divide	Deer Lodge	215	1400	2,850	Over	3,563
		318	500	381	Below	475
		335	600	695	At	869
	Granite Butte	343[4]	1,400	1,617	At	2,021

1. Visibility of elk during surveys can be affected by weather conditions, snow cover, canopy cover, animal activity, and survey vehicle (helicopter or fixed-wing). The 80% visibility index provided in this table is for illustrative purposes only and is not a true population estimate.
2. HD 422 includes part of Upper Blackfoot GA but is listed only once, under the Rocky Mountain Range GA, which includes the majority of HD 422.
3. HD 293 includes part of the Divide GA but is listed only once, under the Upper Blackfoot GA, which includes the majority of HD 293. Also, data for HD 293 include HD 284.
4. Data for HD 343 and 339 are combined in the Statewide Elk Trend Estimates data.

The information in Table 84 also includes whether elk numbers are over, at, or below the population objectives established by MTDFWP. Population objectives are established by considering the history of long-term trend counts in an area, input from the public, land managers, and community working groups, landowner tolerance, desired type of harvest, accessibility of elk to harvest, and other factors. Of 34 units that overlap HLC NFS lands and in which elk are counted and numeric objectives have been established, 22 (67%) are above objective, 8 (24%) are at objective, and 3 (6%) are below objective. Figure 14 shows the status of elk populations relative to established objectives for the entire state of Montana, by hunting district, for 2017.

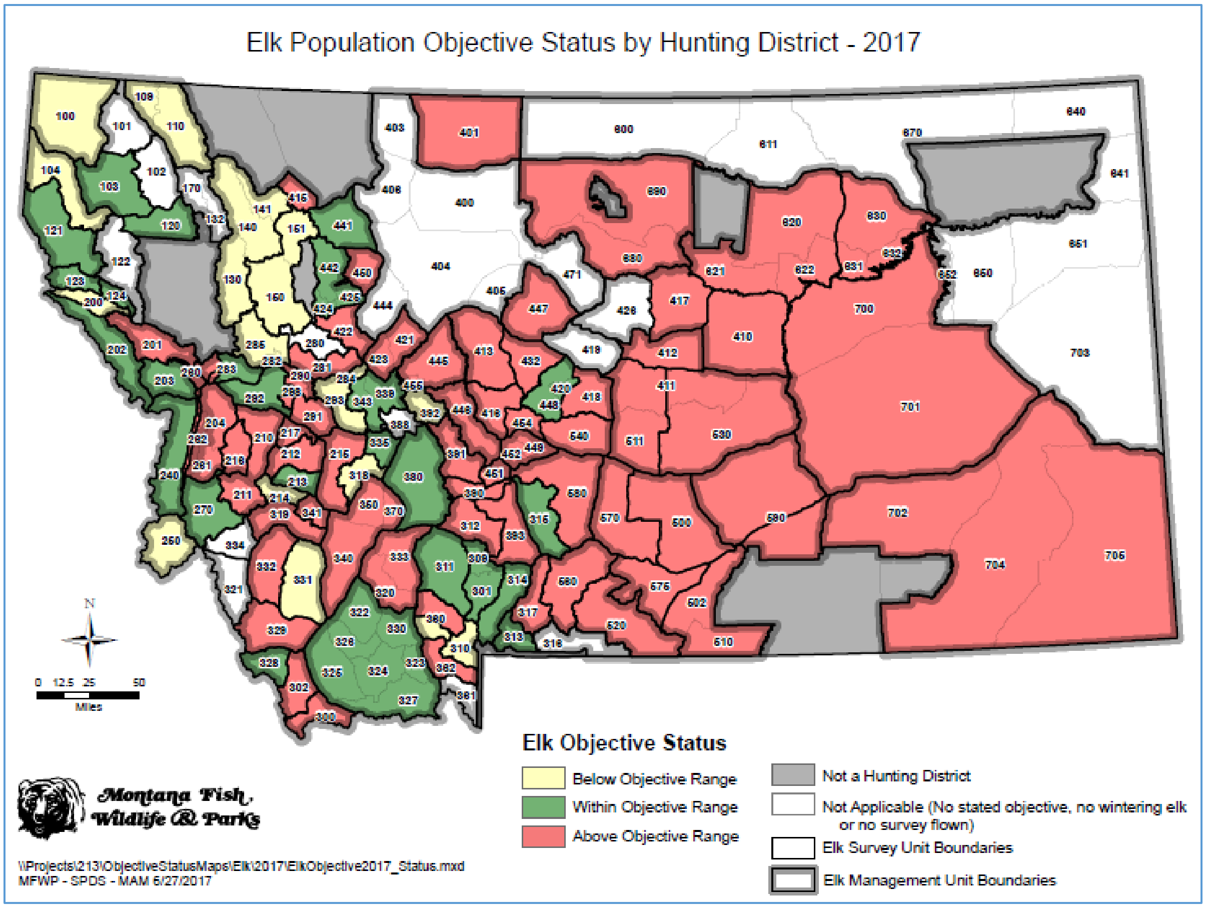


Figure 14. Elk population objective status by hunting district in 2017 (MTDFWP 2017a)

Elk populations in most of Montana, are at or over objectives, with a few areas primarily in western and northwestern Montana below objective. It should be noted that elk populations that are significantly above established objectives pose management issues that are different but no less important than populations that are below (MTFWP, 2004). Consequently, shoulder seasons (a firearms hunting season that occurs outside the 5-week general firearms and archery hunting seasons) are planned for 43 hunting districts in Montana in order to reduce elk populations in areas that are over objective (MFWP 2017a).

Relationship to existing forest plans

The existing (1986) Helena NF and Lewis and Clark NF plans identified elk population potential as a major issue during plan development, and discussed elk populations relative to hunting opportunity. The elk population potential identified for both plans was based on population goals identified in the Northern Regional Plan (U.S. Department of Agriculture, Forest Service, 1981), which were in turn based on the 1978 Montana Statewide Comprehensive Outdoor Recreation Plan (Montana Fish, 1978). The latter included goals of protecting and perpetuating “elk and their habitat and to increase the supply of available, harvestable elk to meet demands for hunting and non-hunting recreation” (Montana Fish, 1978). All of these plans were developed at a time when elk numbers were markedly lower than they are currently (less than one third of current numbers statewide), logging was increasing on NFS lands particularly in western Montana, and concerns were being raised by the public and biologists about the potential impacts to elk of logging and of roads created for logging and used by hunters.

The elk population capacity of lands under management of the Helena NF at the time the existing plan was written was estimated at 6,300 elk in summer and 3,300 in winter, with a maximum capacity estimated at 8,500 for both seasons (USDA 1986). The elk population capacity of lands under management of the Lewis and Clark NF at the time the existing plan was written was estimated at 8,800 elk, with a maximum capacity estimated at 12,500. Analysis for both plans predicted the same (Lewis and Clark NF) or slightly fewer (Helena NF) elk would use NFS lands in summer by the end of five decades after implementation. The Helena NF plan predicted that the number of elk wintering on NFS lands would increase over time.

Summarizing from Table 84 above, MTDFWP counts show over 26,000 elk within the hunting districts that largely overlap the Helena NF, and over 31,000 elk within the hunting districts that overlap the Lewis and Clark NF. Not all of those elk use NFS lands, but those estimates indicate that elk numbers have far exceeded the targets and maximum capacities identified in the analyses for the existing forest plans.

Hunter days have been used as an indicator of hunting opportunity associated with elk and other big game presence on public lands. When opportunity to encounter or harvest an animal is or is perceived to be low, hunter-days are expected to be lower than when those opportunities are greater or perceived to be greater. It is important to note, however, that hunter effort is also influenced by weather, access both on and off NFS lands, economic trends, social factors, and other things that may vary greatly among years. Table 85 shows the estimated number of hunter days by GA since 2004; hunter days shown in the table are calculated by hunting districts, which usually include non-NFS lands.

Table 85. Estimated elk hunter days by GA 2004-2016 (MTDFWP 2017b)

GA (hunting districts included)	Average hunter days 2004-2016	Range of hunter days 2004-2016	Trend
Big Belts (390, 391, 392, 445, 446)	36,415	27,909 – 56,300	Stable to increasing
Divide (215, 318, 335, 343)	41,848	33,023 – 59,568	Stable to increasing
Elkhorns (380)	22,558	17,384 – 31,786	Increasing
Upper Blackfoot (281, 284, 293, 298, 339, 343, 421, 423)	43,022	36,275 – 54,643	Stable
Former HNF portion Subtotal	*143,843*	*na*	*na*
Castles (449,452)	6,248	4,341 – 11,237	Increasing
Crazies (315, 580)	13,177	10,203 – 18,640	Increasing
Highwoods (447)	4,214	3,023 – 7,441	Stable to Increasing
Little Belts (413, 416, 418, 420, 432, 448, 454, 540)	38,732	30,092 – 52,042	Stable to Increasing
Rocky Mountain Range (424, 425, 441, 442)	11,765	8,755 – 15,893	Stable to Increasing
Snowies (411, 511, 530)	10,447	6,092 – 16,559	Increasing
Former LCNF portion Subtotal	*84,613*	*na*	*na*

The 1986 Helena NF plan projected 43,100 hunter-days per year by the fifth decade (beginning in 2026) of implementation (FEIS, II/46). Elk hunter-days on hunting districts that include the Helena NF have increased to approximately 177,531 days as of 2016 (see project record and http://fwp.mt.gov/hunting/planahunt/harvestReports.html), and have averaged over 143,000 hunter days annually between 2004 and 2016. The 1986 Lewis and Clark NF plan projected 63,700 hunter-days per year by the fifth decade (beginning in 2026) of implementation. Elk hunter-days on hunting districts that include the Lewis and Clark NF have increased to approximately 117,480 days as of 2016 (ibid), and have averaged over 84,000 hunter days annually between 2004 and 2016. Not all of these hunter-days are associated with elk, and not all occur on HLC NF lands, but as an indicator of the recreational opportunity associated with elk hunting they show that this opportunity has increased beyond what was anticipated in the analyses for the existing plans.

Elk habitat status

Discussion of the potential impacts to elk from land management practices, hunting, wildlife viewing, and the presence of people in elk habitat have generally focused on seasonal habitat needs.

Elk summer habitat

Elk summer habitat includes a mix of cover and foraging areas, often including riparian areas (Ward Thomas, Black, Scherzinger, & Pedersen, 1979). Elk may use a variety of vegetation types, including conifer and hardwood forests, grasslands, alpine zones, and stream and valley bottoms. Some research suggests that the quality of summer forage may be the most important variable in determining annual variation in herd growth (J. G. Cook, 2002; J. G. Cook et al., 1996; K. M. Proffitt, Hebblewhite, Peters, Hupp, & Shamhart, 2016; Ranglack et al., 2014; Stewart, Bowyer, Dick, Johnson, & Kie, 2005).

Generally, the resources that elk need to thrive on summer range are well distributed across mid to high elevation habitats on NF lands across western and central Montana. Elk summer habitat on the HLC NF has not been specifically mapped or quantified because of the generalist nature of elk summer habitat use. Elk, as most wildlife species, may not find all habitat and resources equally available due to a variety of factors, including the distribution of open roads and trails that may contribute to disturbance or displacement from nearby habitats, competition from domestic livestock, and vegetation patterns created by disturbances such as timber harvest and fire. Hiding cover, defined as “vegetation capable of hiding 90 percent of a standing adult elk from the view of a human at a distance equal to or less than 200 feet” (J. L. Lyon & Christensen, 1992) has been used as a measure of summer habitat quality (Thomas, 1979), assuming that adequate hiding cover may increase the ability of elk to use summer habitat by providing areas where they can rest, forage, and regulate body temperature without disturbance or displacement caused by humans or predators. Various sources have recommended managing for a variety of mixtures of hiding cover, thermal cover, and foraging areas, depending on characteristics of the area under consideration (Thomas, 1979). However, habitat relationships on summer range are far more complex than can be defined by cover/forage ratios (Leege, 1984), making management recommendations for specific cover/forage ratios difficult and of questionable value.

Elk fall habitat

Habitat used by elk in fall is variable and dependent on annual and seasonal changes in forage availability, weather and climate, hunting pressure, predation, and other factors. It is not useful to attempt mapping specific fall habitat for elk on the HLC NF. Instead, elk habitat management during the fall has generally attempted to achieve a balance between elk availability to hunters and the need to allow some elk to escape hunting-related mortality or displacement by providing for some level of security throughout NFS lands. Elk security has been defined as “the protection inherent in any situation that allows elk to remain in a defined area despite an increase in stress or disturbance associated with the hunting season or other human activities” (J. L. Lyon & Christensen, 1992). Security may be affected by vegetation, topography, road density, distance from roads, size of vegetation blocks, hunter density, season timing, and land ownership (ibid), as well as road use type and levels, weather, and other factors.

Management concerns in the past have been focused on elk vulnerability to hunting as a result of logging activity and human access created by logging roads on NFS lands. Concerns about those impacts emerged largely from western Montana and some other western states in which elk populations were lower than desired or were perceived to be declining (L. J. Lyon et al., 1985). During that same period, the pace and scale of logging activity had increased on NFS lands, and there was concern that logging and the access created by roads associated with logging were increasing elk vulnerability to harvest to potentially unacceptable levels. Concerns focused on elk distribution and movements on a drainage or watershed scale.

Research from several areas in Montana regarding the potential for logging roads and activity on them to disturb or displace elk and increase their vulnerability to harvest also provided recommendations for management of elk habitat on NFS lands where logging was occurring (L. J. Lyon et al., 1985). Several studies since then have documented the effect of roads on elk security, population structure, and hunter success (Edge & Marcum, 1991; Gratson & Whitman, 2000; Gucinski, Furniss, Ziemer, & Brookes, 2001; Leptich & Zager, 1991; Unsworth & Kuck, 1991). Those found that open roads can influence elk distribution during the hunting season, and that targeted road closures can lower the elk harvest rate in a given area. Other research (Preisler, Ager, & Wisdom, 2006; Kelly M. Proffitt, Gude, Hamlin, & Messer, 2013; M. J. Wisdom et al., 2005) has indicated that factors such as topography, cover, forage quality and quantity, and hunting pressure on adjoining lands, may affect the degree to which roads influence elk movements.

The role of hiding cover, which is a component of elk security, appears to vary. Some studies have emphasized cover as a key habitat component for elk in the fall and have attempted to quantify its contribution to security as a counterweight to open road density (L. J. Lyon, 1979); Perry and Overly 1976). A majority of management approaches, however, have concluded that the influence of cover can be outweighed by hunting pressure resulting from open roads or by the availability of un-hunted or very lightly hunted areas nearby (Christensen, Lyon, & Unsworth, 1993; Henderson, Sterling, & Lemke, 1993; J. L. Lyon & Canfield, 1991; J. L. Lyon & Christensen, 1992; Kelly M. Proffitt et al., 2013; Skovlin, Zager, & Johnson, 2002; Thomas, 1979) Montana Fish, Wildlife and Parks 2015.

The abundance, distribution, and importance of hiding cover is less well understood in the more open elk ranges across much of central and eastern Montana as compared to the dense forest environments of western Montana and northern Idaho (Hillis et al., 1991) where much of the research on elk security and hiding cover has taken place. Most research and recommendations regarding elk security, hiding cover, and managing elk vulnerability during the hunting season cautions against applying results and recommendations from one area too broadly, and most recommend a site or area specific analysis of the many factors influencing elk vulnerability in a given area (Hillis et al., 1991; L. J. Lyon et al., 1985; U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013).

Increasingly, movement of elk early in the fall from accessible NFS lands to remote areas or to adjoining private lands that receive little or no early hunting pressure has been a concern with respect to hunter success rate throughout the remainder of the season. Some studies in Montana have concluded that many elk move to private land that is lightly hunted or not hunted, rather than remain in security areas (defined as areas that hold elk during periods of stress (J. L. Lyon & Christensen, 1992)) or other areas on public land (Burcham, Edge, & Marcum, 1999; Kelly M. Proffitt et al., 2013) Ranglack et al. (2017) also found that elk may increase use of private land during the hunting season due to limited hunting pressure. Elk appear to be moving in increasing numbers to these private land refuges, and are doing so regardless of the level of security provided on NFS lands (Montana Fish, Wildlife and Parks 2015). Population increases and elk numbers over objective, as discussed earlier in this section, appear to be caused in part by the inability of elk harvest on public lands to reduce elk numbers sufficiently to reduce population growth (Kujala, Q., and Gude, J. MTDFWP, Pers. Comm. 2017).

Elk winter habitat (winter range)

Traditionally, the availability of suitable winter range has been seen as the key limiting factor for most elk populations (Polfus, 2011) (J. L. Lyon & Christensen, 2002). Winter ranges are usually smaller than summer ranges, supply less forage, provide less forest cover, often lie closer to sources of human disturbance, are often grazed by domestic livestock, and are occupied by elk when temperatures are low and snow may limit access to forage. Winter ranges have been identified and mapped by both the FS and by MTDFWP, but areas used by elk in winter vary over time and based on factors such as forage availability, snow depth and characteristics, disturbance by humans, and characteristics of adjacent private lands. Managing for wintering areas with minimal human activity and adequate forage can help reduce energy costs associated with over-winter survival (Skovlin et al., 2002). On the other hand, recent studies suggest that while natural mortality is generally higher on winter ranges, the probability of elk surviving a given winter is directly linked to the quality of nutrition on spring, summer, and fall habitat (J. G. Cook, 2002; Ranglack et al., 2014).

For several decades, thermal cover and forage have been the two habitat elements of greatest management concern on big game winter ranges. In winter, thermal cover stands curtail snow accumulation, block wind, and can moderate microsite temperature. However, although thermal cover was widely accepted as a key component of elk winter range in the 1970s and 1980s (Thomas, 1979) (Beall 1976) more recent research (J. G. Cook, Irwin, Bryant, Riggs, & Thomas, 2005; Skovlin et al., 2002) has concluded that thermal cover may not be a critical factor to elk on most winter ranges in Montana. Thompson and others (2005) indicate that forest cover on Montana elk winter ranges may be important to provide areas for reduced energy expenditure and access to forage during times when deep or crusted snow have made higher quality forage unavailable. Forest cover as described by Thompson and others (2005) is not specifically defined, but rather is described more generally as a cover/forage mosaic.

Relationship to existing forest plans and seasonal habitat status in the plan area

Elk summer habitat

The existing Helena NF and Lewis and Clark NF Plans both use hiding cover as the primary determinant of summer habitat capability. The existing Helena NF Plan includes a standard requiring that hiding cover is to be maintained at or above 35 percent (measured by ground surveys) or 50 percent (measured as 40 percent crown closure) of the elk summer range within each herd unit (USDA 1986) with a 40 acre minimum patch size. The existing Lewis and Clark Plan requires that effective hiding cover be maintained within a drainage or herd unit for projects involving significant vegetation removal (ibid).

Table 86 summarizes the status of hiding cover by GA, which reflects the scale at which the ability of the draft plan to provide hiding cover will be measured. Methods for calculating hiding cover are described in the project file. Two estimates of hiding cover are shown. The first is calculation using the same methods as for project-level analysis. The second is using the SIMPPLLE model, to allow comparisons with predictions made for hiding cover under the draft plan (see environmental consequences section). Although both estimates are based on methods outlined in the USFS and MTDFWP Collaborative Recommendations for Big Game Habitat Management on the Custer, Gallatin, Helena, and Lewis and Clark National Forests (U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013), the map calculation uses basic queries of vegetation data whereas the SIMPPLLE model estimates are based on a more complex interaction of parameters (see project file and terrestrial vegetation section for information about SIMPPLLE). Estimates of hiding cover differ based on the method of calculation, and are provided solely for the purpose of comparison rather than as established amounts of hiding cover, and should not be used for purposes other than the general comparisons made in this section.

Table 86. Elk hiding cover by geographic area

GA	Total acres - all ownerships	Total acres hiding cover - all ownerships (% of GA) map calculation	Total acres hiding cover - all ownerships (% of GA) SIMMPPLE model calculation
Big Belts	452,292	130,595 (29%)	49,790 (11%)
Castles	79,862	32,716 (41%)	18,670 (23%)
Crazies	70,036	17,658 (25%)	7,210 (10%)
Divide	232,890	76,015 (33%)	42,350 (18%)

GA	Total acres - all ownerships	Total acres hiding cover - all ownerships (% of GA) map calculation	Total acres hiding cover - all ownerships (% of GA) SIMMPPLE model calculation
Elkhorns	175,259	65,876 (38%)	21,510 (12%)
HIghwoods	44,495	3,251 (7%)	3,930 (8%)
Little Belts	900,961	554,599 (62%)	89,470 (10%)
Rocky Mountain Range	782,986	263,367 (34%)	59,680 (8%)
Snowies	121,897	68,862 (56%)	8,390 (7%)
Upper Blackfoot	348,185	127,697 (37%)	83,410 (24%)

Hiding cover is more appropriately estimated and evaluated on an elk herd or analysis unit scale (U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013) or by drainage. Hiding cover standards in both forest plans are also based on a herd unit or drainage scale.

The role of hiding cover within each GA as a determinant of retaining elk on public land is not clear and likely depends on local or site-specific conditions.

Elk fall range

Elk hiding cover is generally calculated for the spring/summer/fall period, although concerns regarding hiding cover are generally expressed in terms of elk vulnerability during the fall hunting season. Compliance with existing forest plan standards is one way to characterize the current status of this habitat component. Estimates of hiding cover made according to protocols identified in the existing Lewis & Clark plan indicates that 54 of 75 (72%) of 6th code hydrologic units and 109 of 144 (76%) of 7th code Hydrologic Units on the Lewis & Clark portion of the HLC NF meet existing summer/fall hiding cover numeric standards. Note that these calculations were made for the entire Lewis and Clark NF portion, although the hiding cover standard in the existing Lewis and Clark NF Plan states that it applies only to "projects involving significant vegetative removal". Nevertheless, these numbers provide an idea of the existing condition of hiding cover across the Lewis and Clark NF portion of the HLC NF.

The current Helena NF Plan includes a standard for measuring elk security/vulnerability during the hunting season [big game standard 4a (USDA 1986)] using an index that combines open road density and hiding cover. The Lewis and Clark Plan does not include a hiding cover/open road density requirement.

Table 87 summarizes the status of elk security by GA. Travel management is not included as part of the draft plan, the amount and configuration of open roads, and therefore of open road density, will not change except in alternatives B and D (refer to the environmental consequences section). Estimates of existing security are provided here as a means to describe this component of fall elk habitat on the HLC NF. As with hiding cover, the size and specific characteristics of areas that are effective in providing security for elk likely varies by elk herd unit; Hillis et al. emphasize that "strict adherence to the guidelines should be avoided" (Hillis et al., 1991). To provide a basic idea of the availability of security on the HLC NF, however, security as reported in Table 87 for all GAs is based on areas at least 250 acres in size and at least on half mile from roads open to the public between 9/1 and 12/1 (Hillis et al., 1991; U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013).

Table 87. Elk security by geographic areas

GA	Total acres (All ownerships)	Secure acres	Percent security
Big Belts	452,292	116,977	26%

GA	Total acres (All ownerships)	Secure acres	Percent security
Castles	79,862	15,796	20%
Crazies	70,036	26,240	37%
Divide[1]	232,890	69,224	30%
Elkhorns	175,259	73,629	42%
HIghwoods	44,495	25,713	58%
Little Belts	900,961	281,663	31%
Rocky Mountain Range	782,986	608,475	78%
Snowies	121,897	82,607	68%
Upper Blackfoot[1]	348,185	187,255	54%

1. Note that both the Divide and Upper Blackfoot GAs have updated security methodologies developed in conjunction with MFWP during the respective travel planning revision efforts. For the purposes of analysis, the basic Hillis methodology is used here.

Security percentages range from 20% in the Castles to 78% in the Rocky Mountain Range GA. The high percentage of security in the Rocky Mountain Range is to be expected given the preponderance of wilderness as well as the lack of roads within that GA.

The Helena NF standard for elk security is based on a ratio of hiding cover and road density calculated and applied at an elk herd unit scale. Of 40 elk herd units (37 on the Helena NF and 3 on the Beaverhead-Deerlodge portion of the Elkhorns GA that is included in the plan area), 15 (38%) currently meet the standard for elk security during the fall hunting season. As discussed above, the level of security on public lands is not a reliable indicator of overall elk availability or distribution on public lands during the hunting season where private land ‘refuges’ are available (Burcham et al., 1999; Kelly M. Proffitt et al., 2013; Ranglack et al., 2014), Ranglack et al. 2017).

Elk winter range

The Helena NF Plan requires that thermal cover on winter range be maintained at 25 percent in blocks of at least 15 acres. Thermal cover is described as stands of trees greater than or equal to 40 feet high with at least 70 percent canopy closure. The Lewis and Clark Plan does not include a thermal cover requirement. Recent science strongly suggests that traditionally defined and measured thermal cover may be less important to elk over-winter survival than previously thought. For that reason, cover on winter range was modelled using the SIMPLLE model to get a broader estimate of forest cover that may provide some benefit to elk, as described by more recent research and review (J. G. Cook et al., 2005).

Table 88 summarizes the status of thermal and winter cover by winter range and GA. Although winter range extends outside of the NF boundary, only that portion within the boundary is considered in the analysis. Private land on winter range within the forest boundary is included in the calculations. Thermal cover was calculated using the same methods as for project-level analysis. The SIMPPLLE model estimates for winter cover were made using parameters identified in the MTDFWP/FS collaborative recommendations for elk habitat on the east-side forests (Montana Fish, 2013); refer to the project file and to the terrestrial vegetation section for more information about SIMPPLLE. The SIMPPLLE model estimates also allow comparisons with predictions made for winter cover under the draft plan (see environmental consequences section, appendix B, and the elk background report in the project file).

Table 88. Elk thermal cover on winter range by geographic area

GA	Total acres (all ownerships)	Total acres winter range (all ownerships)	Total acres thermal cover winter range (all ownerships)	Percent thermal Cover on winter range (all ownerships)	Total acres winter cover estimated by SIMPPLLE model
Big Belts	452,292	223,000	85,466	19%	52,580
Castles	79,862	25,892	10,889	14%	8,410
Crazies	70,036	40,378	22,927	33%	7,050
Divide	232,890	130,005	96,503	41%	35,950
Elkhorns	175,259	90,136	50,629	29%	23,660
HIghwoods	44,495	40,619	25,778	58%	15,220
Little Belts	900,961	152,694	87,937	10%	57,350
Rocky Mountain Range	782,986	167,150	71,568	9%	52,390
Snowies	121,897	11,775	8,938	7%	5,000
Upper Blackfoot	348,185	131,825	99,910	29%	59,820

The Helena NF standard for thermal cover is calculated and applied at the scale of the elk herd unit. Estimates of thermal cover made for the purposes of evaluating compliance with existing forest plans provide some idea of the existing condition of this habitat component on the former Helena NF portion of the plan area. Of the 24 total elk herd units (21 on the Helena NF and 3 on the Beaverhead-Deerlodge portion of the Elkhorns GA that is included in the plan area) that include identified winter range, none currently meet the standard for thermal cover (refer to the Elk Background Report in the project file for estimates of thermal cover by herd unit).

Stressors under FS control

Vegetation management can influence elk distribution and potentially elk numbers in a given area by affecting both forage and cover. Livestock grazing can affect forage, and some research has suggested that elk may be displaced from some habitats by the presence of domestic livestock (Wisdom et al. 2005). Motorized travel on roads and trails can displace elk from some habitats, and can increase vulnerability of elk to hunting mortality by allowing greater access by hunters into elk habitat.

Stressors not under FS control

Insects, disease and fire can all affect vegetation characteristics in elk habitat and lead to changes in cover and forage. Those forces often increase the amount and palatability of forage by opening forest canopy, but can reduce available cover. Conversely, extensive blowdown associated with fire, insects, and disease can provide ‘cover’ by making areas inaccessible to hunters. Both weather and climate affect the availability and quality of forage. Management of non-NFS lands, particularly those adjoining NFS boundaries, can affect elk distribution by providing refuges from hunting and by providing high-quality forage in the form of hay and irrigated cropland. Those factors can in turn affect elk population trend by increasing growth rates and/or reducing vulnerability to hunters and other predators.

3.16.6 Elk, environmental consequences

Effects common to all alternatives

The terrestrial vegetation section shows that vegetation conditions for those types used by elk would likely move toward more open forest densities under all alternatives. Because elk are a habitat generalist, and because distribution of elk is driven by the varying and complex interactions among forage availability, weather and climate, and hunting and other predation pressure, the number and distribution of elk on NFS lands is unlikely to differ among alternatives. All alternatives would provide forage and cover for elk to a similar degree, as discussed in the terrestrial wildlife diversity section on species associated with grass/shrub, dry conifer, and mixed conifer vegetation types. Under all alternatives, mortality of elk is likely to continue to be influenced primarily by hunting, and in some areas by predation, neither of which would differ by alternative.

A great deal of management and public attention has been focused on the concept of elk security and its potential effect on elk distribution and on hunting opportunity (Burcham et al., 1999; Christensen et al., 1993; Hillis et al., 1991; L. J. Lyon et al., 1985; Ranglack et al., 2014; U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013). As described in the affected environment section above, hiding cover can be one component of security, which also may depend on topography, road density, distance from roads, timing and use level of roads, hunter density, season, forage availability and other factors. The HLC NF manages vegetation, which can affect hiding cover (see below), and access via roads. The pattern (density), timing, and season of use of roads on the HLC NF are determined by travel management, which is a site or area-specific decision that occurs separately from forest planning. The draft plan and alternatives to the draft plan, including the no action alternative, do not differ in terms of the amount, density, or timing and season of use of open roads.

Spring/summer/fall hiding cover

As discussed above in the affected environment section, hiding cover has been considered an important component of elk habitat because it allows elk to use areas for bedding, foraging, thermal relief, and other functions (J. L. Lyon & Christensen, 1992) with reduced potential for disturbance or displacement . Because hiding cover has been the focus of management and discussion about management in the past, and because it is considered to be an important habitat element used by elk, the SIMPPLLE model was used to estimate potential hiding cover under all alternatives. Cover in winter was modelled separately from that for spring/summer/fall, following guidance described in the collaborative FS and MTDFWP recommendations for elk management (U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013). Estimates of hiding cover are based on vegetation characteristics, with predicted natural disturbance incorporated into the model, as well as predicted vegetation management under each alternative (details of the model parameters and process are available in appendix B and in the project file). Estimates do not consider the potential effects of plan components for elk security in alternatives B and D, because those would occur at an area or project specific scale (see discussion below on effects of those alternatives) and the specific means for achieving security would vary by situation. Results are displayed in the figures below. Although some results vary by alternative, most are similar across all alternatives. Therefore all alternatives are shown below in order to facilitate comparison.

Figure 15 shows the predicted average spring/summer/fall hiding cover by alternative and GA, including the estimated NRV for hiding cover in each GA. This figure displays the average hiding cover estimated currently, and predicted over all five decades modelled.

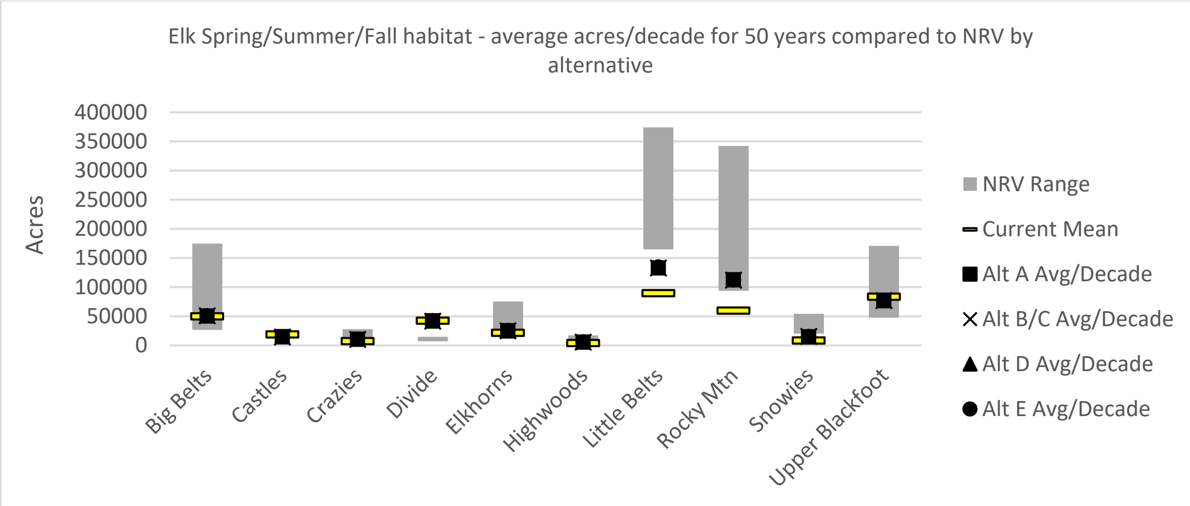


Figure 15. Predicted elk spring/summer/fall cover by GA over 5 decades by alternative

It appears that on average, modelled hiding cover in most GAs is currently within or above the estimated NRV and is predicted to remain so under all alternatives. Only the Little Belts, Rocky Mountain Range, and Snowies GAs appear to have less modelled spring/summer/fall hiding cover currently than the estimated NRV.

The estimates in Figure 15 are averages over the five decades modelled, and don't provide information about trend, which is useful for evaluating progress toward a desired condition or toward the estimated NRV. Figure 16 shows the predicted forestwide trend of spring/summer/fall hiding cover for all alternatives.

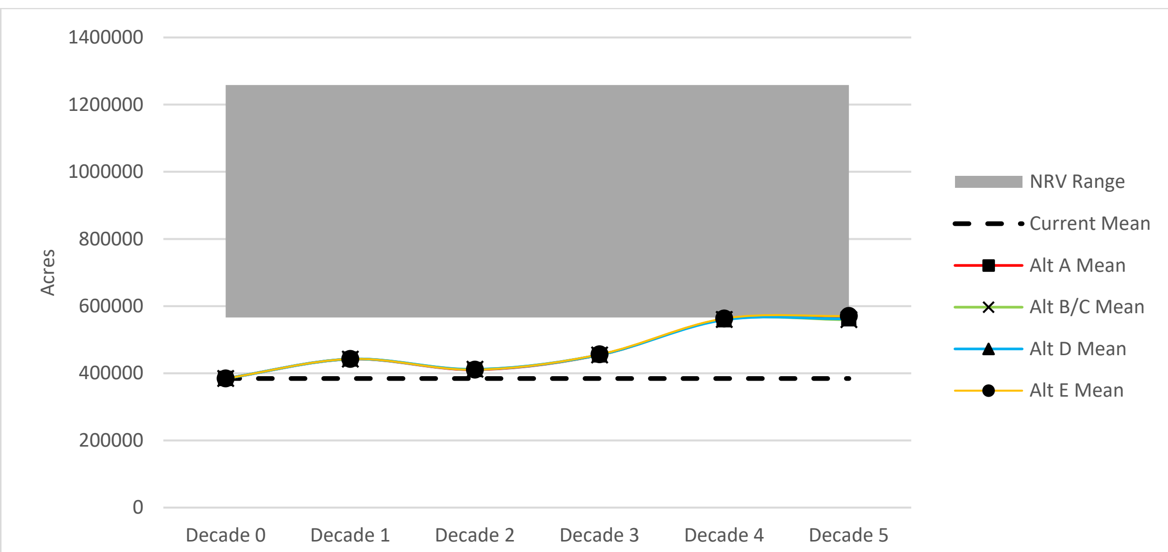


Figure 16. Predicted trend in elk spring/summer/fall cover over 5 decades by alternative

Because all alternatives showed a similar trend and pattern over time, the lines and symbols for each alternative are stacked directly on top of one another and are indistinguishable in the graphic. The estimated spring/summer/fall elk hiding cover increases to the lower end of NRV by the fourth decade modelled, at the forestwide scale, after a small decline in the second decade.

As discussed in the affected environment section, cover is most appropriately evaluated and managed at the scale of the elk herd unit (U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013). Habitat was modelled at the level of the elk herd unit (Big Belts, Castles, Divide, Elkhorns and Upper Blackfoort GAs) or elk analysis unit (Castles, Crazies, Highwoods, Little Belts, Rocky Mountain Range, and Snowies GAs). The results involve a large amount of data that is difficult to display, so it is summarized here. Full results are available in the project file.

Table 89 displays the status of elk herd or analysis units by GA, indicating whether they are within the NRV currently, whether they are predicted to be within the NRV under any alternatives, and whether they are predicted to experience increase or decrease in hiding cover as compared to the current estimated amount.

Table 89. Estimated elk spring/summer/fall hiding cover trend by GA

GA	Total number of elk herd/analysis units in GA	Status of hiding cover currently relative to NRV	Predicted status of hiding cover in alternatives, relative to NRV	Predicted status of hiding cover in alternatives, relative to estimated current amount
Big Belts	18	All herd units within NRV	All units within NRV	9 units slightly increase 6 units slightly decrease 3 units remain approximately the same
Castles	3	2 units in or above NRV 1 unit below NRV	All units in or below NRV	2 units decrease slightly 1 unit remains approximately the same
Crazies	2	Both units below NRV	Both units at or below NRV	Both units increase
Divide	7	5 units in NRV 2 units below NRV	5 units in NRV 2 units below NRV	3 units increase 2 units decrease slightly 2 units remain approximately the same
Elkhorns	9	All units within NRV	All units within NRV	5 units increase 3 units decrease 1 unit remains approximately the same
Highwoods	3	1 unit below NRV 2 units within NRV	All units within NRV	2 units increase 1 unit remains approximately the same
Little Belts	22	11 units at lower end or below NRV 11 units within NRV	3 units at low end or below NRV 19 units within NRV	17 units increase 2 units decrease 3 units remain approximately the same
Rocky Mountain Range	13	All units within NRV	All units within NRV	12 units increase 1 unit remains approximately the same
Snowies	6	5 units at lower end or below NRV 1 unit within NRV	2 units at low end or below NRV 4 units within NRV	All units increase
Upper Blackfoot	9	All units within NRV	All units within NRV	4 units increase 5 units decrease slightly

The NRV for hiding cover provides an approximate idea of the range of conditions under which elk evolved and that allowed them to be present in historic distribution and numbers across what is now the HLC NF. The role of hiding cover, however, continues to depend on site-specific conditions including the amount and nature of human activity and hunting pressure in an area relative to other areas accessible to those elk. The information in Table 89 serves mainly to demonstrate the degree to which the plan area currently approximates the NRV, and the degree to which hiding cover on the HLC would increase or decrease relative to current conditions and to the NRV under each alternative. Those estimates do not vary measurably among the different alternatives. Furthermore, the amount and trend of hiding cover at a forestwide, GA, or elk herd/analysis unit scale is not an indicator of elk distribution or of the availability of elk for hunting or other uses on NFS lands.

Winter cover

Winter cover on mapped elk winter ranges was modelled in order to compare these habitat elements across alternatives. Guidance established in the 2013 cooperative FS and MTDFWP recommendations paper (U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013) was followed, and the SIMPPLLE model (refer to project file for more information about parameters) was used. Figure 17 shows the estimated winter cover by GA, for the portion of winter ranges on NFS lands managed by the HLC NF, averaged over the 5 decades that were modelled.

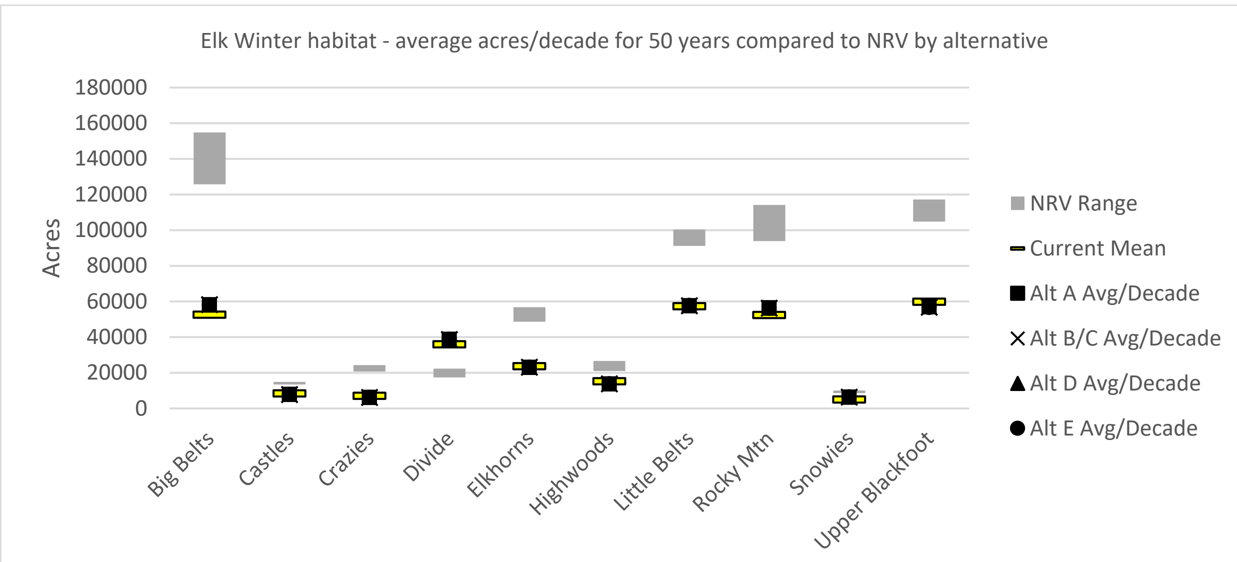


Figure 17. Predicted elk winter cover by GA over 5 decades by alternative

Because all alternatives showed a similar trend and pattern over time, the symbols for each alternative are stacked directly on top of one another and are indistinguishable in the graphic. The Divide GA appears to be the only GA in which existing winter cover is estimated to be at or slightly above the estimated NRV. Under all alternatives, the amount of winter cover is predicted to remain close to the same as current amounts. Note that the estimated NRV for winter cover is a narrow range, reflecting the fact that a relatively small acreage of winter range occurs on lands administered by the HLC NF.

Winter cover is predicted to increase slightly for all alternatives in the Big Belts, Divide, Rocky Mountain Range, and Snowies GAs, although the model shows a slight decline in the fifth decade modelled for the Snowies. Winter cover is predicted to decrease slightly in the Castles, Crazies, Highwoods, and Upper Blackfoot GAs, and remain roughly the same in the Elkhorns and Little Belts GAs. The predicted increases and declines appear to be very slight and if they occurred, would possibly not have a measurable impact on the ground. Refer to the project file and to Appendix B for more detail regarding modelled estimates of winter cover.

Effects common to all action alternatives

The draft plan includes a number of components that could potentially impact elk habitat, as well as habitat for other ungulate species. A summary of those components and their expected effects is shown in Table 90. Please refer to the draft plan for the complete text of listed components.

Table 90. Summary of plan components pertinent to elk and elk habitat management – revised forest plan

Plan component(s)	Summary of expected effects
General habitat management	
FW-WL-GDL-15 FW-WL-DC-01; 02 FW-VEGT-DC-01 ; 02 FW-VEGT-OBJ-01 FW-VEGF-DC-01-04; 10 FW-LAND-DC-03 FW-WILD-GO-01	These plan components all address general aspects of habitat, guiding managers to provide habitat for native wildlife species, provide vegetation conditions consistent with NRV, move toward vegetation desired conditions, and manage consistent with adjoining lands that are managed for wildlife values. The effects of implementing these components would be to assure that the vegetation conditions that support the life history requirements for elk are met through consideration of habitat needs and managing for appropriate vegetation condition. These components represent coarse-filter management of elk habitat.
Components that support forage	
FW-WL-DC-02; 08 FW-WL-GDL-01; 06 FW-VEGNF-DC-01-04 FW-GRAZ-DC-02 FW-GRAZ-STD-02 FW-GRAZ-GDL-03; 05 FW-TIM-GDL-06 CA-WL-DC-01 SN-VEGNF-GDL-01 EH-WL-GDL-02 SN-VEGF-DC-03; GDL-01	These plan components guide managers to provide for the natural history requirements of native wildlife species, to provide forage for big game on winter range, and to manage livestock and coordinate grazing allotment planning and permitting with Montana Department of Fish, Wildlife and Parks to ensure wildlife forage needs are addressed. Some components are only for certain GAs, where specific wildlife or big game forage needs (e.g., enhancing summer big game forage in the Snowies GA, managing for high quality big game winter range in a portion of the Castles, etc.) are addressed. The effects of implementing these components would be to assure that management activities, including livestock grazing, either maintain or enhance forage for elk and other wildlife species, particularly on key seasonal ranges.
Components that support cover (thermal and hiding)	
FW-WL-DC-02; 08 FW-WL-GDL-06 FW-FWL-GDL-01 to 03 FW-TIM-STD-04 FW-TIM-STD-08-09 DI-WL-GO-01 DI-WL-GDL-01 RM-VEGF-DC-03 UB-WL-DC-01 UB-WL-GDL-01	These plan components guide managers to provide for the life history requirements for all parts of the life cycle of native wildlife species, as well as to intermix forage species with hiding and thermal cover for big game on winter range and elsewhere, to maintain or increase elk security, to use clearcuts only where wildlife habitat needs allow, and set a limit on maximum opening size created by timber harvest. Some components are specific to GAs, guiding managers to maintain or improve wildlife habitat connectivity for wide-ranging species, as well as to acquire, if possible, lands in one GA (Divide) to enhance both security and connectivity for wide-ranging species. The effects of implementing these components would be to maintain or manage for cover where it is needed, which may contribute to habitat security.
Components that limit disturbance by humans	
FW-WL-DC-07; 03 FW-WL-GDL- 05 FW-FWL-DC-05 FW-RSUP-GDL-01 FW-IRA-DC-01 FW-RT-GO-03 FW-RT-GDL-15	These plan components guide managers to minimize disturbance on winter range and other key habitats, balance access needs with needs for wildlife security, decommission unneeded roads when doing so would benefit wildlife, and concentrate human activities in space and time to minimize impacts to wildlife. GA-specific components would limit certain activities in the Elkhorns on winter range and other seasonal habitats. The effects of implementing these components would be to limit or prevent certain types of disturbance, particularly in seasonal habitats, which is

Plan component(s)	Summary of expected effects
EH-TIM-GDL-01 EH-EMIN-GDL-01; 02	in turn likely to minimize the potential for elk to be displaced by certain human activities.
Aquatic Ecosystems	This section includes components wherein the vegetation condition helps achieve the desired conditions for these resources, such as water quality and quantity, riparian ecosystems, fish habitat, and soil condition. These components complement those enumerated in the vegetation sections. Some components also specifically guide or limit vegetation management.
Fire and Fuels Management	This section describes the role of natural fire and fire management which are primary drivers of change in terrestrial vegetation. These components complement the achievement of desired conditions especially related to wildland fire management strategies and hazardous fuels treatments.

Effects of alternative A, no action

The existing forest plans include components requiring evaluation and management of elk security (Helena NF plan) or hiding cover (Lewis and Clark NF plan) when carrying out certain management activities. These standards would remain in place under this alternative. Implementation of the current plans has resulted in achievement of plan standards for hiding or thermal cover or security on portions of the HLC NF but not across the entire forest (refer to the Affected Environment section). The inherent characteristics of vegetation and topography, as well as insect, disease, and fire related mortality contribute to limiting the extent to which standards can be met. Additionally, standards relating to elk habitat on the former Lewis and Clark portion of the plan area are applied only for projects "involving significant vegetative removal", so application of standards is limited to those times and areas where these take place. On the former Helena portion of the plan area, existing standards and guidelines are applied during vegetation management actions or during travel management. Neither existing plan includes specific desired conditions for vegetation or for elk habitat, meaning that achievement of standards or guidelines for elk habitat would continue to be driven largely by implementation of projects developed to address other purposes or needs. There would continue to be inconsistency between the two portions of the combined HLC NF, with project-level management for security and thermal cover on the Helena NF portion, and project-level management for hiding cover on the Lewis and Clark NF portion.

Effects of action alternatives

Spring/summer/fall habitat

Refer to Figure 14 and Figure 16 and Table 89 above for a display of predicted impacts to spring/summer/fall cover by GA for all alternatives. The similarity in outcomes modelled for all alternatives indicate that it is likely that all alternatives would result in similar amount and distribution of hiding cover by GA, largely as a result of natural processes and predicted vegetation management.

Alternatives B and E include guidelines for managing elk security. Guideline FW-FWL-GDL-01 states that in areas where lack of secure habitat is an identified concern, vegetation management should retain existing security areas, with the intent of reducing potential displacement of elk from NFS lands during the hunting season (see FW-FWL-DC-01 and FW-FWL-GDL-02). Guideline FW-FWL-GDL-02 states that new motorized routes should not reduce habitat security in areas where it has been identified as lacking. These plan components would specifically guide managers to assess NFS lands managed by the HLC NF according to the BASI, such as the "Collaborative overview and recommendations for elk habitat management on the Custer, Gallatin, Helena, and Lewis and Clark National Forests" (U.S. Department of Agriculture, Forest Service and Montana Department of Fish,, Wildlife & Parks, 2013), to determine where additional measures to maintain or create elk security would help achieve the desired condition of having elk "present and potentially available to hunters on NFS lands during both the archery and rifle hunting seasons" (FW-FWL-DC-01). FW-FWL-GDL-01 and 02 would guide managers to provide for security if it is determined to be needed, through one or more actions that could include restricting motorized access, managing hiding cover, adjusting livestock grazing, or other methods. Some vegetation management activities could be constrained in some areas, if analysis determines that elk security is needed and that specific vegetation characteristics (such as maintaining hiding cover) are needed to provide it. Refer to appendix C of the Draft Plan for more information about methods and actions that could potentially be used to assess security and implement these guidelines. Although a forestwide assessment of security could be carried out at any time, any actual management measures that are needed would likely be carried out in conjunction with vegetation management projects or future travel management planning.

In contrast, alternatives C and D do not include specific guidelines for assessing and managing elk security. Those alternatives retain the desired condition to have elk "present and potentially available to hunters on NFS lands during both the archery and rifle hunting seasons" (FW-FWL-DC-01). There would be no specific guidance about assessing elk security under these alternatives, although management actions such as vegetation management, access management, and others would need to move NFS lands toward the desired condition, or not preclude achieving the desired condition (refer to appendix C of the draft plan).

In addition to elk security, which is specifically defined (J. L. Lyon & Christensen, 1992) as applying to elk during hunting season, the action alternatives differ somewhat in terms of general habitat security. Habitat security, generally speaking, refers to habitat characteristics that allow wildlife to forage, rest, move among habitats, rear young, and carry out other life requirements without disturbance (usually by humans) that would cause them to be displaced from key habitats or disrupt normal activities. Areas that are remote and have minimal use by humans, particularly minimal motorized use, usually have higher value as secure habitat than areas with a greater human presence. Areas such as IRAs, RWAs, designated wilderness, and Conservation Management Areas all provide some degree of security for wildlife using those areas.

Under all alternatives, the acreage and distribution of IRAs, designated wilderness, and conservation management area would not change. Alternatives B and C both include over 213,000 acres of RWAs, with alternative B removing existing motorized uses on 12 miles of road within RWAs. Alternative D would include more than twice as much RWAs (over 474,000 acres), and would remove existing motorized uses on 23 miles of road and 59 miles of trail. In contrast, alternative E would have no RWAs, although many areas that are recommended in other alternatives overlap partly or entirely with IRAs. Nevertheless, it is likely that alternative D would provide the most general habitat security for elk and other wildlife, followed by alternative B and then alternative C.

Winter habitat

Figure 17 shows that at a GA scale, predicted winter cover would increase very slightly over time under all alternatives, but would remain below the estimated NRV. That predicted trend appears to have no discernable differences among alternatives except possibly in the Snowies, where under alternative D there could be a slightly greater decline in winter cover in the fifth decade modelled, as compared to a very slight decline under the other alternatives (refer to appendix B and project file). Given the uncertainties in modelling processes and in estimating parameters, the similarity in outcomes modelled for all alternatives indicate that it is likely that all alternatives would result in similar amount and distribution of winter cover by GA, as a result of natural processes and predicted vegetation management.

Effects of forest plan components associated:

Aquatic ecosystems, fire and fuels management, infrastructure, livestock grazing, and timber harvest

The effects of these plan components are in Table 90 above.

Terrestrial vegetation; plants at risk, and invasive species, terrestrial wildlife, cultural, historic, and tribal resources, land status and ownership and land uses, special uses, and energy and minerals

The effects of these plan components are discussed in the terrestrial wildlife diversity section.

Recreation settings, opportunities, access, and scenery

The effects of these plan components are mostly discussed in the terrestrial wildlife diversity section.

The draft plan does not directly constrain public uses, but it does set desired conditions, placement of recreation facilities, and puts constraints on permitted special uses. As discussed in the environmental consequences section above, recreation access via roads can have an effect on elk distribution and therefore on elk availability on the HLC NF. Some recreation special uses, such as permitted outfitter and guide operations that provide hunting opportunities, may impact elk numbers and distribution in concert with other factors (including forage, weather, other hunters, etc.).

Plan components for management of recreation would potentially result in some impacts to elk and other big game species where specific facilities exist or activities occur, but would minimize impacts to individual animals and to the population as a whole by including constraints designed to reduce conflicts, disturbance, displacement, or negative impacts to habitat. Some components would improve wildlife habitat by moving facilities out of sensitive areas such as riparian areas, and by rehabilitating unauthorized access routes.

Designated areas, including RWAs

The effects of these plan components are discussed in the terrestrial wildlife diversity section, and in the environmental consequences section above.

Cumulative effects

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in the terrestrial wildlife diversity section for wildlife species, including elk.

Conclusions

Under all alternatives, seasonal elk habitat would continue to be widely available across the entire HLC NF. All alternatives would provide for similar amounts of spring/summer/fall hiding cover and winter cover both forestwide and by GA. Under all alternatives, the desired condition of providing habitat for native wildlife species across their range (FW-WL-DC-01), and providing vegetation composition, structure, and distribution that would fulfill elk life history requirements (FW-WL-DC-02) would be supported, allowing elk to continue to be present in the plan area in support of the planning rule requirement to maintain the diversity of native wildlife species.

The prevalence of spring/summer/fall hiding cover under all alternatives is a good indication that hiding cover, which contributes to elk security, would be present and available with and without specific plan components to manage for it.

Plan components for security and cover in alternative A would require managers to evaluate and provide for very specific amounts of security and thermal cover on the Helena NF portion of the plan area, and hiding cover on the Lewis and Clark NF portion of the plan area, which would result in continued inconsistencies across the plan area and likely difficulty in meeting standards because of insects, disease, and fire. Whether those standards actually result in retaining elk on NFS lands during the hunting season is unclear, and may be outweighed where private lands with little or no hunting access occur nearby. Components for evaluating and managing for elk security in alternatives B and E would provide greater consistency in approach than under the current plans or under alternative A, but would not guarantee that elk remain on NFS lands, particularly were private land refuges are available. Alternatives C and D, without specific components to manage for elk security, would likely have less constraint on vegetation management projects, would potentially have different impacts on the amount and distribution of secure habitat for elk, but would meet or move toward the desired condition for elk to be available on HLC NF lands.

The alternatives with larger amounts of RWA (D, followed by B and C) could provide greater general security than the existing plans (alternative A) or Alternative E. However, on the ground the difference may be minimal because of the presence of IRAs in alternative E similar to that of the other alternatives. Furthermore, it is not possible to predict whether the differences in the amount and location of RWAs, or the differences in whether motorized travel is allowed or not would have any measurable impact on elk presence or distribution.

3.17 Recreation Settings

3.17.1 Introduction

Recreation is recognized as a critical resource on the HLC NF due to its contributions to the local economy, its influence in connecting people to the land, its impact on public understanding of natural and cultural resources, and its role as a catalyst for public stewardship.

To address both the challenges and opportunities in recreation management, the FS strives to provide a set of recreation settings, opportunities, and benefits that are sustainable over time. Sustainable recreation is defined as the set of recreation settings and opportunities on the NF that are ecologically, economically, and socially sustainable for present and future generations. For best effect, all aspects of recreation should include the principle of sustainability. As such, the HLC NF developed plan components aimed at providing direction for a sustainable recreation program.

Issues

A number of issues were raised during the scoping period for the proposed action. The issues that drove alternatives for recreation settings were:

- Changes to ROS settings associated with requests to limit mechanical means of transportation (including bicycles) in some areas on the Forest.
- Site specific changes to ROS settings to address mapping errors found during the analysis period.

Another issue that was analyzed in this section includes:

- The effects to ROS settings associated with RWA designations.

Measurement indicators

Effects to ROS settings will be measured by determining the acres of desired summer and winter ROS settings by alternative.

Analysis area

The geographic scope of the analysis is the lands administered by the HLC NF. All lands within the forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan (approximately 15 years).

3.17.2 Regulatory framework

Land and Water Conservation Fund Act of 1965 (P.L. 88-578, 78 Stat. 897 as amended; 16 U.S.C. 460l-4(note); 460l-4 thru 6a, 460l-7 thru 460l-10, 460l-10a-d, 460l-11): "The purposes of this act are to assist in preserving, developing, and assuring accessibility to all citizens of the United States of America…such quality and quantity of outdoor recreation resources…providing funds for:" 1. States for acquisition, planning, and development of recreation facilities and; 2. Federal acquisition and development of certain lands and other areas.

Architectural Barriers Act of August 12, 1968 (P.L. 90-480, 82 Stat. 718 51 U.S.C. 4151-4154, 4154a, 4155-4157): This act establishes additional requirements to ensure that buildings, facilities, rail passenger cars, and vehicles are accessible to individuals with disabilities. It covers architecture and design, transportation, and communication elements of recreational site planning and development.

Rehabilitation Act of September 26, 1973 (P.L. 93-112, Title V, 87 Stat. 390, as amended; 29 U.S.C. 791, 793-794, 794a, 794b): This act requires that programs and activities conducted by federal agencies and by entities that receive funding from, or operate under a permit from, federal agencies provide an equal opportunity for individuals with disabilities to participate in an integrated setting, as independently as possible. The only exception to the requirement is when the program would be fundamentally altered if changes were made solely for the purpose of accessibility.

Federal Lands Recreation Enhancement Act of December 8, 2004 (P.L. 108-447, as amended): This act gives the Secretaries of Agriculture and Interior the authority to establish, modify, charge, and collect recreation fees at federal recreational lands where a certain level of amenities have been developed.

National Forest Roads and Trails Act of October 13, 1964 (P.L. 88-657, 78 Stat. 1089, as amended): This act declared that an adequate system of roads and trails be constructed and maintained to meet the increasing demand for recreation and other uses. This act authorizes road and trail systems for the NFs. It authorizes granting of easements across NFS lands, construction and financing of maximum economy roads (FS Manual 7705), and imposition of requirements on road users for maintaining and reconstructing roads, including cooperative deposits for that work.

Ski Fees, Omnibus Parks and Public Lands Management Act of November 12, 1996 (Pub. L. 104-333, div. I, Title VII, Sec. 701, 110 Stat. 4182; 16 U.S.C. 497c): Section 701 of this act:

- Establishes a system to calculate fees for ski area permits issued under the National Forest Ski Area Permit Act of 1986 (16 U.S.C. 497b);
- Provides for holders of ski area permits issued under other authorities to elect this permit fee system (FS Handbook 2709.11, sec. 38.03a);
- Includes provisions concerning compliance with NEPA when issuing permits for existing ski areas (FS Manual 2721.61f and FS Handbook 2709.11, sec. 41.61b); and
- Withdraws leasable and locatable minerals, subject to valid existing rights (FS Handbook 2709.11, sec. 41.61c).

3.17.3 Assumptions

Since adoption of the 1986 plans, recreation activities within the plan area have changed. This analysis assumes that changes to recreational use patterns would occur naturally as a result of factors associated with recreation trends, advances in technology, aging population, aging infrastructure, and climatic changes.

3.17.4 Best available scientific information used

The Forest used the best available data and science relevant to inform the analysis for the new forest plan components for recreation settings, recreation opportunities, recreation special uses, and recreation access. Data sources included the latest information from the National Visitor Use Data project, information stored in the corporate data base, and site-specific knowledge from forest personnel.

3.17.5 Affected environment

Sustainable recreation settings are the social, managerial, and physical attributes of a place that, when combined, provide a distinct set of recreation opportunities. Sustainable recreation settings and opportunities are affected by trends in recreation uses and the mix of outdoor activities chosen by the public, which continuously evolve. Recreation activities offered on the HLC NF include, but are not limited to, cross-country and downhill skiing, snowboarding, snowmobiling, dog sledding, hiking, backpacking, horseback riding, mountain biking, camping, hunting, fishing, off-highway vehicle driving or riding, picnicking, swimming, boating, paddle boarding, recreation aviation, wildlife watching, visiting historic sites or scenic areas, participating in interpretive programs or tours, and resort use. The FS utilizes a framework called the ROS which describes different settings across the landscape and attributes associated with those settings. All six of the ROS classes are found within the HLC NF. Table 91 defines these classes.

Table 91. ROS classes and definitions

ROS Class	Definition
Primitive	Large, remote, wild, and predominately unmodified landscapes. Areas with no motorized activity and little probability of seeing other people.
Semi-Primitive Non-Motorized	Areas of the Forests managed for nonmotorized use. Uses include hiking and equestrian trails, mountain bikes and other non-motorized mechanized equipment. Rustic facilities and opportunity for exploration, challenge, and self-reliance.
Semi-Primitive Motorized	Backcountry areas used primarily by motorized users on designated routes. Roads and trails designed for off-highway vehicles and high-clearance vehicles. Offers motorized opportunities for exploration, challenge, and self-reliance. Rustic facilities. Often provide portals into adjacent Primitive or Semi-Primitive Non-Motorized areas.
Roaded Natural	Often referred to as front country recreation areas, these areas are accessed by open system roads that can accommodate sedan travel. Facilities are less rustic and more developed with campgrounds, trailheads and airstrips often present. Provide access points for adjacent Semi-Primitive Motorized, Semi-Primitive Nonmotorized, and Primitive settings.
Rural	Highly developed recreation sites and modified natural settings. Easily accessed by major highways. Located within populated areas where private land and other land holdings are nearby and obvious. Facilities are designed for user comfort and convenience.
Urban	Areas with highly developed recreation sites and extensively modified natural settings. Often located adjacent to or within cities or high population areas. High probability of seeing large groups of people and opportunities for solitude or silence are few.

3.17.6 Environmental consequences

Effects common to all alternatives

In all alternatives, natural disturbances, recreation use patterns, and emerging technologies would continue to influence recreation settings across these landscapes. Travel plans would continue to provide site-specific direction for where motorized uses could take place. Additional management direction for recreation may also be provided through recreation special use permits, or, in the cases where recreation uses need to be restricted, through closure orders outside of travel plans.

Effects common to all action alternatives

The plan components developed for recreation settings remain the same in all action alternatives. Table 92 summarizes the expected effects of each plan component related to recreation settings.

Table 92. Summary of plan components for recreation settings

Plan component	Expected effects
FW-ROS-DC-01 through 13	These plan components set up the desired distribution of ROS classes, as well as provide descriptions of each of these classes. The specific locations for each ROS class are mapped by GA for the entire Forest. Recreation opportunity classes establish the expectations for recreation settings across the forest.
FW-ROS-OBJ-01 and 02	These objectives would improve primitive and semi-primitive nonmotorized settings by eliminating motorized incursions into these areas.
FW-ROS-STD-01 through 05	These standards would provide clear direction on the construction of recreation facilities, such as motorized roads and trails, airstrips, and trailheads for each ROS class.
FW-ROS-GDL-01 through 13	These guidelines provide direction for the SIOs of each area, and the expectations of vegetative management in each of the ROS classes.
FW-ROS-SUIT-01 through 32	The suitability plan components lay out specifically where motorized uses, mechanized means of transport, and airstrips may and may not be suitable within the desired ROS classes on the Forest.

Settings for recreation aviation

Public commenters asked for the allowance of more access for recreation aviation activities, especially for provisions for airstrips or locations where motorized aircraft may take off and land. Access for recreation aviation activities would be determined by the ROS classes for all action alternatives. The specifics of where recreation aviation activities may occur is detailed in the suitability plan components in the draft revised plan.

Motorized recreation aviation activities are most appropriate in motorized ROS settings. Nonmotorized recreation aviation uses, such as glide planes and hang gliders, may be found in nonmotorized ROS settings. Facilities constructed in nonmotorized settings would be designed and constructed to meet the facilities development direction for nonmotorized settings.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Activities related to watershed, soil, riparian, or aquatic habitat improvements would have little to no effects related to the overall management of recreation settings.

Fire and fuels management

Natural, unplanned fires would continue to affect the long-term ecological processes across recreation settings. Fire effects could include a temporary loss of vegetation, reduction in water quality due to sedimentation, and air pollution. However, these effects are part of natural, ecological processes.

Timber and vegetation management

Timber management would continue on lands suitable for timber production and in those areas where timber harvest could be used as a tool to enhance other resource values. These activities would be most noticeable in the semi primitive motorized, roaded natural, and rural ROS settings. All action alternatives establish suitability direction for the management of timber and vegetation within ROS settings. The sights and sounds of salvage timber sales and associated road building activities may temporarily impact nonmotorized recreation settings.

Livestock grazing and management

Livestock grazing would continue to occur in active allotments across the forest and livestock may be found in all recreation settings. The locations of facilities associated with grazing, such as water features and extensive fencing, may have an impact on the less developed recreation settings. The action alternatives provide suitability direction for the management of grazing within developed recreation sites.

Wildlife management

Activities related to wildlife improvements and management would occur across all ROS settings. These activities are expected to have little to no affect to recreation settings.

Recreation and scenery management

Recreation settings are most affected by the presence or absence of motorized uses. These uses can take place on constructed features such as roads, trails, or airstrips, or they may take place cross country as with motorized over-snow recreation. Travel plans that establish where motorized use can or cannot take place would support and help maintain recreation settings for both summer and winter. All action alternatives establish desired ROS settings that would provide future direction for motorized access and construction/reconstruction of infrastructure.

Cultural, historic, and tribal resource management

There are many historic recreation residences and historic special use resorts that contribute to the Roaded Natural and Rural ROS settings on the HLC NF. The action alternatives provide direction for the management of these historic structures.

Road access and infrastructure

ROS settings are based on the location of roads, trails, and infrastructure and on whether these features are open and available for public recreational uses. Travel plans establish where motorized use can or cannot take place and support and help maintain ROS settings for both summer and winter. All action alternatives establish desired ROS settings that would provide future direction for motorized access and construction/reconstruction of infrastructure.

Minerals management

Areas with active mining may occur across all recreation settings within the HLC NF. Evidence of historic and ongoing mining on forest is an expected part of these settings. New and ongoing mining may affect the recreation settings by creating roads and opening that might not normally be located within certain settings. Additionally, mine reclamation may have impacts on recreation settings, at least in the short-term.

Alternative A, no action

In alternative A, recreation settings would continue to be managed under the 1986 Helena NF and Lewis and Clark NF Plans. Travel plans would continue to provide the direction for where motorized uses can and cannot occur, and future wilderness and other laws may determine where various ROS classes may be located. Table 93 describes the plan components in the 1986 plans that provide direction for ROS settings.

Table 93. Summary of existing plan components for recreation settings

Plan component	Expected effects
1986 Helena NF Plan Objectives, Resource Activity/Summaries, Recreation and Roadless Page II/2.	Recreation: This objective highlights that approximately 40% of the Forest would be managed in a way that provides primitive or semi-primitive recreation. Roadless: This objective lists specific areas of undeveloped acres outside of wilderness that would remain undeveloped and managed for semi-primitive recreation values. Additionally, this

Plan component	Expected effects
	objectives mentions large blocks over 5,000 acres in size with other resource goals, such as wildlife, that would also be managed for semi-primitive recreation.
1986 Helena NF Plan Management Areas R-1, P-3; Page III/24	Management area R-1 provides direction for large blocks of undeveloped lands suited for dispersed recreation. Motorized uses are not allowed in these areas and they are managed for a semi-primitive non-motorized recreation opportunities. Primitive and semi-primitive non-motorized recreation settings are described for the Big Log RWA in management area P-3.
1986 Helena NF Plan Analysis of the Management Situation Summary, Resource and Support Program Elements, Recreation, Page AMS Summary V/2.	The analysis of the management situation discusses the demand, supply, and production potential of recreation on the Helena NF. The tables and narrative in this section discuss the potential for growth and the ability of the forest to handle the expected potential growth patterns in all of the ROS settings.
1986 Lewis and Clark NF Plan, Forest-wide Objectives, Resource Activity/Summaries, Recreation, Page 2-4.	This objective highlights that approximately 65% of the Forest would be managed in a way that provides primitive or semi-primitive recreation.
1986 Lewis and Clark NF Plan, Desired Future Conditions, First Decade, Rocky Mountain Division and Jefferson Division, Page 2-19.	Rocky Mountain Division: This desired future condition states that the high quality opportunities for semi-primitive motorized and semi-primitive non-motorized opportunities would remain unchanged. Jefferson Division: Desired future condition mentions maintaining semi-primitive recreation in the Middle Fork/Lost Fork Judith and Big Snowies.
1986 Lewis and Clark NF Plan, Desired Future Conditions, Fifth Decade, Jefferson Division, Page 2-21.	Jefferson Division: This desired future condition predicts that that semi-primitive recreation opportunities would decrease slightly and roaded natural opportunities would increase. Also semi-primitive recreation would be maintained in the Middle Fork/Lost Fork Judith and Big Snowies areas.
1986 Lewis and Clark NF Plan, Management Areas, Pages 3-3 through 3-104.	Recreation settings are established for each of the management areas on the Forest.

The 2012 Planning Rule requires the mapping of desired ROS classes and the use of this information in revised forest plans. In order to provide a comparison between alternatives, estimated ROS classes were developed for alternative A. These maps were derived using current travel plan information and site-specific knowledge from forest personnel, and are displayed for both summer and winter.

Table 94 depicts the estimated acreages and percent total of the estimated existing ROS classes for summer in alternative A. Table 95 displays the percent of each estimated existing ROS class for summer in each GA.

Table 94. Forestwide ROS classes - summer (alternative A)

Desired ROS Classification	Acres	Percent of Total NFS Lands
Primitive	758,131	26
Semi-primitive nonmotorized	1,031,329	36
Semi-primitive motorized	365,953	13
Roaded natural	700,160	24
Rural	28,018	1
Urban	29	<1

Table 95. Percent of ROS class by GA in summer (alternative A)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	15	34	12	36	3	0
Castles	0	24	23	52	0	0
Crazies	0	59	26	15	0	0
Divide	8	43	11	34	4	0
Elkhorns	0	57	4	38	2	0
Highwoods	0	71	19	10	0	0
Little Belts	8	29	28	35	<1	0
Rocky Mountain Range	58	35	3	4	<1	0
Snowies	75	4	6	15	1	0
Upper Blackfoot	26	48	2	24	<1	0

Table 96 depicts the estimated acreages and percent total of the estimated existing ROS classes for winter in alternative A. Table 97 displays the percent of each estimated existing ROS class for winter in each GA.

Table 96. Forestwide recreation opportunity classes – winter (alternative A)

Desired ROS Classification	Acres	Percent of Total NFS lands
Primitive	744,609	26
Semi-primitive nonmotorized	1,151,264	40
Semi-primitive motorized	779,127	27
Roaded natural	181,020	6
Rural	27,595	1
Urban	29	<1

Table 97. Percent of ROS class by GA in the winter (alternative A)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	15	42	26	14	3	0
Castles	0	21	79	0	0	0
Crazies	0	63	37	0	0	0
Divide	8	32	33	22	5	0
Elkhorns	0	73	21	4	2	0
Highwoods	0	93	7	0	0	0
Little Belts	8	45	44	3	<1	0
Rocky Mountain Range	58	36	5	1	<1	0
Snowies	64	4	30	2	0	0
Upper Blackfoot	26	30	28	15	<1	0

Alternative B

Alternative B would establish desired ROS classes for each GA for both summer and winter, as per the direction provided in the 2012 Planning Rule. Desired ROS settings would provide direction for management of a sustainable recreation program on the forest. These desired ROS classes were based on existing travel plans but were adjusted to incorporate changes to include additional RWAs.

Table 98 depicts the acreages and percent total of the desired ROS classes for summer in alternative B. Table 99 displays the percent of each desired ROS class for summer in each GA.

Table 98. Forestwide ROS classes - summer (alternative B)

Desired ROS Classification	Acres	Percent of Total NFS lands
Primitive	846,121	29
Semi-primitive nonmotorized	955,767	33
Semi-primitive motorized	367,377	13
Roaded natural	686,186	24
Rural	28,139	1
Urban	29	<1

Table 99. Percent of ROS class by GA in summer (alternative B)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	15	34	12	36	3	0
Castles	0	24	23	52	0	0
Crazies	0	59	26	15	0	0
Divide	16	36	11	33	4	0
Elkhorns	0	56	4	38	2	0
Highwoods	0	71	19	10	0	0
Little Belts	10	27	28	35	<1	0
Rocky Mountain Range	58	35	3	4	<1	0
Snowies	81	<1	6	13	1	0
Upper Blackfoot	42	34	2	22	<1	0

Table 100 depicts the acreages and percent total of the desired ROS classes for winter in alternative B. Table 101 displays the percent of each desired ROS class for winter in each GA.

Table 100. Forestwide ROS classes - winter (alternative B)

Desired ROS Classification	Acres	Percent of Total NFS lands
Primitive	846,121	29
Semi-primitive nonmotorized	1,076,056	37
Semi-primitive motorized	765,796	27
Roaded natural	167,925	6
Rural	27,717	1

Desired ROS Classification	Acres	Percent of Total NFS lands
Urban	29	<1

Table 101. Percent of ROS class by GA in the winter (alternative B)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	15	42	26	14	3	0
Castles	0	21	79	0	0	0
Crazies	0	63	37	0	0	0
Divide	16	26	33	21	4	0
Elkhorns	0	73	21	4	2	0
Highwoods	0	93	7	0	0	0
Little Belts	10	43	44	3	<1	0
Rocky Mountain Range	58	36	5	1	<1	0
Snowies	81	<1	19	<1	0	0
Upper Blackfoot	42	17	28	13	<1	0

Alternative C

Similar to alternative B, alternative C would establish desired ROS classes for each GA for both summer and winter as per the direction provided in the 2012 Planning Rule. The desired ROS classes in alternative C would also primarily be based on existing travel plans. However, in the center of the Elkhorns and in the Cellar Creek area in the north end of the Divide GA, desired winter ROS classes would change. These areas are currently open to motorized over-snow uses within a semi-primitive motorized ROS settings. In alternative C, the motorized setting in both of these areas would be changed to semi-primitive non-motorized and over-snow motorized uses would no longer be permitted.

In addition, minor changes to summer ROS classes in the Middle Fork Warm Springs drainage of the Elkhorns would change. These changes to summer recreation opportunity classes in the Elkhorns correct mapping errors found in alternative B.

The distribution of ROS classes for summer in alternative C is noted in Table 102. Table 103 displays the percent of each desired ROS class for summer in each GA.

Table 102. Forestwide ROS classes - summer (alternative C)

Desired ROS Classification	Acres	Percent of Total NFS Land
Primitive	846,175	29
Semi-primitive nonmotorized	956,076	33
Semi-primitive motorized	367,323	13
Roaded natural	685,877	24
Rural	28,139	1
Urban	29	<1

Table 103. Percent of ROS class by GA in summer (alternative C)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	15	34	12	36	3	0
Castles	0	24	23	52	0	0
Crazies	0	59	26	15	0	0
Divide	16	36	11	33	4	0
Elkhorns	0	57	4	38	2	0
Highwoods	0	71	19	10	0	0
Little Belts	10	27	28	35	<1	0
Rocky Mountain Range	58	35	3	4	<1	0
Snowies	81	<1	6	13	1	0
Upper Blackfoot	42	34	2	22	<1	0

The distribution of ROS classes for winter in alternative C is noted in Table 104. Table 105 displays the percent of each desired ROS class for winter by GA.

Table 104. Forestwide ROS classes - winter (alternative C)

Desired ROS Classification	Acres	Percent of Total NFS lands
Primitive	846,175	29
Semi-primitive nonmotorized	1,095,868	38
Semi-primitive motorized	745,984	26
Roaded natural	167,925	6
Rural	27,717	1
Urban	29	<1

Table 105. Percent of ROS class by GA in the winter (alternative C)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	15	42	27	14	3	0
Castles	0	21	79	0	0	0
Crazies	0	63	37	0	0	0
Divide	16	27	32	21	5	0
Elkhorns	0	84	10	4	2	0
Highwoods	0	93	7	0	0	0
Little Belts	10	43	44	3	<1	0
Rocky Mountain Range	58	36	5	1	<1	0
Snowies	81	<1	19	<1	0	0
Upper Blackfoot	42	17	28	13	<1	0

Alternative D

Alternative D responds to comments received during pubic scoping asking the Forest to consider an alternative that increases the amount of RWAs and primitive recreation opportunities on the forest. Additional RWAs and additional primitive, undeveloped areas were identified. The increase of RWAs and the emphasis on undeveloped areas created a shift in the ROS classes, increasing the amount of primitive ROS classes in both summer and winter seasons in alternative D. Table 106 displays the summer ROS classes for alternative D. Table 107 displays the percent of each desired ROS class for summer in each GA.

Table 106. Forestwide ROS classes - summer (alternative D)

Desired ROS Classification	Acres	Percent of Total NFS Lands
Primitive	1,231,795	43
Semi-primitive nonmotorized	617,244	21
Semi-primitive motorized	341,327	12
Roaded natural	666,817	23
Rural	26,409	1
Urban	29	<1

Table 107. Percent of ROS class by GA in summer (alternative D)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	22	28	12	35	3	0
Castles	44	5	1	50	0	0
Crazies	43	19	26	12	0	0
Divide	30	26	11	30	3	0
Elkhorns	31	26	4	38	2	0
Highwoods	20	50	20	10	0	0
Little Belts	22	18	26	34	<1	0
Rocky Mountain Range	74	19	3	4	<1	0
Snowies	81	<1	6	13	<1	0
Upper Blackfoot	42	34	2	22	<1	0

Table 108 displays the winter ROS classes for alternative D. Table 109 displays the percent of each desired ROS class for winter in each GA.

Table 108. Forestwide ROS classes - winter (alternative D)

Desired ROS Classification	Acres	Percent of Total NFS Lands
Primitive	1,220,681	42
Semi-primitive nonmotorized	754,246	26
Semi-primitive motorized	715,347	25
Roaded natural	167,371	6
Rural	25,971	1

Desired ROS Classification	Acres	Percent of Total NFS Lands
Urban	29	<1

Table 109. Percent of ROS class by GA in the winter (alternative D)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	22	34	27	14	3	0
Castles	44	15	41	0	0	0
Crazies	43	28	29	0	0	0
Divide	30	18	29	20	3	0
Elkhorns	23	50	21	4	2	0
Highwoods	20	73	7	0	0	0
Little Belts	22	33	42	3	<1	0
Rocky Mountain Range	74	20	5	1	<1	0
Snowies	81	<1	19	<1	0	0
Upper Blackfoot	42	17	28	13	<1	0

Alternative E

Alternative E responds to comments received during pubic scoping asking the Forest to consider an alternative that did not identify RWAs and that increased the amount of NFS lands available for timber harvest. In response to these comments, Alternative E does not include any RWAs. Additionally, areas for timber production were identified. The ROS classes in alternative E shifted due to these changes, resulting in an increase in motorized ROS classes and a decrease in the amount of primitive ROS classes. Table 110 displays the summer ROS classes for alternative E. Table 111 displays the percent of each desired ROS class for summer in each GA.

Table 110. Forestwide ROS classes - summer (alternative E)

Desired ROS Classification	Acres	Percent of Total NFS Lands
Primitive	723,944	25
Semi-primitive nonmotorized	1,058,230	37
Semi-primitive motorized	244,040	8
Roaded natural	830,397	29
Rural	26,979	1
Urban	29	<1

Table 111. Percent of ROS class by GA in summer (alternative E)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	10	38	7	42	3	0
Castles	0	24	24	52	0	0
Crazies	0	59	25	16	0	0
Divide	0	50	1	45	4	0

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Elkhorns	0	56	4	38	2	0
Highwoods	0	71	18	11	0	0
Little Belts	8	29	19	44	<1	0
Rocky Mountain Range	58	35	3	4	<1	0
Snowies	75	4	0	21	<1	0
Upper Blackfoot	26	48	<1	26	<1	0

Table 112 displays the winter ROS classes for alternative E. Table 113 displays the percent of each desired ROS class for winter in each GA.

Table 112. Forestwide ROS classes - winter (alternative E)

Desired ROS Classification	Acres	Percent of Total NFS Lands
Primitive	710,422	25
Semi-primitive nonmotorized	1,181,189	41
Semi-primitive motorized	302,100	10
Roaded natural	662,234	23
Rural	27,670	1
Urban	29	<1

Table 113. Percent of recreation opportunity class by GA in the winter (alternative E)

GA	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural	Urban
Big Belts	10	46	9	32	3	0
Castles	0	21	35	44	0	0
Crazies	0	63	10	27	0	0
Divide	0	40	4	51	5	0
Elkhorns	0	73	21	4	2	0
Highwoods	0	92	8	0	0	0
Little Belts	8	45	11	36	<1	0
Rocky Mountain Range	58	36	5	1	<1	0
Snowies	64	3	13	20	0	0
Upper Blackfoot	26	30	19	25	<1	0

Conclusions

Alternative A, the no-action alternative, would not move the HLC NF toward meeting the purpose and need of the revised forest plan which is to provide a range of recreation opportunities using the ROS to display the allocations. The ROS system would continue to be used as a tool for the management of recreation but would not provide maps tied directly to the forest plan. Travel plans would continue to provide the direction for where motorized uses can and cannot occur, and future wilderness and other laws may determine where the various ROS classes may be located.

Alternatives B, C, D, and E each meet the purpose and need of the revised forest plan by mapping desired ROS settings as per the intent of the 2012 Planning Rule. All of the action alternatives would establish desired ROS classes for both summer and winter recreation settings. These ROS classes would provide overall guidance and set expectations for the recreation settings on the Forest. Desired ROS classes would aid the Forest in managing both existing and emerging recreation uses. Additionally, by establishing expected recreation settings early on, the public can clearly identify areas where their preferred recreation activity is allowed. Setting clear expectations and identifying a spectrum of settings for recreation users is important to the long-term management of recreation use on the Forest.

Table 114 describes the percent of each desired ROS class by alternative. Since the 1986 forest plans do not establish a range of specific ROS classes in alternative A, an estimate of the existing ROS classes was developed to be used for comparison purposes when examining all of the alternatives together.

Table 114. Percent of desired ROS classes

Alternative	Desired ROS classification	Summer - Acres	Summer - Percent of Total NFS Lands	Winter - Acres	Winter – Percent of Total NFS Lands
A	Primitive	758,131	26	744,609	26
	Semi-primitive nonmotorized	1,031,329	36	1,151,264	40
	Semi-primitive motorized	365,953	13	779,127	27
	Roaded natural	700,160	24	181,020	6
	Rural	28,018	1	27,595	1
	Urban	29	<1	29	<1
B	Primitive	846,121	29	846,121	29
	Semi-primitive nonmotorized	955,767	33	1,076,056	37
	Semi-primitive motorized	367,377	13	765,796	27
	Roaded Natural	686,186	24	167,925	6
	Rural	28,139	1	27,717	1
	Urban	29	<1	29	<1
C	Primitive	846,175	29	846,175	29
	Semi-primitive nonmotorized	956,076	33	1,095,868	38
	Semi-primitive motorized	367,323	13	745,984	26
	Roaded Natural	685,877	24	167,925	6
	Rural	28,139	1	27,717	1
	Urban	29	<1	29	<1
D	Primitive	1,231,795	43	1,220,681	42
	Semi-primitive nonmotorized	617,244	21	754,246	26
	Semi-primitive motorized	341,327	12	715,347	25
	Roaded Natural	666,817	23	167,371	6
	Rural	26,409	1	25,971	1
	Urban	29	<1	29	<1
E	Primitive	723,944	25	710,422	25
	Semi-primitive nonmotorized	1,058,230	37	1,181,189	41
	Semi-primitive motorized	244,040	8	302,100	10
	Roaded Natural	830,397	29	662,234	23
	Rural	26,979	1	27,670	1

Alternative	Desired ROS classification	Summer - Acres	Summer - Percent of Total NFS Lands	Winter - Acres	Winter – Percent of Total NFS Lands
	Urban	29	<1	29	<1

3.18 Recreation Opportunities

3.18.1 Introduction

To address both the challenges and opportunities in recreation management, the FS strives to provide a set of recreation settings, opportunities, and benefits that are sustainable over time. Sustainable recreation is defined as the set of recreation settings and opportunities on the NF that are ecologically, economically, and socially sustainable for present and future generations.

3.18.2 Regulatory framework

Please see the regulatory framework for Recreation Settings.

3.18.3 Assumptions

Since adoption of the 1986 plans, recreation activities within the plan area have changed. This analysis assumes that changes to recreational use patterns would occur naturally as a result of factors associated with recreation trends, advances in technology, aging population, aging infrastructure, and climatic changes.

3.18.4 Best available scientific information used

Please refer to the BASI description under the recreation settings section.

3.18.5 Affected environment

Sustainable recreation sites are generally managed on a continuum based on a development scale ranging from 1 to 5. Recreation sites with minimum to low or few site modifications are lower on the development scale (1-2) and are considered “dispersed” recreation sites. Recreation sites with higher site modification and infrastructure on the development scales (3-5) are considered “developed” recreation sites. Table 115 displays the development scale and provides a definition of each.

Table 115. Recreation site development scales

Development Scale	Definition	Developed or Dispersed	ROS Setting(s)
1	*Recreation sites with minimum site modification.* Rustic or rudimentary improvements designed for protection of the site rather than comfort of the users. Use of synthetic materials excluded. Minimum controls are subtle. No obvious regimentation. Spacing informal and extended to minimize contacts between users. Motorized access not provided or permitted.	Dispersed	Primitive
2	*Recreation sites with little site modification.* Rustic or rudimentary improvements designed primarily for protection of the site rather than the comfort of the users. Use of synthetic materials avoided. Minimum controls are subtle. Little obvious regimentation. Spacing informal and extended to minimize contacts between	Dispersed	Semi-primitive nonmotorized and

Development Scale	Definition	Developed or Dispersed	ROS Setting(s)
	users. Motorized access provided or permitted. Primary access over primitive roads. Interpretive services informal.		Semi-primitive motorized
3	*Recreation sites with moderate modification.* Facilities about equal for protection of natural site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surfaced and trails formalized. Development density about three family units per acre. Primary access may be over high standard roads. Interpretive services informal, but generally direct.	Developed	Roaded Natural
4	*Recreation sites that are heavily modified*. Some facilities designed strictly for comfort and convenience of users. Luxury facilities not provided. Facility design may incorporate synthetic materials. Extensive use of artificial surfacing of roads and trails. Vehicular traffic control usually obvious. Primary access usually over paved roads. Development density about three to five family units per acre. Plant materials usually native. Interpretive services often formal or structured.	Developed	Rural
5	*Recreation sites with a high degree of site modification.* Facilities mostly designed for comfort and convenience of users and usually include flush toilets; may include showers, bathhouses, laundry facilities, and electrical hookups. Synthetic materials commonly used. Formal walks or surfaced trails. Regimentation of users is obvious. Access usually by high-speed highways. Development density about five or more family units per acre. Plant materials may be foreign to the environment. Formal interpretive services usually available. Designs formalized and architecture may be contemporary. Mowed lawns and clipped shrubs not unusual.	Developed	Urban

The health and resiliency of the HLC NF’s natural resources are critical to the sustained delivery of their nature-based recreational settings and opportunities. Without healthy resilient landscapes and habitats, many of the recreation opportunities that have historically been enjoyed would not be sustainable. Obvious linkages exist between the types of activities being pursued and the presence and condition of the natural resources.

The HLC NF’s recreation programs contribute to the economic sustainability of Central Montana’s rural communities. Hunting is the primary reason visitors come to the Forest (U.S. Department of Agriculture, Forest Service, 2013b). Both jobs and revenue directly and indirectly result from visitors traveling to the Forest. The remoteness of the forests’ recreational settings encourages visitors to stop and buy groceries, gas, and other supplies to support their off-highway vehicle, stock, backpacking, boating, and biking experiences before entering the Forest. More direct jobs and revenue are associated with the Forests’ outfitter- guide operations, downhill ski areas, and visitors to the Lewis and Clark National Historic Trail Interpretive Center.

Developed recreation

Developed recreation opportunities are located throughout the plan area but are primarily concentrated in the roaded natural and rural ROS settings. Developed recreation opportunities are located at specific locations or “sites” and have infrastructure or features that have been designed for health and safety and to facilitate visitor comfort. The types of features and infrastructure often offered at developed sites include developed roads and parking areas, toilets, tables, fire rings, water systems, interpretive signs, and/or fee stations. Depending upon the location and the type of opportunity offered, these developed sites may or may not have fees associated with them. All of these developed sites are FS operated and maintained. There are no developed recreation facilities operated by concessionaire within the plan area. Ski areas, which have considerable development and infrastructure, are developed recreation sites managed under recreation special use permit. See map in appendix A.

The most common developed sites within the plan area are campgrounds, picnic areas, trailheads, cabin and lookout rentals, ski areas (both Nordic and alpine), interpretation sites, fishing sites, and boating sites. Most of the developed recreation sites are located along main roads and travel ways. Water-based recreation sites are located adjacent to the lakes or rivers on which the activities take place.

The Lewis and Clark National Historic Trail Interpretive Center is also considered a developed recreation opportunity within the plan area and is located outside of the forest boundary in the community of Great Falls, Montana.

One of the most unique developed recreation opportunities offered within the plan area is the rental of a cabin or lookout. Currently, there are 17 cabins/lookouts available to rent within the plan area. These cabins range from being more rustic to those that have more modern conveniences. A number of these properties are also listed on the National Register for Historic Places.

Table 116 displays the existing developed recreation site types currently managed by the HLC NF. These recreation opportunities are arranged by GA to show their distribution and location.

Table 116. Existing developed recreation site types by GA

Site Type	Big Belts	Castles	Crazies	Divide	Elkhorns	Highwoods	Little Belts	Rocky Mountain Range	Snowies	Upper Blackfoot	Outside of GA	TOTAL
Boating Site	3	-	-		-	-	-	2	1	-	-	6
Campground	4	2	1	4	-	1	18	12	1	2	-	45
Group Campground	1	-	-	2	-	-	1	-	1	1	-	6
Horse Campground	-	-	-	-	-	-	1	4	-	1	-	6
Picnic Site	3	-	-	2	-	-	1	1	1	-	-	8
Group Picnic Site	2	-	-	2	-	-	1	-	-	1	-	6
Fishing Site	1	-	-		-	-	1	-	-	-	-	2
Interpretive Center	-	-	-	-	-	-	-	-	-	-	1	1
Interpretive Site	5	-	-	3	-	-	4	-	-	1	2	15
Observation Site	1	-	-	1	-	-		1	-	-	-	3
Cabin/Lookout	4	-	-	2	2	-	6	2	1	1	-	18
Ski Area Alpine	-	-	-	-	-	-	1	1	-	-	-	2
Ski Area Nordic	1	-	-	1	-	-	1	-	-	-	-	3
Snow Park (snowmobile)	1	-	-	3	-	-	3	-	-	-	-	7
Trailhead	22	-	-	8	12	1	9	13	2	17	-	84
Scenic Byway Interpretation	-	-	-	1	-	-	-	-	-	-	2	3
Grand Total	**48**	**2**	**1**	**29**	**14**	**2**	**47**	**36**	**7**	**24**	**5**	**215**

Dispersed recreation

Dispersed recreation includes the full suite of recreation opportunities that take place outside of developed recreation sites. Dispersed recreation activities generally do not have fees associated with them and little or no facilities such as toilets, tables, or garbage collection. Common dispersed recreation activities within the plan area include, but are not limited to, camping, hunting, fishing, hiking, off-highway vehicle use, rock climbing, mountain biking, wildlife viewing, photography, cross-country skiing, snowmobiling, snowshoeing, dog sledding, visiting historic sites, viewing scenery, driving for pleasure, and exploring. The majority of forest visitors come to the plan area to engage in dispersed recreation activities. Once on the Forest, over 57 percent of visitors participate in some type of dispersed recreation (U.S. Department of Agriculture, Forest Service, 2013b).

Even though dispersed recreation activities happen across all ROS classes, most of the specific dispersed recreation sites (such as campsites) are typically concentrated in the Forests' roaded natural and semi-primitive motorized ROS settings.

Dispersed camping

Dispersed camping is heaviest during the summer holidays (Memorial Day, Fourth of July, and Labor Day weekends) and during bow and general rifle hunting seasons. For both types of dispersed camping users (general and intense) there are places within the plan area where minor site improvements have been made to protect the resource and to reduce the useable area within dispersed sites. GAs such as the Little Belts and the Big Belts have a higher percentage and density of dispersed hunting camps than GAs such as the Elkhorns and the Highwoods that have special tag drawings and receive fewer hunters by comparison.

Another issue associated with dispersed recreation, is the unauthorized creation by the public of new campsites, trails, and/or facilities within the general forest area. In 2009, USFS Region 1 began developing a standardized protocol for inventorying and monitoring resource conditions of dispersed recreation, concentrating on dispersed camping sites.

Dispersed day use activities

Common dispersed day use recreation throughout the plan area includes hunting, driving for pleasure, viewing natural features, photography, bird watching, target shooting, fishing, cross-country skiing, dog sledding, snowshoeing, and others. These activities can happen with individual visitors or with groups of people and tend to occur primarily on the weekends over the course of the year.

In general, these dispersed activities have remained fairly consistent in the past 10 years with a couple of exceptions. Snow shoeing has seen a slight increase with more users noticed on weekends. Recently, snow shoe trails were added to the Silvercrest Cross Country Ski area within the Little Belts GA to address this increased use. District personnel have also noted a slight increase in dog sledding activities. There has been an increase in the number of hunters during archery season, which has created a longer period of use at dispersed hunting camps but has also increased the amount of day use that is taking place across the plan area.

Areas of concentrated dispersed use have seen an increase in the amount and distribution of trash and resource damage to natural resources.

3.18.6 Environmental consequences

Effects common to all alternatives

In all alternatives, natural disturbances, recreation trends and use patterns, and emerging technologies would continue to influence the specific type, amount, and location of recreation opportunities across the

Forest. Travel plans would continue to provide site-specific direction for where motorized recreational uses can take place. Dead and dying trees and other natural occurrences may impact the location and availability of some areas for recreation use. The health and safety of the recreating public would continue to influence recreation management, particularly at developed recreation sites, where visitor use is concentrated.

Effects common to all action alternatives

Plan components developed for recreation opportunities would remain the same in all action alternatives. See Table 117.

Table 117. Summary of revised plan components for recreation opportunities (alternatives B-E)

Plan component	Expected effects
FW-REC-DC-01	This desired condition highlights the need to connect people to the natural and cultural/historic environments in which they recreate.
FW-REC-DC-02	This desired condition focuses on the need to contribute, by providing a variety of recreation opportunities, to the economic stability of the Central Montana area.
FW-REC-DC-03	This desired condition provides direction for the strategic placement of developed recreation sites and facilities to accommodate recreation uses and to protect the natural and cultural resources of the Forest.
FW-REC-DC-04	This desired condition recognizes cabin and lookouts rentals as a valued and unique recreation opportunity on the Forest.
FW-REC-DC-05	Vegetation within developed recreation sites would be managed to ensure the health and resiliency of the trees and the health and safety of the pubic.
FW-REC-DC-06	This desired condition recognizes dispersed camping as a valued and unique recreation opportunity and provides direction for the long-term management of this recreation use.
FW-REC-GO-01	This goal provides for the operation, maintenance, and delivery of recreation facilities and programs, and information, education, and visitor services while incorporating the support of partnerships and volunteer groups.
FW-REC-OBJ-01	This objective would improve dispersed recreation camping opportunities in areas that have seen damage to natural and cultural resources due to overuse.
FW-REC-OBJ-02	This objective would improve the accessibility of developed recreation sites and programs on the Forest.
FW-REC-GDL-01	The guideline addresses the need to assess changes in the environment that may require changes in the location and availability of recreation opportunities.
FW-REC-GDL-02	This guideline acknowledges that vegetative management in areas where there is concentrated recreation uses should be done in an aesthetic manner and should be tied to desired SIOs.
FW-REC-GDL-03	This guideline provides direction for the groundwater use developments associated with recreation opportunities in riparian areas on the Forest.
FW-REC-GDL-04	This guideline provides direction for the placement of new recreation facilities and infrastructure within expected long-term channel migration zone to reduce potential impacts to fishery resources.
FW-REC-GDL-05	This guideline provides direction for the potential removal of some recreation facilities from riparian areas.
FW-REC-GDL-06	The guideline provides direction on managing roadside vegetation at developed recreation facilities to reduce human-animal interactions.
FW-REC-GDL-07 and 08	These guidelines emphasizes that recreation facilities, for both developed and dispersed recreation sites, should be consistent with desired ROS classes.
FW-REC-GDL-09	This guideline states that minor developments may be necessary at dispersed recreation sites to protect environmental or cultural resources.

Plan component	Expected effects
FW-REC-SUIT-01	Managing trees for timber production would not be suitable in developed recreation sites; however, trees may be cut down to address safety concerns or other resource concerns that would affect the recreating public.
FW-REC-SUIT-02	Developed recreation sites would not be suitable for saleable mineral activities, unless the material is used onsite for administrative purposes.
FW-REC-SUIT-03	Developed recreation sites would be protected from the impacts that can be created by livestock grazing.

An issue brought forward during public scoping was the overall aging of the American public and the need for the FS to provide additional accessibility. The FS is required to meet all law and policy related to accessibility. Developed recreation sites in all alternatives would be upgraded to comply with law and policy. Dispersed recreation sites are not required by law to meet accessibility standards. Neither is it policy or law to provide motorized access to areas that are closed to motorized recreation use in order to meet accessibility standards.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities related to watershed, soil, riparian, or aquatic habitat improvements would have effects on developed and dispersed recreation opportunities on the HLC NF. The plan components that would have the greatest influence on recreation opportunities under the action alternatives are those associated with RMZs. East of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative.

Many developed and dispersed recreation sites are located in RMZs and near sources of water across the forest. Aquatic and soil management activities may have an impact on developed and dispersed recreation. Existing recreation sites may be hardened with gravel to reduce impacts to bare soil and/or areas may be confined with parking barrier to keep the recreation public out of sensitive resource areas. New construction of developed recreation sites, including considerations for outhouse location and water systems, would need to meet more stringent requirements. Vegetation management that may occur within recreation areas would also need to meet RMZ plan components. Where possible recreation sites and facilities would be located outside of RMZs. Plan components in the revised plan encourage the removal or relocation of recreation facilities that are currently within RMZs if they are degrading aquatic or riparian resources.

In summary, all action alternatives provide direction and guidance for the management of recreation opportunities to protect watershed, soil, riparian and aquatic habitats, most specifically within RMZs. The area on which these components apply is greater with the action alternatives than with the no-action alternative on landscapes east of the Continental Divide. These components may limit or restrict the development of certain recreation opportunities or facilities within RMZs, and over time may decrease the number of recreation facilities found in those areas.

Fire and fuels management

Unplanned and prescribed fires would continue to affect the long-term ecological processes across recreation settings and may impact the location and availability of recreation opportunities on the Forest. Fire could create a temporary loss of vegetation, reduction in water quality due to sedimentation, reduction in recreation access to some recreation opportunities, and air pollution which could cause displacement of some forest visitors to other areas on the forest or to other forests in the region.

Timber and vegetation management

Timber management would continue on lands suitable for timber production. These activities may be noticeable from within developed recreation sites. Additionally, dispersed recreation sites may be located within or very near timber harvest units which may create concerns about health and safety and may cause visitors to relocate until activities are complete.

Livestock grazing and management

Generally, the grazing of livestock is not allowed within developed recreation sites and many developed recreation sites are surrounded by fencing to ensure grazing occurs outside of these areas. However, grazing is more common within or near dispersed recreation sites where fences are less common and where there are fewer constructed recreation features. The action alternatives provide suitability direction for the management of grazing within developed recreation sites.

Wildlife management

Activities related to wildlife improvements and management would affect recreation opportunities across the HLC NF. Most notable is direction for food storage for bears in developed sites and at outfitter guide camps. Additionally, the grizzly bear amendment establishes direction for the development of future recreation opportunities in some GAs of the forest.

Cultural, historic, and tribal resource management

There are many historic lookouts and cabins across the HLC NF that are rented and used for recreational purposes. These sites contribute to the variety of developed recreation opportunities offered on the Forest. Future expansion of the lookout and cabin rental program may include additional historic structures.

Additionally, many existing developed and dispersed sites are located on or near landscapes that have cultural significance on the Forest. Expansion of developed sites or development of dispersed sites may impact these cultural/historic landscapes.

All action alternatives provide plan components that would protect and enhance these cultural and historic resource values.

Road access and infrastructure

Most developed and dispersed recreation sites are accessed from open roads and trails. Infrastructure, usually buildings, site furniture, and water systems, is generally found at the most developed recreation sites. Deferred maintenance has been an issue as facilities and recreation sites age. Travel plans establish where motorized use can or cannot take place and support and help maintain ROS settings for both summer and winter.

All action alternatives developed plan components that provide future direction for road access and the construction/reconstruction and maintenance of infrastructure across the Forest.

Minerals management

Areas with active mining may impact the recreation settings of the area immediately surrounding the mining area. The action alternatives provide suitability direction for the management of saleable mineral activities within developed recreation sites.

Alternative A, no action

In the no-action alternative, recreation opportunities would continue to be managed under the 1986 Helena and Lewis and Clark Forest Plans. Both of these plans provide direction for developed recreation and motorized and non-motorized dispersed recreation. Additionally, the 1986 plans provide very limited direction for the management of cabin and lookout rentals, and there is no direction for the management of the Lewis and Clark National Historic Trail Interpretive Center. In alternative A, travel plans would continue to provide the direction for where motorized uses can occur, and wilderness and other laws may determine where various recreation facilities and opportunities occur. Table 118 displays the plan components in the 1986 plans that provide direction for recreation opportunities on the HLC NF.

Table 118. Summary of existing plan components for recreation opportunities

Plan component	Expected effects
1986 Helena NF Plan; Forest-wide Management Direction, Goals 1 and 2, Page II/1.	These plan components provides for a range of outdoor recreation opportunities, including motorized and non-motorized opportunities.
1986 Helena NF Plan; Objectives, Resource Activity/Summaries; Recreation, Page II/2.	This objectives emphasizes using Recreation Opportunity Guides to communicate recreation opportunities to the public. It also speaks to emphasizing dispersed recreation opportunities, including both motorized and non-motorized opportunities. This objective also encourages the use of partnerships with private, State and other federal agencies to provide recreation opportunities and to close, eliminate, or relocate recreation opportunities that are no longer needed or no longer cost efficient.
1986 Helena NF Plan, Forest-wide Standards, Recreation 1, 3, and 5, Page II/14 through II/15.	Recreation Standard 1: This standard aims to maintain existing developed sites while encouraging dispersed recreation opportunities. New developed recreation facilities shall generally not be constructed and removal of some developed recreation sites may be necessary to meet other recreation needs. Recreation Standard 3: Recreation opportunity guides were developed that described the primary recreation opportunities on each ranger district. Recreation Standard 5: The "Pack-in Pack-out" policy is emphasized in dispersed recreation and wilderness areas.
1986 Helena NF Plan, Management Areas, Pages III/3 through III/92.	Each of the management areas provides direction for recreation opportunities.
1986 Lewis and Clark NF Plan Forest-wide Objectives, Resource Activity Summaries, Recreation; Page 2-4.	This objectives emphasizes using Recreation Opportunity Guides to communicate recreation opportunities to the public. Dispersed recreation opportunities would be emphasized. "Pack-in Pack-out" would be encouraged. An increase in winter trails programs, winter cabin rentals, camping, picnicking, and other developed site opportunities are expected.
1986 Lewis and Clark NF Plan, Forest-wide Standards, A-1, A-2, and A-5, Pages 2-25 through 2-26.	A-1 Recreation Information: Use recreation opportunity guides to describe the primary recreation opportunities on each ranger district. A-2 Developed Recreation: Provides guidance for developed recreation opportunities. A-5 Winter Dispersed Recreation Opportunities: Provides direction for both motorized and non-motorized winter snow trails.
1986 Lewis and Clark NF Plan Management Areas, Pages 3-3 through 3-104.	Each of the MAs provides general direction for recreation opportunities.

Alternatives B – E

See effects common to all action alternatives, above.

Cumulative Effects

There are a wide variety of recreation opportunities in the central Montana area and the HLC NF contributes substantially to those opportunities. In addition to the recreation experiences that the HLC NF offers, other recreation opportunities exist on lands managed by: MTDFWP; the BLM; the National Park Service, and private organizations such as the Nature Conservancy. Coordination with other agencies and organizations to provide recreation opportunities would continue to be necessary to meet public demands.

Conclusions

The specific number and kind of developed recreation facilities and the number of dispersed recreation sites would not vary in any of the alternatives, including alternative A. However, the action alternatives would include plan components that would provide additional direction for the construction of new recreation sites in riparian areas, the development of future water supplies, the management of dispersed recreation, and the management of cabin and lookout rentals.

By providing the plan components outlined in the action alternatives, the HLC NF would meet the purpose and need of the revised forest plan, ensuring that recreation opportunities are ecologically, economically, and socially sustainable for present and future generations.

3.19 Recreation Special Uses

3.19.1 Introduction

Recreation special use permits provide for occupancy and use of the NF through issuance of permits. Permitted recreation uses provide specific recreational opportunities to the public and deliver economic benefits to rural economics.

3.19.2 Regulatory framework

Please see the regulatory framework for Recreation Settings.

3.19.3 Assumptions

Since adoption of the 1986 plans, recreation activities within the plan area have changed. This analysis assumes that changes to recreational use patterns would occur naturally as a result of factors associated with recreation trends, advances in technology, aging population, aging infrastructure, and climatic changes.

3.19.4 Best available scientific information used

Please refer to the BASI description under the recreation settings section.

3.19.5 Affected environment

The HLC NF has both commercial and non-commercial recreation permits. Table 119 gives a summary of the number and kinds of recreation special use permits currently managed by the HLC NF.

Table 119. Summary of recreation special uses permits by GA

GA	Recreation Residences	Organization Camps	Resorts	Ski Areas	Outfitter and Guides
Big Belts	-	-	-	-	4
Castles	1	-	-	-	1
Crazies	-	-	-	-	2
Divide	11	1	-	-	1
Elkhorns	-	-	-	-	1
Highwoods	3	-	-	-	-
Little Belts	58	1	-	1	21
Rocky Mountain Range	98	-	4	1	19
Snowies	-	-	-	-	-1
Upper Blackfoot	1	-	-	-	7
Totals	**172**	**2**	**4**	**2**	**57**

Recreation special events

The HLC NF also provides recreation special use permits for recreation special events on the Forest (Table 120). Special event permits are issued to groups or organizations for events that are short-lived or temporary in nature.

Table 120. Number of recreation special use permits issued for special events by ranger district from 2013 through 2017

Ranger District	2013	2014	2015	2016	2017
Helena	7	4	1	5	4
Lincoln	3	4	2	5	4
Townsend	0	0	0	1	0
Belt Creek-White Sulphur Springs	4	1	5	6	2
Judith-Musselshell	0	2	3	3	3
Rocky Mountain	0	0	0	0	0

3.19.6 Environmental consequences

Effects common to all alternatives

In all alternatives, natural disturbances, recreation use patterns, and emerging technologies would continue to influence the need for recreation special use permits across the Forest. Vegetative conditions can seriously impact the location and infrastructure of recreation special uses. Additionally, the condition of aging infrastructure can have both long and short-term effects to permit holders. Emerging technologies as well as shifts and changes in recreational interests can influence the kinds and location of special uses on the landscape.

Effects common to all action alternatives

Plan components developed for recreation special uses would remain the same in all action alternatives and provide general guidance for recreation special uses. Specific guidance regarding individual permits would remain a part of the permit process. Direction for overall forest capacity and needs assessments would occur outside of the forest planning process. The revised forest plan would not set limits on number and kind of special uses provided on the HLC NF in any of the action alternatives.

Table 121 summarizes the expected effects of each plan component related to recreation special uses.

Table 121. Summary of proposed plan components for recreation special uses

Plan component	Expected effects
FW-RSUP-DC-01	Recreation special uses would provide unique opportunities, services, and experiences depending upon a demonstrated demand for a specific recreation opportunity.
FW-RSUP-DC-02	Recreation special uses would provide services while ensuring public health and safety and the protection of natural and cultural resources.
FW-RSUP-DC-03	This desired condition recognizes that recreation special uses contribute to the local economy and must remain compatible with ecological and social capacity thresholds.
FW-RSUP-DC-04	This desired condition highlights the historic values of buildings under special use permit while providing for permitted uses to occur.
FW-RSUP-DC-05	Vegetative management would be used to provide for public health and safety and the protection of permitted uses and facilities.
FW-RSUP-GDL-01	This guideline provides direction for the development of permits that reduce conflict with other users and natural resources.

Effects from Forest Plan Components Associated With:

Aquatic ecosystems and soil management

Plan components and activities related to watershed, soil, riparian, or aquatic habitat improvements would have effects to some recreation special use permits. The plan components that would have the greatest influence on recreation opportunities under all action alternatives are those associated with RMZs. East of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative. Please refer to the RMZ section.

Many special use permits require access to areas located within RMZs and near sources of water. Where possible recreation special uses would be located outside of RMZs. Plan components for RMZs would limit road construction and vegetation management activities that could occur in association with special use permits.

All action alternatives provide direction and guidance for the management of recreation special uses to protect watershed, soil, riparian and aquatic habitats, most specifically within RMZs. The area on which these components apply is greater with the action alternatives than with the no-action alternative on landscapes east of the Continental Divide.

Fire and fuels management

Unplanned and prescribed fires would continue to affect the long-term ecological processes across the HLC NF. Fire could create a temporary loss of vegetation, reduction in water quality due to sedimentation, reduction in recreation access to some areas, and air pollution which could cause displacement of some forest visitors to other areas on the forest or to other forests in the region.

Timber and vegetation management

Timber and vegetation management activities would occur on lands suitable for timber production. These activities may be noticeable from areas where recreation special uses area taking place. In some cases, such as downhill ski permit areas, vegetation management is an effective tool for creating additional opportunities and/or protecting forest visitors (i.e. hazard tree removal on ski runs). All action alternative include plan components for the management of vegetation around developed recreation sites and permanent structures associated with recreation special uses.

Livestock grazing and management

Generally, the grazing of livestock associated with recreation special uses is allowed within areas associated with the recreation special use permits. The action alternatives provide suitability direction for the management of grazing within developed recreation sites and associated with recreation special uses.

Wildlife management

Activities related to wildlife improvements and management would affect recreation special uses across the HLC NF. Most notable is direction for food storage for bears in developed sites and at outfitter guide camps. Additionally, the grizzly bear amendment establishes direction for the development of future recreation opportunities in some GAs of the forest.

Cultural, historic, and tribal resource management

Many of the recreation residences and resorts on the HLC NF are historic and have a need to be managed for their historic values in addition to their recreational values. Future expansion and remodeling of these requires additional planning and approval to ensure that historic values are not damaged. All action alternatives provide plan components that would protect and enhance the historic resource values associated with recreation special use permits.

Road access and infrastructure

All action alternatives developed plan components that provide future direction for road access and the construction/reconstruction and maintenance of historic buildings and infrastructure associated with recreation special use permits on the Forest.

Alternative A, no action

In the no-action alternative, recreation special uses would continue to be managed under the guidance provided in the 1986 Helena and Lewis and Clark Forest Plans. See Table 122.

Table 122. Summary of existing plan components for recreation special uses

Plan component	Expected effects
1986 Helena NF Plan, Forest-wide Standards, Recreation (7) Page II/15.	"Outfitter and guide use will generally be maintained at a level determined from the highest of 2 years of actual use experienced during the period 1979-1983. Applications for new special use permits will be considered on a case-by-case basis with consideration for resource limitation and public need." This standard provides specific direction for the management of the special uses program. It also does not allow for new or additional information on recreation special uses beyond the year 1983 and may not be including the variety of special use requests that the HLC NF currently receives.
1986 Helena NF Plan, Appendix O, Pages O/1 and O/2.	Provides guidance for special uses and subdivisions including: "occasional" events, commercial recreation developments, and recreation cabins on the forest. This appendix does not include direction for all recreation special uses on the forest and leaves forest managers flexibility for determining the needs of permits on case-by-case basis.
1986 Lewis & Clark NF Plan, Forest-wide Objectives, Resource/Activity Summaries Recreation, Page 2-4.	"Recreation residence permits will be continued except where there are substantial conflicts with public needs or resources values." This objective does not provide guidance for the special needs of historic values of recreation residences. Additionally there are no objectives for other recreation special use permits.
1986 Lewis & Clark NF Plan, Forest-wide Standards, Recreation Residences A-3, Travel Shelters A-4, Winter Dispersed Recreation A-5, Land Uses J-3 (3) and (7) Pages 2-26 and 2-62.	These standards provide direction for recreation residences, travel shelters, and winter dispersed recreation opportunities. Specifically, Standard A-3 outlines the use of FSM 2720 for the administration of recreation residence permits. Standard A-4 authorizes the use of permits to developing travel shelters. Standard A-5 encourages cooperative agreements for motorized and non-motorized winter snow trails. Standard J-3 provides direction for a number of kinds of special uses. Relevant to recreation, (3) states that special uses will be provided to support Forest goals and objectives and (7) provides direction to maintain the number of outfitter-guide permits to the 1984 level, but to consider new outfitter-guide permits on a case-by-case basis.

Alternatives B – E

See effects common to all action alternatives.

Conclusions

In alternative A, the special uses program would continue to be managed by the direction provided in the 1986 Helena and Lewis and Clark Forest Plans. Direction in the 1986 plans focuses primarily on recreation residents and outfitter and guides, and does not provide guidance for other recreation special uses such as ski areas, resorts, organization camps, or special events.

Under the action alternatives, the Draft Plan components would provide overall direction for the management of all recreation special uses across the HLC NF. Specific guidance regarding individualized permits would remain a part of the permit process. To be responsive to the frequent changes and flexible in the overall management of the recreation special uses program, direction for overall forest capacity and needs assessments would occur outside of the forest planning process.

By providing the plan components outlined in the action alternatives, the HLC NF would meet the purpose and need of the revised forest plan, ensuring that recreation special uses are ecologically, economically, and socially sustainable for present and future generations.

3.20 Recreation Access

3.20.1 Introduction

Access to and through the forest is facilitated year round, and in a number of ways. Visitors select their access based on their preferred setting, experience, and mode of transportation. Roads, motorized trails, nonmotorized trails, rivers, and airstrips penetrate the forest for visitors to walk, bike, boat, ride, drive, or fly to their destinations.

This section reviews the effects of the plan components associated with recreation access. These effects are measured by the following indicators:

- Miles of open road
- Miles of motorized trail
- Miles of trail open to mechanized means of transport
- Miles of groomed trail
- Acres open to motorized over-snow uses

3.20.2 Regulatory framework

Please see the regulatory framework for Recreation Settings.

3.20.3 Assumptions

Since adoption of the 1986 plans, recreation activities in the plan area have changed. This analysis assumes that changes to recreational use patterns would occur naturally as a result of factors associated with recreation trends, advances in technology, aging population, aging infrastructure, and climate changes.

3.20.4 Best available scientific information used

Please refer to the BASI description under the recreation settings section. All road and trail miles are derived from the Infrastructure database and are approximate.

3.20.5 Affected environment

Access to and through the forest is facilitated year round and in a number of ways. In many cases, travel routes destinations and these routes are often recognized by unique designations, such as scenic byways, historic trails, and WSRs. In other cases, forest access, through roads and trails, links local communities with forest settings and facilitates backyard recreation opportunities.

Travel plan direction

Travel plan direction has been established for all areas of the HLC NF. These travel plans provide direction to users as to which parts of the NF can be accessed for motorized recreation activities. Table 123 lists the name of the travel plans that provide direction for the HLC NF.

Table 123. Travel plans by GA

GA	Name of Travel Plan	Decision Signed (ROD or DN)
Big Belts	North Belts	2005
	South Belts	2007
	Winter South Belts	1999
Castles	Little Belts, Castles, and Crazies	2007
Crazies	Little Belts, Castles, and Crazies	2007
Divide	Divide Travel Plan	2016
	Soundwood	1998
	Clancy Unionville	2003
Elkhorns	Elkhorns Travel Plan	1995
Highwoods	Highwoods Access	1993
Little Belts	Little Belts, Castles, and Crazies	2007
Rocky Mountain Range	Badger Two Medicine	2009
	Birch Creek South	2007
Snowies	Big Snowies Access and Travel Management	2002
	Little Snowies Vegetative Management and Public Access	1993
Upper Blackfoot	Blackfoot Winter Travel Plan	2013
	Blackfoot Non-Winter Travel Plan	2017

Roads

Roads are the primary routes that recreationists use to access the HLC NF. Roads often provide direct access to recreational facilities. Forest travel plans dictate which roads are open and for how long. Table 124 displays the miles of road by GA and type of road access.

Table 124. Miles of road by GA and by type of road access

GA	Miles of Road Open Year Round	Miles of Road Open Seasonally	Miles of Road Closed Year Round	Total Miles of Road
Big Belts	172	201	333	705
Castles	64	9	3	76
Crazies	36	2	7	45
Divide	309	29	216	554
Elkhorns	75	96	116	286
Highwoods	11	0	1	12
Little Belts	504	351	166	1,020
Rocky Mountain Range	101	18	15	134
Snowies	44	7	34	85
Upper Blackfoot	244	135	193	571
Outside GA[1]	132	9	21	162
Totals	**1,690**	**855**	**1,105**	**3,650**

1. Miles of road outside of GA boundaries that the FS manages on private or other public lands.

Trails

Table 125 displays the miles of trails broken out by GA within the plan area. Trails are further identified by motorized trails, nonmotorized trails outside of wilderness, and wilderness trails.

Table 125. Miles of trail by GA and type of trail

GA	Miles of Motorized Trail	Miles of Non-motorized Trails Outside of Wilderness	Miles of Wilderness Trail	Total Miles Trail
Big Belts	62	107	39	208
Castles	87	15	0	102
Crazies	31	50	0	81
Divide	6	76	0	82
Elkhorns	9	102	0	111
Highwoods	28	10	0	38
Little Belt Mountains	470	226	0	696
Rocky Mountain Range	70	456	457	983
Snowies	13	105	0	118
Upper Blackfoot	36	77	98	211
Totals	**812**	**1224**	**594**	**2,630**

Groomed trails and motorized over-snow areas

The groomed trails on NFS lands are often only a small portion of a larger network of groomed trails that extend onto state, county, and private roads and lands. These trails are often groomed by local snowmobile clubs. In addition, the Forest has approximately 892,311 acres open for over-snow motorized use during the winter season. Table 126 shows the number of miles of groomed trails and where they are located on the Forest.

Table 126. Miles of groomed trail by GA

GA	Miles of Groomed Trail
Big Belts	73
Castles	0
Crazies	0
Divide	97
Elkhorns	0
Highwoods	0
Little Belt Mountains	278
Rocky Mountain Range	0
Snowies	0
Upper Blackfoot	86
Totals	**534**

Over-snow motorized use is very popular on the Forest. Table 127 displays the approximate acreages that are open for over-snow motorized uses on the HLC NF.

Table 127. Acres open to motorized over-snow use by GA

GA	Acres open to motorized over-snow recreation use
Big Belts	80,035
Castles	55,130
Crazies	21,292
Divide	114,340
Elkhorns	25,364
Highwoods	0
Little Belt Mountains	368,763
Rocky Mountain Range	27,653
Snowies	34,632
Upper Blackfoot	127,742
Total	**854,951**

Aviation recreation

Another recreation activity that receives considerable attention within the HLC NFs plan area and is growing in popularity is aviation recreation. Owners of small aircraft use backcountry air strips to access dispersed campgrounds or dispersed recreation areas. Table 128 displays these air strips and the GAs in which they are located.

Table 128. Airstrips and the GAs where they are located

GA	Name of Air Strip	Location
Little Belt Mountains	Russian Flats Backcountry Airstrip	T11N R11E Sections 7, 12, and 13
Rocky Mountain Range	Benchmark Backcountry Airstrip	T20N R10W Sections 15, 16, and 22
Upper Blackfoot	Lincoln Community Airport	T14N R08W Sections 19 and 20

3.20.6 Environmental consequences

Effects common to all alternatives

In all alternatives, natural disturbances, recreation use patterns, and emerging technologies would continue to influence recreation across these landscapes. Travel plans would continue to provide site-specific direction for where motorized and nonmotorized uses can take place. The three current airstrips would remain available under all alternatives.

Effects Common to all action alternatives

The plan components developed for recreation access would remain the same in all action alternatives. Desired ROS classes would provide a variety of recreation access opportunities across the HLC NF and travel plans would provide site-specific determinations on where motorized uses may occur. Table 129 summarizes the expected effects of each plan component related to recreation access.

Table 129. Summary of proposed plan components for recreation access

Plan component	Expected effects
FW-ACCESS-DC-01, 02, and 03	These desired conditions state that the forest would provide a variety of access options for recreation uses on system roads, trails, and airstrips, and that users stay on these designated systems to recreate.

Plan component	Expected effects
FW-ACCESS-DC-04	This desired condition states that facilities that support recreation access ensure the public health and safety and protect natural and cultural resources.
FW-ACCESS-GO-01	The FS works in cooperation with landowners, other agencies, and partners to provide legal access to public lands.
FW-ACCESS-GDL-01	Unauthorized recreation trails should be rehabilitated.
FW-ACCESS-GDL-02	Trailheads and airstrips should be strategically located to provide the best opportunities for recreation access.

Public commenters asked for the allowance of more access for recreation aviation activities, especially for provisions for airstrips or where motorized aircraft may take off and land. Access for recreation aviation activities would be determined by the ROS classes for the action alternatives. Please see the recreation settings section for further clarifications.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities related to watershed, soil, riparian, or aquatic habitat improvements would have effects recreation access on the HLC NF. The plan components that would have the greatest influence on recreation opportunities under all action alternatives are those associated with RMZs. East of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative.

In order to accomplish aquatic and soil management activities, recreation access routes, such as roads and trails, may be temporarily closed or rerouted. Where possible recreation access facilities, such as roads and trails, would be located outside of RMZs. Plan components for RMZs would limit road construction that could occur in association with recreation access.

All action alternatives provide direction and guidance to protect watershed, soil, riparian and aquatic habitats, most specifically within RMZs. The area on which these components apply is greater with the action alternatives than with the no-action alternative on landscapes east of the Continental Divide.

Fire and fuels management

Unplanned and prescriptive fires would continue to affect the long-term ecological processes across the Forest. These fire activities could create a temporary loss of vegetation, reduction in water quality due to sedimentation, or reduction in recreation access to some recreation opportunities on the Forest.

Timber and vegetation management

Timber management would continue on lands suitable for timber production. These activities may be noticeable from roads and trails across the forest. Additionally, temporary road and trail closures required to accomplish timber and vegetation management activities, may have short term impacts to recreation access.

Livestock grazing and management

Grazing of livestock is allowed within approved allotments across the Forest. There would be little to no effect of livestock grazing to recreation access on the Forest.

Wildlife management

Activities related to wildlife improvements and management would occur across the Forest. These activities are expected to have little to no affect to recreation access.

Alternative A, no action

Recreation access would continue to be managed under the 1986 Helena and Lewis and Clark Forest Plans. Travel plans would provide the direction for where motorized uses can and cannot occur, and wilderness and other laws may determine where various recreation facilities, such as trailheads and airstrips, occur. Table 130 describes the plan components in the 1986 Helena and Lewis and Clark Forest Plans that provide direction for recreation access.

Table 130. Summary of existing plan components for recreation access

Plan component	Expected effects
1986 Helena NF Plan, Objectives, Resource Activity/Summaries Facilities, Page II/6	This objective states that transportation facilities such as roads and trails would be constructed, managed, and maintained to cost effectively meet the Forest land and resource objectives and visitors' needs. This objective also talks about the integration and coordination of public and private with NF system roads and trails.
1986 Helena NF Plan, Forest-wide Standards, Facilities/Road Management, Facilities/Trails, Pages II/31 through II/33	The road management standards generally focus on the availability of roads, trails, and areas to motorized uses. This standard also provides criteria for road, trail, or area restrictions. The trails standards reference FSH 2309.18 and outline priority trails work as well as provides direction for construction, reconstruction, abandonment, and/or rerouting of trails.
1986 Helena NF Plan, Management Areas, Pages III/3 through III/97	Each of the management areas provides direction for recreation access, generally in discussions of roads and trails facilities.
1986 Lewis and Clark NF Plan, Forest-wide Objectives Facilities, Page 2-8	This objective states that transportation facilities, such as roads, trails and airfields, would be constructed, managed, and maintained to cost effectively meet the Forest land and resource objectives and visitors' needs. This objective also talks about the integration and coordination of public and private with NF system roads and trails. This objective ensures adequate and safe airfield facilities for the Forests' needs.
1986 Lewis and Clark NF Plan, Forest-wide Standards, Travel Planning L-2, Maintenance and Construction of Roads, Trails, and Other Facilities L-4, Pages 2-64 through 2-71.	These standards provide direction for road and trail facilities on the Forest. Specifically, Standard L-2 provides direction for the development of travel plans for roads and trails. Standard L-4 provides direction for the proper construction, reconstruction, and rehabilitation of roads and trails on the Forest.
1986 Lewis and Clark NF Plan, Management Areas, Pages III/3 through III/97.	Each of the management areas provides direction for recreation access, generally in discussions of roads and trails facilities.
1986 Lewis and Clark NF Plan, Appendix O, Roads and Trails Management	This table describes the amount of public access and the categories of trail management by management area. This table does not discuss winter trails or airstrip access.

Alternative B

The amount and location of RWAs in alternative B would have an effect on recreation access. In alternative B, nine (9) areas were identified as RWA. These nine RWAs are located within five GAs and total approximately 213,076 acres. Motorized uses and mechanized means of transport (including bicycles) would be considered unsuitable and would not be allowed in RWAs in alternative B.

Identification of RWAs would affect the number of roads, motorized trails, groomed snowmobile trails, and motorized over snow areas available for motorized recreation uses. Additionally, the number of non-motorized trails available for mechanical means of transport would also be affected.

Roads

Approximately 12 miles of open road would be closed in alternative B. These miles of open road are located in the Snowies GA. Table 131 displays the miles of road by GA and the type of road access that would be available in alternative B.

Table 131. Miles of road by GA by type of road access (alternative B)

GA	Miles of Road Open Year Round	Miles of Road Open Seasonally	Miles of Road Closed Year Round	Total Miles of Road
Big Belts	172	201	333	705
Castles	64	9	3	76
Crazies	36	2	7	45
Divide	309	29	216	554
Elkhorns	75	96	116	286
Highwoods	11	0	1	12
Little Belts	504	351	166	1,020
Rocky Mountain Range	101	18	15	134
Snowies	32	7	34	73
Upper Blackfoot	244	135	193	571
Outside GA[1]	132	9	21	162
Totals	**1,678**	**855**	**1,105**	**3,638**

1. Miles of road outside of GA boundaries that the FS manages on private or other public lands.

Trails

Access on approximately 0.1 mile of motorized trial would be closed in alternative B. This small segment of motorized trail is located in the Snowies GA. Additionally in alternative B, approximately 205.7 miles of nonmotorized trails would be closed to mechanized means of transportation, including bicycles. These trails are located within the Big Belts, Divide, Little Belts, Snowies and Upper Blackfoot GAs.

Table 132 displays the miles of trails broken out by GA within the plan area. Trails are further identified by motorized, nonmotorized/non-wilderness and wilderness trails.

Table 132. Miles of trail by GA and type of trail (alternative B)

GA	Miles of Motorized Trail	Miles of Non-Motorized Trails Outside of Wilderness	Miles of Wilderness Trail
Big Belts	62.0	88.1	39.0
Castles	87.0	15.0	0
Crazies	31.0	50.0	0
Divide	6.0	59.7	0
Elkhorns	9.0	102.0	0
Highwoods	28.0	10.0	0
Little Belts	470.0	213.1	0
Rocky Mountain Range	70.0	456.0	457.0

GA	Miles of Motorized Trail	Miles of Non-Motorized Trails Outside of Wilderness	Miles of Wilderness Trail
Snowies	12.9	6.7	0
Upper Blackfoot	36.0	17.8	98.0
Totals	**811.9**	**1,018.4**	**594.0**

Groomed trails and motorized over-snow areas

The number and location of groomed trails would not change in alternative B (Table 133); therefore, the miles of available groomed trail in alternative B would be the same as those described in alternative A, the no-action alternative.

Table 133. Miles of groomed trail by GA (alternative B)

GA	Miles of Groomed Trail
Big Belts	73
Castles	0
Crazies	0
Divide	97
Elkhorns	0
Highwoods	0
Little Belt Mountains	278
Rocky Mountain Range	0
Snowies	0
Upper Blackfoot	86
Totals	**534**

There are a number of motorized over-snow areas that are within identified RWAs in alternative B. Motorized uses in RWAs would not be suitable in alternative B and would not be allowed. Therefore, in alternative B the amount of motorized over-snow areas would be reduced by approximately 24,289 acres (11 acres in Divide GA, 13,144 acres in Big Snowies GA, and 11,134 acres in Upper Blackfoot GA). Table 134 displays the total acres of motorized over-snow areas that would remain open in alternative B.

Table 134. Acres open to motorized over-snow use by GA (alternative B)

GA	Acres open to motorized over-snow recreation use
Big Belts	80,035
Castles	55,130
Crazies	21,292
Divide	114,329
Elkhorns	25,364
Highwoods	0
Little Belt Mountains	368,763
Rocky Mountain Range	27,653
Snowies	21,488
Upper Blackfoot	116,608
Total	**830,662**

Alternative C

Alternative C was designed to address a number of comments received during public scoping of the proposed action. Specifically, alternative C addresses the desire to retain motorized uses and mechanized means of transport within RWAs. Alternative C includes the same nine (9) RWAs identified in alternative B, but allows for motorized uses and mechanized means of transport (including bicycles) to continue so long as these uses do not affect the wilderness characteristics within the RWAs.

In addition to allowing motorized and mechanized uses within RWAs in alternative C, a number of changes to ROS settings in the center of the Elkhorns and in the Cellar Creek area in the north end of the Divide GA would affect the recreation access in alternative C. Currently, identified areas with the Elkhorns and Cellar Creek area are open to motorized over-snow uses within a semi-primitive motorized ROS setting. In alternative C, the semi-primitive motorized setting would be changed to semi-primitive non-motorized and over-snow motorized uses would no longer be allowed. A reduction of approximately 30,949 acres of motorized over snow areas would occur in alternative C as a result of these ROS changes.

Also, minor changes to summer ROS classes in the Middle Fork Warm Springs drainage of the Elkhorns would change. These changes correct mapping errors found in alternative B but would have limited direct effect on recreation access.

Also in response to public comment, alternative C would prohibit the use of mechanical means of transport (including bicycles) in an area called the “Elkhorns Core” (map in appendix A). Closing this area to mechanical means of transport would support a remote, undeveloped “core” area within the Elkhorns that would allow only non-motorized and non-mechanized uses in both summer and winter. Approximately 60 miles of trails would be closed to mechanical means of transport in the Elkhorns core as a result of these closures.

Roads

There would be no road closures in alternative C. The miles of open road would remain the same as those in alternative A, the no action.

Trails

There would be no motorized trail closures in alternative C. There would, however, be approximately 60 miles of non-motorized trails within the Elkhorns Core area that would be closed to mechanized means of transportation, including bicycles. Table 135 displays the total miles of trails of motorized, non-motorized/non-wilderness, and wilderness trails by GA.

Table 135. Miles of trail by GA and type of trail (alternative C)

GA	Miles of Motorized Trail	Miles of Nonmotorized Trails Outside of Wilderness	Miles of Wilderness Trail
Big Belts	62	107	39
Castles	87	15	0
Crazies	31	50	0
Divide	6	76	0
Elkhorns	9	82	0
Highwoods	28	10	0
Little Belts	470	226	0
Rocky Mountain Range	70	456	457

GA	Miles of Motorized Trail	Miles of Nonmotorized Trails Outside of Wilderness	Miles of Wilderness Trail
Snowies	13	105	0
Upper Blackfoot	36	77	98
Totals	**812**	**1,204**	**594**

Groomed trails and motorized over-snow areas

There are no groomed trails in RWAs in alternative C; therefore, the miles of available groomed trail in alternative C would remain the same as those described in alternative A.

Motorized over-snow uses would continue to be allowed within RWAs in alternative C. However, there would be a reduction of approximately 30,949 acres of motorized over snow use as a result of changes to the winter ROS classes outside of RWAs. These changes would occur in the center of the Elkhorns GA (reduction of 17,878 acres) and in Cellar Creek in the Divide GA (reduction of 13,071 acres). In these areas, semi-primitive motorized areas would be changed to semi-primitive nonmotorized areas and motorized over-snow uses would no longer be allowed. Table 136 displays the total acres of motorized over-snow areas that would remain open in alternative C.

Table 136. Acres open to motorized over-snow use by GA (alternative C)

GA	Acres open to motorized over snow recreation use
Big Belts	80,035
Castles	55,130
Crazies	21,292
Divide	101,268
Elkhorns	7,486
Highwoods	0
Little Belt Mountains	368,763
Rocky Mountain Range	27,653
Snowies	34,632
Upper Blackfoot	127,742
Total	**824,001**

Direct effects

In alternative C, approximately 60 miles of non-motorized trails in the core of the Elkhorns GA would be closed to mechanical means of transportation (including bicycles). Table 137 lists these trails.

Table 137. Nonmotorized trails closed to mechanized means of transport in the core of the Elkhorns GA (alternative C)

Trail Number	Trail Name	Miles
101	Eagle Interpretive	0.2
109	Crow Creek	4.54
110	Poe Park	2.25

Trail Number	Trail Name	Miles
112	Longfellow Clear Creek	8.7
113	Elk Park	4.16
114	Moose Creek	3.09
115	Beaver Creek	7.32
116	Sheep Park	1.83
117	Pole Creek	0.5
127	South Crow Lakes	1.3
129	Manley Park	0.8
130	Little Tizer Creek	1.66
131	Leslie Lake	1.77
133	Crazy Creek Longfellow	2.96
134	Falls Creek	1.85
135	Long Park	2.72
301	Montgomery Park	4.03
302	McClellan Creek	5.32
343	Casey Meadows	3.7
344	Jackson Creek	0.66
374	Casey Peak	1.09
TOTAL		60.46

Alternative D

Alternative D responds to comments received during pubic scoping asking the Forest to consider an alternative that increased the amounts of RWAs and primitive recreation opportunities on the forest. Additional RWAs and additional primitive, undeveloped areas are identified in alternative D.

Motorized recreational uses and mechanized means of transport (including bicycles) would not be suitable within RWAs in alternative D. This alternative would see a decrease in the miles of open road, motorized trails, nonmotorized trails open to mechanized transport (including bicycles), groomed trails, and acres open to motorized over-snow uses.

Alternative D also identifies additional primitive, undeveloped areas outside of RWAs. Motorized uses would also not be suitable in these primitive undeveloped areas; however, mechanical means of transportation (including bicycles) would be allowed.

Roads

Approximately 22.8 miles of open road would be closed in alternative D. Road closures would occur in the Big Belts, Castles, Little Belt Mountains, Big Snowies, and Divide GAs. Table 138 displays the miles of road by GA and the type of road access that would be available in alternative D.

Table 138. Miles of road by GA by type of road access (alternative D)

GA	Miles of Road Open Year Round	Miles of Road Open Seasonally	Miles of Road Closed Year Round	Total Miles of Road
Big Belts	171.7	201.0	333.0	705.7
Castles	57.9	9.0	3.0	69.9

GA	Miles of Road Open Year Round	Miles of Road Open Seasonally	Miles of Road Closed Year Round	Total Miles of Road
Crazies	36.0	2.0	7.0	45.0
Divide	307.3	29.0	216.0	552.3
Elkhorns	75.0	96.0	116.0	287.0
Highwoods	11.0	0	1.0	12.0
Little Belts	500.7	351.0	166.0	1,017.7
Rocky Mountain Range	101.0	18.0	15.0	134.0
Snowies	32.2	7.0	34.0	73.2
Upper Blackfoot	244.0	135.0	193.0	572.0
Outside GA[1]	132.0	9.0	21.0	162.0
Totals	**1,668.8**	**857.0**	**1,105.0**	**3,630.8**

1. Miles of road outside of GA boundaries that the FS manages on private or other public lands.

Trails

Access on approximately 59.4 miles of motorized trial would be closed to motorized and mechanized means of transport, including bicycles, and 360.1 miles of non-motorized trails would be closed to mechanized means of transport in alternative D. These trails are located within the Big Belts, Castles, Crazies, Divide, Little Belt Mountains, Snowies and Upper Blackfoot GAs.

Table 139 displays the miles of trails broken out by GA within the plan area. Trails are further identified by motorized, nonmotorized/non-wilderness and wilderness trails.

Table 139. Miles of trail by GA and type of trail (alternative D)

GA	Miles of Motorized Trail	Miles of Non-Motorized Trails Outside of Wilderness	Miles of Wilderness Trail
Big Belts	62.0	72.1	39.0
Castles	55.1	5.5	0
Crazies	31.0	26.5	0
Divide	3.6	51.8	0
Elkhorns	9.0	102.0	0
Highwoods	28.0	10.0	0
Little Belt Mountains	448.4	116.2	0
Rocky Mountain Range	70.0	456.0	457.0
Snowies	12.9	6.7	0
Upper Blackfoot	32.6	16.1	98.0
Totals	**752.6**	**862.9**	**594.0**

Groomed trails and motorized over-snow areas

Approximately 2.4 miles of groomed trail would be closed in alternative D. These trails are all located within the Blackfoot Meadows RWAs in the Divide GA. Table 140 displays the miles of groomed trails that are available by GA in alternative D.

Table 140. Miles of groomed trail by GA (alternative D)

GA	Miles of Groomed Trail
Big Belts	73.0

GA	Miles of Groomed Trail
Castles	0
Crazies	0
Divide	94.6
Elkhorns	0
Highwoods	0
Little Belt Mountains	278.0
Rocky Mountain Range	0
Snowies	0
Upper Blackfoot	86.0
Totals	**531.6**

A number of motorized over-snow areas are located within identified RWAs in alternative D. Motorized uses within RWAs would not be suitable in alternative D and would not be allowed. Therefore, in alternative D the amount of motorized over-snow areas would be reduced by approximately 79,107 acres (26,331 in Castles GA, 4,754 acres in Crazies GA, 6,347 acres Divide GA, 13,176 in Little Belt Mountains GA, 13,144 acres in Big Snowies GA, and 15,355 acres in Upper Blackfoot GA). Table 141 below displays the total acres of motorized over-snow areas that would remain open in alternative D.

Table 141. Acres open to motorized over-snow use by GA (alternative D)

GA	Acres open to motorized over-snow recreation use
Big Belts	80,035
Castles	28,799
Crazies	16,538
Divide	107,993
Elkhorns	25,364
Highwoods	0
Little Belt Mountains	355,587
Rocky Mountain Range	27,653
Snowies	21,488
Upper Blackfoot	112,387
Total	**775,844**

Alternative E

Alternative E responds to comments received during pubic scoping asking the Forest to consider an alternative that does not identify RWAs and that increases the amount of forest lands available for timber production. In response to these comments, alternative E does not include any RWAs.

No changes in miles of open roads, motorized trails, nonmotorized trails open to mechanized means of transport, groomed trails, acres open to motorized over-snow uses, or airstrips would occur. Travel plans would continue to provide the direction for where motorized uses can and cannot occur.

Conclusions

Under alternative A, recreation access would continue to be managed under the 1986 plans. No changes in miles of open roads, motorized trails, trails open to mechanized means of transport, groomed trails, acres open to motorized over-snow uses, or airstrips would occur. Travel plans would continue to provide the direction for where motorized uses can and cannot occur. Wilderness and other laws may determine where future changes to recreation access may occur.

The plan components for recreation access would remain the same in all of the action alternatives. By providing the plan components outlined in the action alternatives, the HLC NF would meet the purpose and need of the revised forest plan, ensuring that recreation access is ecologically, economically, and socially sustainable for present and future generations.

The miles of open road, motorized trails, trails open for mechanized means of transportation (including bicycles), groomed trails, and motorized over-snow acres would change by alternative. Table 142 compares the miles of open road, motorized trails, trails open for mechanical means of transport and acres open to motorized over-snow uses by alternative. There are currently 3 airstrips located on the HLC NF and there would be no changes to those airstrips in any of the alternatives.

Table 142. Miles of open road, motorized trail, trails open to mechanized means of transport, and acres open to motorized over-snow uses by alternative.

Measurement Indicators	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Miles of open road	3,650	3,638	3,650	3,631	3,650
Miles of motorized trails	812.0	811.9	812.0	752.6	812
Miles of nonmotorized trail open for mechanical transport	1224	1,018.4	1,204	862.9	1224
Miles of groomed trail	534	534	534	531.6	534
Acres open to motorized over-snow use	854,951	830,662	824,001	775,844	854,951

3.21 Scenery

3.21.1 Introduction

The scenery of the forest is important to the overall settings and experiences people encounter when visiting the Forest. Therefore, maintaining natural appearing landscapes contributes to recreation experiences and sense of place within the Forest. Understanding the values of scenic character and maintaining scenic integrity are important components of scenery management.

This section reviews the effects to SIOs related to changes in ROS settings as well as the effects of plan components associated with scenery. These effects are displayed by acres of desired SIOs by alternative.

3.21.2 Regulatory framework

Please see the regulatory framework for Recreation Settings.

3.21.3 Assumptions

This analysis assumes that natural changes to forest conditions would continue and that these changes would have a dynamic effect on the scenery of the Forest.

3.21.4 Best available scientific information used

Currently both the 1986 Helena and the Lewis and Clark Forest Plans use the visual management system to describe and determine the effects of management practices to scenery. The visual management system was a systematic approach to inventory, analyze, and monitor scenic resources, but it did not recognize or incorporate natural disturbance processes such as fire, insects and disease, or valued cultural attributes of

FS landscapes. Due to these deficiencies, the visual management system was replaced in 1995 by the scenery management system outlined in Landscape Aesthetics: A Handbook for Scenery Management, Agriculture Handbook 701. Handbook 701 describes the most current FS direction for the management of scenery resources on NFS lands, and provides the process used for this analysis.

3.21.5 Affected environment

Scenic character descriptions

Scenic character is defined as a combination of the physical, biological, and cultural images that give an area its scenic identity and contribute to its sense of place. The scenic character provides a frame of reference from which to determine the scenic attractiveness of a landscape and to measure changes to the scenic integrity of the scenery described.

Additionally, scenic character is often enhanced by cultural elements found on the landscape. Many of these include old barns and historic structures, remaining evidence of past mining activity, and unique features on the landscape such as historic fences and signs.

Many of the scenic qualities that contribute to or make up the scenic character across these landscapes are outlined and discussed in the “distinctive roles and contributions” segment for each of the GAs.

Full landscape character descriptions for each of the GAs are described in appendix J of the Draft Plan; this constitutes the bulk of the affected environment description.

Scenic attractiveness

Scenic attractiveness is the primary indicator of the intrinsic beauty of a landscape. Scenic attractiveness helps to determine the level of importance of scenic beauty based on perceptions of landform, vegetation patterns, composition, water, and land use patterns and cultural features. Landscape elements are rated at various levels of scenic values, or attractiveness, and the forest scenic character descriptions serve as the frame of reference for determining scenic attractiveness.

Landscape visibility

Landscape visibility addresses the relative importance and sensitivity of what is seen and/or perceived in a given landscape. Landscape visibility is measured from what is seen from main travelways and use areas and from the distance the viewer is from the landscape being viewed. Additionally, individual members of the public may place a higher degree of importance to the viewing of scenery from unique travelways, use areas, or viewpoints. Landscape visibility is mapped with a GIS and is determined by distance zones, or the distance at which the landscape is being viewed.

The affected environment for landscape visibility is displayed in appendix F.

Scenic integrity and scenic integrity objectives

Scenic integrity is defined as a measure of the degree to which a landscape is visually perceived to be complete, when compared to the landscape character described for that area. The highest scenic integrity ratings are given to those landscapes which have little or no deviation from the identified scenic character.

Scenic integrity objectives (SIOs) are developed in coordination with the recreational setting, management direction, and the scenic class that were developed from the scenic inventory. Scenic integrity objectives are incorporated based on the 2012 planning rule, as defined in the glossary. These objectives are mapped using a GIS modeling process. These desired SIOs, combined with the scenic character descriptions, provide direction for the management of scenery on the forest. Individual desired SIO maps were developed for each of the GAs on the Forest for each alternative.

Table 143 describes each of the SIOs.

Table 143. SIOs and descriptions

SIO	Description
Very High	The valued scenery appears natural or unaltered. Only minute visual disturbances to the valued scenery, if any, are present.
High	The valued scenery appears natural or unaltered, yet visual disturbances are present; however, they remain unnoticed because they repeat the form, line, color, texture, pattern and scale of the valued scenery
Moderate	The valued scenery appears slightly altered. Noticeable disturbances are minor and visually subordinate to the valued scenery because they repeat its form, line, color, texture, pattern and scale.
Low	The valued scenery appears moderately altered. Visual disturbances are co-dominant with the valued scenery, and may create a focal point of moderate contrast. Disturbances may reflect, introduce or “borrow” valued scenery attributes from outside the landscape being viewed.
Very Low	The valued scenery appears heavily altered. Disturbances dominate the valued scenery being viewed; and they may only slightly borrow from, or reflect, valued scenery attributes within or beyond the viewed landscape.

The HLC NF has a wide range of existing scenic integrity, as displayed for Alternative A in the environmental consequences section. Areas designated for very high scenic integrity are often located in remote and pristine areas. There are areas across the forest that have low to moderate existing scenic integrity. Some of these lands include areas that show contrast in shape, form and texture with the surrounding natural appearing environment.

Scenic classes

Scenic classes represent the relative landscape value by combining visibility mapping inventories and scenic attractiveness inventories.

3.21.6 Environmental consequences

Scenery is affected by activities that may alter the appearance of the landscape. These activities can be either natural processes, such as wildfire and insect and disease processes, or human management activities.

Effects common to all alternatives

Scenery is an important component of forest management and would continue to be planned for and managed in all alternatives. Scenic values would be managed at the highest level for all wilderness areas.

Effects common to all action alternatives

All action alternatives include the same desired conditions, guidelines, standards, and monitoring for scenery. Table 144 summarizes the expected effects of each plan component for scenery.

Table 144. Summary of proposed plan components for scenery, all action alternatives

Plan component	Expected effects
FW-SCENERY-DC-01	This desired condition bases scenery on the natural form, lines, colors, and textures found in the inherent scenic character of the Forest and would ensure projects meet the natural scenic characteristics in landscapes. Scenic character descriptions have been developed for each GA across the Forest.

Plan component	Expected effects
FW-SCENERY-DC-02	SIOs would provide direction to future projects for scenery and would support the valued connections that communities feel with the landscapes that surround them.
FW-SCENERY-DC-03	This desired condition connects the importance of scenery to recreation users, recreation settings, and opportunities at recreation facilities.
FW-SCENERY-GDL-01	This guideline provides direction for meeting SIOs in vegetative management and facility construction and development projects. These guidelines should ensure that scenery is managed to maintain or enhance the identified scenic character of the GAs across the Forest.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Activities related to watershed, soil, riparian, or aquatic habitat improvements would have little to no effect related to the overall management of scenic quality on the Forest.

Fire and fuels management

Wildfire can have a notable impact on both the aesthetics of an area and the amount and distribution of recreation uses across the landscapes they affect. Unplanned and prescribed fires would continue to affect the long-term ecological processes across the Forest. These fire effects would include a temporary loss of vegetation, reduction in water quality due to sedimentation, and air pollution. The changes to vegetation caused by fires can also change the scenic character and the recreational uses of parts of the Forest for long periods of time; however, these effects often tend to mimic naturally occurring topography and vegetation patterns in the area.

Timber and vegetation management

Timber harvesting and road building can sometimes create obvious and long lasting effects to the scenery of an area. Since scenery is measured from viewpoints within and across the forest, placement of these types of management activities is critical to overall effects to scenery. Additionally, final silviculture prescriptions and the design of the units themselves should mimic naturally occurring landscape and forest vegetation patterns. All action alternatives include plan components that consider the management of scenery as an integral part of timber and vegetative management.

Livestock grazing and management

Activities related to livestock grazing and management would have little to no effects related to the overall management of scenic quality on the Forest.

Wildlife management

Activities related to wildlife management would have little to no effects related to the overall management of scenic quality on the Forest.

Cultural, historic, and tribal resource management

Often cultural and historic features on a landscape contribute in a positive way to the overall landscape character of an area. As outlined in the landscape character descriptions for each GA found in appendix J of the Draft Plan, the remnants of historic architecture and other features of past human occupation often provide the area in which they are located with a sense of place or identity. All action alternatives include plan components that tie cultural and historic features to landscape character.

Road access and infrastructure

Management of road access and infrastructure would have little to no effects related to the overall management of scenic quality on the Forest.

Alternative A, no action

In alternative A, the HLC NF would continue to manage scenery under direction provided in the 1986 Helena and Lewis and Clark Forest Plans. Projects would continue to use the visual management system and visual quality objectives to analyze and measure effects to the visual quality on the Forest.

The visual management system is an older, outdated method to analyze effects to visual quality. This system was replaced by the scenery management system (Landscape Aesthetics: A Handbook for Scenery Management, Agriculture Handbook 701) in 1995 which is now required for all future analysis of scenery. To enable better understanding of the comparison between the alternatives, a cross-walk of the terminologies between the visual management system and the scenery management system is displayed in Table 145.

Table 145. Cross-walk between visual quality objective and scenery management system terms

Visual Management System Visual Quality Objectives	Scenery Management System SIOs
Preservation	Very High
Retention	High
Partial retention	Moderate
Modification	Low
Maximum modification	Very Low

Table 146 describes the expected effects of the plan components in the 1986 Helena and Lewis and Clark Forest Plans that provide the current direction for visual quality.

Table 146. Summary of existing 1986 plan components for visual quality

Plan component	Expected effects
1986 Helena NF Plan Goal 9, Page II/1.	"Provide Forest visitors with visually appearing scenery."
1986 Helena NF Plan Objective, Resource Activity/ Summaries, Visual Page II/3.	This objective states that visual landscape management practices would have special emphasis in areas seen from identified visually sensitive roads and trails and that mitigation measure would be applies to resource activities that may affect the visual settings.
1986 Helena NF Plan Forest-wide Standards, Visual, Page II/15.	This forest-wide standard establishes that visual quality objectives would be applied to each management area and would provide the guidance for altering landscapes. Some portions of each management area may have more or less restrictive visual quality objectives and these are determined by sensitive viewpoints or viewing areas. This standard also states that visual quality along the Continental Divide National Scenic Trail would be the same as the management area through which it passes.
1986 Helena NF Plan, Management Areas, Pages III/3 through III/97.	A visual quality objective(s) is established for each of the management areas on the Forest.
1986 Helena NF Plan, appendix B, Sensitive Viewing Areas, Pages B/1-B/2.	This table establishes the visual quality objectives along a listing of heavily used roads or popular recreation areas.
1986 Lewis and Clark NF Plan Long Range Goal 1, Page 2-2.	This goal aims to coordinate resource development and use activities so as to protect and improve land and resource quality and productivity, including natural beauty and quality air, water, and soil.
1986 Lewis and Clark NF Plan Forest-wide Objective,	This objective states that visual landscape management would be emphasized in areas that are seen from identified visually sensitive roads

Plan component	Expected effects
Visual Resources, Page 2-4.	and trails and that mitigation measure would be applies to resource activities that may affect the visual settings.
1986 Lewis and Clark NF Plan Forest-wide Standard A-8 Pages 2-28 and 2-29.	This standard directs the forest to use the NF Landscape Management System for visual resource management. It further states that a visual quality objective would be established for each management area which would provide the guidance for altering landscapes. Some portions of each management area may have more or less restrictive visual quality objectives and these are determined by sensitive viewpoints or viewing areas. Sensitive viewing roads, trails, and viewing areas are listed.
1986 Lewis and Clark NF Plan Management Areas, Pages III/3 - III/97.	A visual quality objective(s) is established for each of the management areas on the Forest.
1986 Lewis and Clark NF Plan appendix N, Existing Visual Condition, Pages N-1 and N-2.	This appendix provides direction for evaluating the existing visual condition of landscapes.

Table 147 displays the existing acres and percent of the forest assigned to each visual quality objective in alternative A. Table 148 shows the percent visual quality objective by GA.

Table 147. Acres and percentage of visual quality objectives in alternative A

Visual Quality Objectives	Acres	Percent of Forest
Preservation	598,474	21
Retention	265,211	9
Partial Retention	647,433	22
Modification	1,372,287	48
Maximum Modification	0	0

Table 148. Percent of visual quality objectives by GA (alternative A)

GA	Preservation	Retention	Partial Retention	Modification	Maximum Modification
Big Belts	15	5	49	31	0
Castles	0	22	23	55	0
Crazies	0	15	1	84	0
Divide	8	2	21	69	0
Elkhorns	0	7	31	62	0
Highwoods	0	12	18	70	0
Little Belt Mountains	0	14	22	64	0
Rocky Mountain Range	58	9	15	18	0
Snowies	0	11	6	83	0
Upper Blackfoot	25	2	24	49	0

Alternative B

Alternative B establishes desired SIOs for each GA using the scenery management system as per the direction provided in the 2012 Planning Rule. These desired SIOs were mapped using the process outlined in the Scenery Management System, and provide direction for managing the scenic quality on the

Forest. Table 149 and Table 150 depict the acreages and percent total of the desired SIOs in alternative B. Individual maps of the SIOs are found by GA in appendix A.

Table 149. Desired SIOs for alternative B

SIO	Acres	Percent of Forest
Very High	867,285	30
High	1,564,128	54
Moderate	228,769	8
Low	223,702	8

Table 150. Percent of SIOs by GA (alternative B)

GA	Very High	High	Moderate	Low	Very Low
Big Belts	15	61	11	13	0
Castles	0	64	20	16	0
Crazies	0	89	4	7	0
Divide	16	55	19	10	0
Elkhorns	0	88	3	9	0
Highwoods	0	97	2	1	0
Little Belt Mountains	12	62	12	14	0
Rocky Mountain Range	58	42	<1	<1	0
Snowies	81	3	4	12	0
Upper Blackfoot	42	45	10	3	0

Alternative C

Similar to alternative B, alternative C would establish desired SIOs for each GA as per the direction provided in the 2012 Planning Rule. The desired SIOs in alternative C reflect changes to ROS classes in the center of the Elkhorns and in the Cellar Creek area in the north end of the Divide GA that resulted from public comment. Table 151 and Table 152 depict the acreages and percent total of the desired SIOs in alternative B. Individual maps of the SIOs are found by GA in appendix A.

Table 151. Desired SIOs for alternative C

SIO	Acres	Percent of Forest
Very High	867,348	30
High	1,415,719	49
Moderate	376,944	13
Low	223,480	8

Table 152. Percent of SIOs by GA (alternative C)

GA	Very High	High	Moderate	Low	Very Low
Big Belts	15	56	16	13	0
Castles	0	54	30	16	0
Crazies	0	82	11	7	0
Divide	16	44	30	10	0

GA	Very High	High	Moderate	Low	Very Low
Elkhorns	0	70	22	8	0
Highwoods	0	97	2	1	0
Little Belt Mountains	12	58	16	14	0
Rocky Mountain Range	58	40	2	<1	0
Snowies	81	3	4	12	0
Upper Blackfoot	42	40	15	3	0

Alternative D

Alternative D responds to comments received during pubic scoping asking the Forest to consider an alternative that increases the amounts of RWAs and primitive recreation opportunities on the Forest. This increase of the number and acres of RWAs and the emphasis on undeveloped areas created a shift in the SIOs, increasing the amount of very high and high SIOs. Table 153 and Table 154 depict the acreages and percent total of the desired SIOs for alternative D. Individual maps of the SIOs are found by GA in appendix A.

Table 153. Desired SIOs for alternative D

SIO	Acres	Percent of Forest
Very High	1,254,192	44
High	1,183,038	41
Moderate	224,266	8
Low	222,402	8

Table 154. Percent of SIOs by GA (Alternative D)

GA	Very High	High	Moderate	Low	Very Low
Big Belts	22	54	11	13	0
Castles	44	20	20	16	0
Crazies	43	47	4	6	0
Divide	30	42	18	10	0
Elkhorns	31	58	3	8	0
Highwoods	20	77	2	1	0
Little Belt Mountains	24	51	11	14	0
Rocky Mountain Range	75	25	<1	<1	0
Snowies	81	3	4	12	0
Upper Blackfoot	42	45	10	3	0

Alternative E

Alternative E responds to comments received during pubic scoping asking the Forest to consider an alternative that does not identify RWAs and that increases the amount of forest lands available for timber harvest. In response to these comments, alternative E does not include any RWAs. Additional areas for timber harvest are also identified in alternative E. The SIOs shift as a result of these changes resulting in a decrease in the amount of area with very high SIOs. Table 155 and Table 156 depict the acreages and percent total of the desired SIOs the SIO classes for alternative E. Individual maps of the SIOs are found by GA in appendix A.

Table 155. Desired SIOs for alternative E

SIO	Acres	Percent of Forest
Very High	745,764	26
High	1,680,821	58
Moderate	231,842	8
Low	225,064	8

Table 156. Percent of SIOs by GA (alternative E)

GA	Very High	High	Moderate	Low	Very Low
Big Belts	10	66	11	13	0
Castles	0	64	20	16	0
Crazies	0	89	4	7	0
Divide	0	70	20	10	0
Elkhorns	0	88	3	9	0
Highwoods	0	97	2	1	0
Little Belt Mountains	11	64	12	13	0
Rocky Mountain Range	58	42	<1	<1	0
Snowies	75	9	4	12	0
Upper Blackfoot	26	61	10	3	0

Conclusions

Alternative A would not meet the purpose and need because it continues to use the visual management system, which is not the most current process nor the best available science for managing the scenic values on Forest landscapes.

All of the action alternatives would meet the purpose and need because they use the scenery management system to establish desired SIOs for the management of the scenery on the Forest. By using the scenery management system, the FS would be able to protect the valued scenic attributes found within the individual GAs on the forest and would be able to design projects that borrow strongly from the natural features on these landscapes.

Table 157 provides a comparison of the desired SIOs by alternative. For comparison purposes, SIOs were also identified for alternative A, even though visual quality objectives would continue to be used in this alternative. The visual quality objectives are placed in parenthesis behind their SIO equivalents in the table in alternative A. A cross-walk of the terminologies between the visual management system and the scenery management system is displayed in Table 145.

Table 157. Comparison of the desired SIOs by alternative

SIO Visual quality objective	Alt. A Acres	Alt. B % of Forest	Alt. B Acres	Alt. B % of Forest	Alt. C Acres	Alt. C % of Forest	Alt. D Acres	Alt. D % of Forest	Alt. E Acres	Alt. E % of Forest
Very High (Preservation)	598,474	21	867,285	30	867,348	30	1,254,192	44	745,764	26
High (Retention)	265,211	9	1,564,128	54	1,415,719	49	1,183,038	41	1,680,821	58

SIO Visual quality objective	Alt. A Acres	Alt. B % of Forest	Alt. B Acres	Alt. B % of Forest	Alt. C Acres	Alt. C % of Forest	Alt. D Acres	Alt. D % of Forest	Alt. E Acres	Alt. E % of Forest
Moderate (Partial Retention)	647,433	22	228,769	8	376,944	13	224,266	8	231,842	8
Low (Modification)	1,372,287	48	223,702	8	223,480	8	222,402	8	225,064	8
Very Low (Maximum Modification)	0	0	0	0	0	0	0	0	0	0

3.22 Administratively Designated Areas

3.22.1 Introduction

Designated areas are specific areas within a forest that have been given permanent designation to maintain their unique special character or purpose. Some designated areas may be established by statute or law while others may be established through other administrative processes. Certain purposes and restrictions are usually established for designated areas, particularly for those areas that have been designated by law.

Land management plans may include recommendations to establish additional or modify existing previously designated areas. Some administrative designations, such as RNAs, may be designated or established concurrent with a plan decision. Once a designated areas is established by the plan decision, the designation continues until a subsequent decision by the appropriate authority removes, or adds to, the designation.

This section analyzes the effects of the draft revised forest plan to the areas that are administratively designated on the Forest. It also analyzes the recommendation of four additional areas for potential future administrative designations (*). The following areas will be covered in this section:

- IRAs
- National Recreation Trails
- RNAs
- Tenderfoot Creek Experimental Forest
- Missouri River Corridor *
- Smith River Corridor *
- South Hills Recreation Area *
- Elkhorn Wildlife Management Unit
- Kings Hill Scenic Byway
- Badger Two Medicine *

Issues

A number of issues surfaced during the scoping period for the proposed action. Some of these issues arose from within the FS and some were brought forward by the public. The issues that drove alternatives for administratively designated areas in this analysis were:

- Mountain bike use in the core area of the Elkhorns GA
- Mountain bike use in portions of the South Hills Recreation Area.

Other issues that were raised and analyzed were:

- Additions to RNAs
- ROS setting changes in the Elkhorns and Badger Two Medicine area

Measurement indicators

Effects to administratively designated areas resulting from the proposed action and alternatives were measured using the following:

- Acres of IRA located within RWAs.
- Miles of nonmotorized trail open to mountain bike uses in the core area of the Elkhorns GA
- Acres of existing and proposed RNAs by alternative
- Miles of nonmotorized trail open to mountain bike uses in the South Hills Recreation Area.

Analysis area

The geographic scope of the analysis varies by the administratively designated area being analyzed. The following describes the analysis area used for each of the administratively designated areas. These analysis areas will also be used as the geographic scope for cumulative effects. The temporal scope for effects is the life of the plan (15 years).

- **IRAs:** the HLC NF boundary
- **National Recreation Trails:** the National Recreation Trails located on the HLC NF
- **RNAs:** the HLC NF boundary
- **Tenderfoot Creek Experimental Forest**: the Tenderfoot Creek Experimental Forest boundary, located within the Little Belts GA
- **Elkhorn Wildlife Management Unit:** the Elkhorns GA boundary
- **Kings Hill Scenic Byway:** the length of US Highway 89 (approximately 71-miles) in the Little Belts GA
- **South Hills Recreation Area:** All NFS lands in the South Hills Recreation Area boundary, located within the Divide GA
- **Missouri River Corridor:** All NFS lands within the identified Missouri River Corridor boundary, located within the Big Belts GA
- **Smith River Corridor:** All NFS lands within the identified Smith River Corridor boundary, located within the Big Belts and Little Belts GAs
- **Badger Two Medicine:** All NFS lands within the identified Badger Two Medicine area boundary, located within the Rocky Mountain Range GA

3.22.2 Regulatory framework

2001 Roadless Area Conservation Rule (36 CFR 294 Subpart B): The 2001 Roadless Rule establishes prohibitions on road construction and road reconstruction, and limitations on timber cutting, sale or removal within IRAs on NFS lands. The intent of the 2001 Roadless Rule is to provide lasting protection for IRAs within the NFS in the context of multiple-use management.

Trails for America in the 21st Century (Executive Order 13195): Signed by President Clinton in 2001 to achieve the common goal of better establishing and operating America’s national system of trails.

Region 1 Natural Areas Assessment 1996 (Chadde et al 1996): Provided an assessment of plant community types needed to fulfill the national spectrum of types to be placed in RNA status in Region 1.

Establishment records for each RNA: These records provide information on the natural features, plant communities and species present in each RNA, as well as management guidance.

1986 Helena NF Plan: Established the Elkhorns as a Wildlife Management Unit and set up management areas to provide guidance for future activities in the Elkhorn mountain range.

3.22.3 Assumptions

The primary assumption is that these identified administratively designated areas would continue to be managed for their unique and special values for the duration of the plan (approximately 15 years).

3.22.4 Best available scientific information used

The HLC NF used the best available data and science to inform the analysis for the new forest plan components for administratively designated areas on the forest. Data sources included GISs for mapping and site-specific knowledge from forest personnel. All road miles, trail miles and acres are approximate.

3.22.5 Inventoried roadless areas, affected environment

IRAs are designated areas under the Roadless Area Conservation Rule (RACR). There are approximately 1,499,181 acres of lands established as official IRAs across the Forest. These IRAs constitute approximately 50% percent of the entire lands administered by the HLC NF. Table 158 identifies each IRA and its location.

Table 158. IRAs within the HLC NF

GA	IRA	Acres
Big Belts	Big Log	8,948
Big Belts	Camas Creek	29,168
Big Belts	Cayuse Mountain	20,131
Big Belts	Devils Tower	7,139
Big Belts	Ellis Canyon	5,574
Big Belts	Grassy Mountain	6,734
Big Belts	Hellgate Gulch	16,809
Big Belts	Holter	1,964
Big Belts	Irish Gulch	7,315
Big Belts	Middleman Mtn./Hedges Mtn.	32,282
Big Belts	Mount Baldy	16,349
Total Acres in Big Belts GA		152,413
Castles	Castle Mountains	29,386
Total Acres in Castles GA		29,386
Crazies	Box Canyon	12,574
Crazies	Crazy Mountains	24,924
Total Acres in Crazies GA		37,489
Divide	Electric Peak	27,858
Divide	Jericho Mountain	8,440
Divide	Lazyman Gulch	11,608
Divide	Nevada Mountain[1]	16,085
Total Acres in Divide GA		63,991
Elkhorns	Elkhorn WSA Plus Additions	75,415
Total Acres in Elkhorns GA		75,415

GA	IRA	Acres
Highwoods	Highwood Baldy	15,293
Highwoods	Highwoods	24,360
Total Acres in Highwoods GA		39,653
Little Belts	Big Baldy	43,102
Little Belts	Bluff Mountain	38,033
Little Belts	Calf Creek	10,100
Little Belts	Eagle Park	5,908
Little Belts	Granite Mountain	10,330
Little Belts	Middle Fork Judith	9,707
Little Belts	Middle Fork Judith WSA	81,069
Little Belts	Mount High	33,461
Little Belts	North Fork Smith	8,438
Little Belts	Paine Gulch	7,869
Little Belts	Pilgrim Creek	44,572
Little Belts	Sawmill Creek	11,578
Little Belts	Spring Creek	17,827
Little Belts	Tenderfoot-Deep Creek	85,546
Little Belts	Tollgate-Sheep	24,026
Little Belts	TW Mountain	8,381
Total Acres in Little Belts GA		439,947
Rocky Mountain Range	Bear-Marshall-Scapegoat-Swan[1]	395,248
Rocky Mountain Range	Sawtooth	15,687
Total Acres in Rocky Mountain Range GA		410,935
Snowies	Big Snowies	9,254
Snowies	Big Snowy Mountains WSA	87,965
Total Acres in the Snowies GA		97,219
Upper Blackfoot	Anaconda Hill	18,536
Upper Blackfoot	Bear-Marshall-Scapegoat-Swan[1]	51,339
Upper Blackfoot	Crater Mountain	9,261
Upper Blackfoot	Lincoln Gulch	8,247
Upper Blackfoot	Nevada Mountain[1]	34,027
Upper Blackfoot	Ogden Mountain	12,144
Upper Blackfoot	Silver King-Falls Creek	6,808
Upper Blackfoot	Specimen Creek	12,362
Total Acres in Upper Blackfoot GA		152,724
Total IRA Acres on the HLC NF		**1,499,181**

2. Located in more than GA; acres reflected are what are in that particular GA.

3.22.6 Inventoried roadless areas, environmental consequences

Effects common to all alternatives

All IRA boundaries and acreages within the plan area were firmly established as a part of the 2001 Roadless Rule and would not change in any of the alternatives.

Effects common to all action alternatives

Plan components developed for IRAs would remain the same in all action alternatives and provide general guidance for these areas. This guidance would be in addition to the guidance provided in the 2001 Roadless Area Conservation Rule. Table 159 summarizes the expected effects of each plan component related to IRAs.

Table 159. Summary of proposed plan components for IRAs

Plan component	Expected effects
FW-IRA-DC-01 and 02	These two desired conditions ensure IRAs provide high quality soil, water, and air, a diversity of plan and animal communities, and secure habitats for fish and wildlife species. These desired conditions also ensure IRAs provide areas where natural, ecological conditions exist, and contribute to reference landscapes utilized for future study and research.
FW-IRA-DC-03	This component ensures that high scenic quality is provided in IRAs.
FW-IRA-DC-04	This desired condition provides remote primitive and semi-primitive (both motorized and non-motorized) recreation opportunities in IRAs.
FW-IRA-DC-05	This desired condition ensures the protection of public drinking water, traditional cultural properties and sacred sites, and locally identified unique characteristics.
FW-IRA-GDL-01	This guideline ensures that scenic quality is consistent with SIOs.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and management activities for aquatic ecosystems and soil management would have little effect related to the overall management within IRAs. The plan components that may have the greatest influence are those associated with RMZs. East of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative. Please refer to the RMZ section. Vegetation treatments such as prescribed fire and harvest that may occur in IRAs would be limited within RMZs, or modified to comply with plan components for those areas. The area on which these components apply is greater with the action alternatives than with the no-action alternative on landscapes east of the Continental Divide.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur within IRAs, and provide opportunities for natural fire to promote and/or enhance the wilderness characteristics of these areas.

Timber and vegetation management

IRAs are not suitable for timber production, but timber harvest may occur for other resource purposes. Timber harvest is limited by the 2001 Roadless Area Conservation Rule. Where it does occur, it would consist of cutting small diameter trees. Plan components associated with timber harvest would ensure that all resource protection measures are met. Harvest would be required to meet other plan components, such as SIOs. Plan components related to desired vegetation conditions could influence whether vegetation treatments (such as harvest or management-ignited fires) are conducted, and help define the objectives for those treatments.

Livestock grazing and management

While livestock grazing itself has the potential to degrade plant communities through factors such as invasive plant spread and damage to riparian areas, plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components should help protect the ecological integrity of IRAs, to a greater degree with the action alternatives as compared to the no-action alternative.

Recreation and scenery management

Plan components for recreation settings, opportunities, and access along with scenery management would complement the management of IRAs. In the action alternatives, IRAs have a primitive or semi-primitive ROS setting and a high SIO. These classifications would ensure that potential recreation and other activities, such as restoration treatments, would be consistent with IRA desired conditions.

Cultural, historic, and tribal resource management

Plan components related to cultural, historic, and tribal resource would have little to no effect on IRAs. The protection of these resources would be consistent with maintaining the wilderness characteristics of these areas.

Road access and infrastructure

Plan components related to road access and infrastructure would have little effect on IRAs, because these areas are generally unroaded. However, where roads do occur, road maintenance activities may occur and would be guided by road access and infrastructure plan components which include protections for other resources. The 2001 Roadless Area Conservation Rule further guides and constrains road construction or reconstruction.

Minerals management

IRAs are discretionarily unavailable for mineral leasing and saleable mineral activities but still open to locatable mineral prospecting, exploration, and development.

Alternative A, no action

In alternative A, the IRAs on the Forest would be managed under the guidance established by the 2001 Roadless Area Conservation Rule and plan components provided in the 1986 Helena and Lewis and Clark Forest Plans. Table 160 describes the plan components in the 1986 plans that provide direction for IRAs.

Table 160. Summary of existing plan components for IRAs

Plan component	Expected effects
Helena NF Goals 1 and 2	These plan components provide for a range of outdoor recreation opportunities, including motorized and non-motorized opportunities.
Helena NF Objectives	A number of roadless areas were identified in the objectives section of the 1986 Forest Plan. Roadless areas and undeveloped areas are well-distributed throughout the Helena Forest and offer semi-primitive recreation opportunity setting experiences.
Helena NF Management Areas R-1 and P-3	Management area R-1 provides direction for large blocks of undeveloped lands suited for dispersed recreation. Motorized uses are not allowed in these areas and they are managed for a semi-primitive non-motorized ROS setting and experiences. Management area P-3 provides direction for three RWAs which are also IRAs. Under this direction the areas are managed to maintain their existing wilderness characteristics.

Plan component	Expected effects
Helena NF Forest Plan Amendment 4	This amendment requires the Helena NF to show Allowable Sale Quantities of timber by both roaded and roadless lands on the forest. This amendment also requires a careful accounting of allowable sale quantity that is removed from roadless lands.
Lewis and Clark NF Objectives	An objective for roadless areas recognizes over a million acres of roadless on the Lewis and Clark Forest. Some of these lands lie adjacent to the Bob Marshall and Scapegoat wilderness areas. Some of these lands have been identified as WSAs. The majority of these lands are spread out across the forest and would be managed for their roadless values.
Lewis and Clark NF Management Areas F, G, and I	Management areas F and G provide direction for blocks of undeveloped land with limited motorized access and semi-primitive recreation opportunity settings. Management area I provides direction for important wildlife habitat on large, undeveloped landscapes that offer semi-primitive recreation settings.
Lewis and Clark NF Amendment 6	This amendment requires the Lewis and Clark NF to show Allowable Sale Quantities of timber by both roaded and roadless lands on the forest. This amendment also requires a careful accounting of allowable sale quantity that is removed from roadless lands.

Alternatives B and C

Alternatives B and C identify nine different RWAs across the forest. Approximately 62% of the RWAs are located on lands that have been designated as IRAs. While the boundaries and acreages of IRAs within the HLC NF are firmly established and would not change in alternatives B and C, the actions taken in IRAs located within RWAs would follow forest plan components for RWAs. Plan components for RWAs would be more restrictive and would also protect the values of the IRAs.

In alternatives B and C the following IRA acres fall within identified RWAs. Table 161 shows the IRA acreages that would be affected by RWA designation in alternatives B and C.

Table 161. Acres of IRAs within RWAs (alternatives B & C)

IRA (Acres)	RWA (Acres)	Acres of IRA in RWA
Big Log (8,948)	Big Log (7,086)	6,233
Holter (1,964)	Big Log (7,086)	225
Mount Baldy (16,349)	Mount Baldy (8,314)	8,314
Electric Peak (27,858)	Blackfoot Meadows (18,296)	18,040
Tenderfoot-Deep Creek (85,546)	Deep Creek (14,490)	14,490
Big Snowies (9,254)	Big Snowies (95,298)	6,907
Big Snowy Mountains WSA (87,965)	Big Snowies (95,298)	87,669
Bear-Marshall-Scapegoat-Swan (343,910)	Dearborn Silverking (20,088)	13,056
Silver King - Falls Creek (6,808)	Dearborn Silverking (20,088	6,815
Bear-Marshall-Scapegoat-Swan (343,910)	Red Mountain (1,901)	1,780
Bear-Marshall-Scapegoat-Swan (343,910)	Arrastra Creek (8,257)	7,669
Nevada Mountain (50,112)	Nevada Mountain (39,345)	36,205
Total acres of inventoried roadless in RWAs		207,404

Alternative D

Additional RWAs are recognized in alternative D, and these areas include many acres of IRAs across the forest. This is in response to the pubic asking the Forest to consider an alternative that increases the amounts of RWAs on the forest. The boundaries and acreages of IRAs within the HLC NF are firmly established and would not change in alternative D. However, the acres of IRAs that have been identified as RWAs would follow the forest plan components for RWAs. Table 162 shows the acres of IRAs that fall within RWAs in alternative D.

Table 162. Acres of IRAs within RWAs (alternative D)

IRA (Acres)	RWA (Acres)	Acres of IRA within RWA
Big Log (8,948)	Big Log (7,086)	6,233
Holter (1,964)	Big Log (7,086)	225
Camas Creek (29,168)	Camas Creek (22,350)	22,005
Mount Baldy (16,349)	Mount Baldy (8,314)	8,314
Castle Mountains (29,386)	Wapiti Peak (30,606)	28,397
Crazy Mountains (24,924)	Loco Mountain (24,977)	22,214
Electric Peak (27,858)	Blackfoot Meadows (26,900)	26,109
Lazyman Gulch (11,608)	Colorado Mountain (14,189)	11,551
Tenderfoot-Deep Creek (85,546)	Deep Creek (14,490)	14,490
Tenderfoot-Deep Creek (85,546)	Tenderfoot Creek (45,870)	38,213
TW Mountain (8,381)	Big Horn Thunder (47,107)	41,131
Middle Fork Judith (9,707),	Middle Fork Judith (62,452)	1,271
Middle Fork Judith WSA (81,069)	Middle Fork Judith (62,452)	59,563
Big Snowies (9,254)	Big Snowies (95,298)	6,907
Big Snowy Mountains WSA (87,965)	Big Snowies (95,298)	87,669
Bear-Marshall-Scapegoat-Swan (343,910)	Dearborn Silverking (20,088)	13,056
Silver King - Falls Creek (6,808)	Dearborn Silverking (20,088)	6,815
Bear-Marshall-Scapegoat-Swan (343,910)	Red Mountain (1,901)	1,780
Bear-Marshall-Scapegoat-Swan (343,910)	Arrastra Creek (8,257)	7,669
Nevada Mountain (50,112)	Nevada Mountain (44,702)	37,430
Total acres of inventoried roadless in RWAs		441,042

Alternative E

All IRAs would be managed under the guidance established by the 2001 Roadless Area Conservation Rule and the plan components established by the draft revised Forest plan.

Conclusions

The IRA boundaries and acreages were firmly established as a part of the 2001 Roadless Rule and would not change in any of the alternatives.

In alternative A, the IRAs on the Forest would continue to be managed only under the guidance established by the 2001 Roadless Area Conservation Rule and the guidance for roadless areas provided by the 1986 Helena and Lewis and Clark Forest Plans.

Plan components developed for IRAs would remain the same in all action alternatives and would provide general guidance for IRAs on the Forest. This guidance would be in addition to the guidance provided in the 2001 Roadless Area Conservation Rule. By providing the plan components outlined in the action alternatives, the HLC NF meets the purpose and need of the revised forest plan, ensuring that the nature and purposes for which IRAs were identified are enhanced and/or protected for present and future generations.

3.22.7 National recreation trails, affected environment

National scenic trails (such as the Continental Divide National Scenic Trail) and national historic trails may only be designated by Congress. National recreation trails may be designated by the Secretary of Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trails managing agency or organization. Through designation, these trails are recognized as part of America's National Trail System.

The national recreation trails on the HLC NF are generally single track, linear features that pass through a great variety of physical features ranging from natural-appearing settings to locations where developments are noticeable. There are 9 national recreation trails on the HLC NF totaling 40 miles. Most of these trails are located in the Little Belt Mountains GA. Approximately 65% of the national recreation trails on the forest are open to motorized trail uses. See Table 163.

Table 163. National recreation trails

GA	Trail Name	Trail Number	Miles
Big Belts	Hanging Valley	247	6
Divide	Mt. Helena	373	6
Little Belt Mountains	North Fork Deep Creek	303	6
Little Belt Mountains	Ming Coulee	307	3
Little Belt Mountains	South Fork Deep Creek	316	5
Little Belt Mountains	Blankenbaker	320	4
Little Belt Mountains	Deep Creek Ridge	338	6
Little Belt Mountains	Monument Ridge	339	2
Snowies	Crystal Lake	404	2
Total			40

3.22.8 National recreation trails, environmental consequences

Effects common to all alternatives

Under all alternatives, the national recreation trails would meet the purpose of the National Trails System Act which is "to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation."

Effects common to all action alternatives

Plan components developed for national recreation trails would remain the same in all action alternatives and provide general guidance for these specifically identified trails. See Table 164.

Table 164. Summary of proposed plan components for national recreation trails

Plan component	Expected effects
FW-NRT-DC-01	This desired condition ensures that management of the national recreation trails protect and/or enhance the nature and purposes for which they have been established.
FW-NRT-DC-02	This component ensures that trails would be clearly marked, and will provide interpretation and education in such a manner as to not impair the identified trail features and/or values.

Plan component	Expected effects
FW-NRT-GDL-01	This guideline would maintain and enhance the valued attributes for which the trail(s) have been established.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities related to aquatic ecosystems and soil management would generally have little effect to national recreation trails. Where the trails cross or parallel streams, plan components related to RMZs would help maintain the scenic quality of those areas, and therefore complement the management of the trail. Trail maintenance activities may be influenced by plan components related to the maintenance of vegetation conditions in riparian areas, downed wood requirements within streams, and the condition of stream crossings.

East of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative. Please refer to the RMZ section.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur near national recreation trails, and provide opportunities for natural fire to alter the vegetation condition of the landscape. When fire does occur, whether natural or management-ignited, it could change the scenery visible from the trails, including charred vegetation in the short term as well as re-growth in the longer term.

Timber and vegetation management

Some stretches of the trails may be located in areas where timber harvest could occur. Where harvest does occur, it could impact the scenic values visible from the trail, including more open vegetation and stumps, as well as soil disturbance in the short term. Conversely, harvest could be used to improve the scenic quality by creating vistas, mimic vegetation structures that would be created by natural disturbance, and promote healthy vegetation. Vegetation plan components would help define the objectives for treatments that may occur near the trail. In addition to harvest, plan components would allow for other vegetation treatments such as tree planting and weed spraying near the trails.

Livestock grazing and management

Livestock grazing allotments could occur along or in proximity to the trails. Evidence of grazing, including cows, cow patties, grazed vegetation, and weeds could occur. However, plan components for livestock grazing emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components should help protect the scenic quality of the trails, to a greater degree with the action alternatives as compared to the no-action alternative.

Recreation and scenery management

Recreation and scenery management plan components would complement the management of the trails by specifying ROS settings and scenic quality objectives that are consistent with the desired conditions of the trail, along with providing the facilities and infrastructure needed for the public to access and use the trail system.

Cultural, historic, and tribal resource management

Plan components for cultural, historic, and tribal resources would complement the management of the national recreation trails.

Road access and infrastructure

To the extent that trails or routes in proximity to the trails may be maintained, reconstructed, or relocated, the plan components for access and infrastructure would ensure that this work is done in a manner that meets the need of trail users and has minimal impacts to other resources. These components would complement the management of the trail system.

Minerals management

Lands along national recreation trails would be available for minerals activities.

Alternative A, no action

National recreation trails do not receive special recognition in the 1986 Helena Forest Plan. However, the 1986 Lewis and Clark Forest Plan does recognize these trails, and created a forestwide standard to address them. In the no-action alternative, national recreation trails covered by the Helena Forest Plan would be managed by direction provided for all forest trails on the Helena NF. The national recreation trails covered by the Lewis and Clark Forest Plan would be managed as national recreation trails as per Forestwide standard L-4/32.

The following plan components provide overall direction for trail and specific direction for national recreation trails in the 1986 Helena and Lewis and Clark Forest Plans. The expected effects from specific plan components are summarized in Table 165.

Table 165. Summary of existing plan components for all trails, including National Recreation Trails

Plan component	Expected effects
Helena NF Goals 1 and 2	These plan components provides for a range of outdoor recreation opportunities that can be developed for visitor use and satisfaction, including motorized and non-motorized opportunities.
Helena NF Objectives	The Helena NF objectives provide for the construction of a cost effective roads and trails system that meets the Forest land and resource objectives and forest visitor needs.
Helena NF Forest-wide Trail Standards 1, 2, 3, 4	These forestwide trails standards provide overall guidance for managing a forest trail system to meet established standards, and address trail maintenance, funding, use, construction and reconstruction.
Helena NF, Management Area R-1	This management area provides direction for the construction of trailhead facilities to increase access and continue to enhance recreation opportunities.
Lewis and Clark NF Objectives	The Lewis and Clark NF objectives for facilities include direction for roads, trails, and airfields. These facilities will be constructed, managed, and maintained to meet the land and resource objectives of the Forest in a cost effective manner.
Lewis and Clark NF Forest-wide Standard L-4/32	This standard specifically states that all National Recreation Trails corridors would be protected and maintained.

Alternatives B – E

See effects common to all alternatives.

Conclusions

Under alternative A, the nine national recreation trails on the Forest would continue to be managed according to direction provided for all trails in the 1986 Helena Forest Plan and for the specific national recreation trails in the Lewis and Clark Forest Plan. There would be no additions to the national recreation trail inventory and travel plans would continue to provide the direction for where motorized uses can and cannot occur.

Plan components developed for national recreation trails are very similar to those presently providing direction in the 1986 Forest Plans. The plan components for national recreation trails would remain the same in all action alternatives and would provide general guidance for these trails. By providing the plan components outlined in the action alternatives, the HLC NF would meet the purpose and need of the revised forest plan, ensuring that the nature and purposes for which these national recreation trails were identified is enhanced and/or protected for present and future generations.

3.22.9 Research natural areas, affected environment

RNAs are permanently established to maintain areas of natural ecosystems and areas of special ecological significance. These protective designations were made in an attempt to maintain the natural ecosystem components and processes of these areas and are cooperatively identified, established, and managed with the USDA FS established as baseline areas for non-manipulative research, education, and the maintenance of biodiversity. They are administratively designated by the Regional Forester with research station director concurrence. In some cases stewardship management is needed to maintain or restore the target plant communities in RNAs, including actions such as invasive weed control or prescribed fire. These management activities are also coordinated between the NFs and the research station.

The HLC NF has 12 designated RNAs under all alternatives, one proposed under all alternatives (Granite Butte), and one candidate (Poe-Manley) under alternative D.

- Designated RNAs are those that have been formally established by a decision signed by the Regional Forester, with concurrence of the Research Station Director, after being vetted through the Forest and Rocky Mountain Research Station via forest planning, during revision or by amendment.
- Proposed RNAs have been vetted through the Forest and Rocky Mountain Research station via forest planning (either in revision or by amendment), but they have not been established by a Regional Forester decision.
- Candidate RNAs have not been fully vetted by the Forest and Rocky Mountain Research station and/or have not been included in a forest plan decision.

When combined, these areas total approximately 21,000 acres. Table 166 describes the RNAs.

Table 166. Designated, proposed, and candidate RNAs

RNA	GA	Purpose for Establishment	Status	Acres
Cabin Gulch	Big Belts	Douglas-fir with bunchgrass understory.	Designated	2,408
Bartleson Peak	Little Belts	Spruce/cleft leaf groundsel and cinquefoil/Idaho fescue habitat types	Designated	1,600
O'Brien Creek	Little Belts	A variety of riparian vegetation types, an un-entrenched, moderate to gentle gradient stream.	Designated	692
Onion Park	Little Belts	Tufted hairgrass-sedge, subalpine fir/grouse whortleberry and subalpine fir/bluejoint reedgrass; mesic meadow	Designated	1,208
Paine Gulch	Little Belts	Long-lived seral Douglas-fir on subalpine fir series sites, seral ponderosa pine and limber pine communities on Douglas-fir series sites.	Designated	2,403
Wagner Basin	Rocky Mountain Range	Unique wetland complexes containing large populations of Giant helleborine and yellow lady's-slipper.	Designated	939
Walling Reef	Rocky Mountain Range	High-elevation forest, shrubland, grassland, wetland, and alpine ecosystems.	Designated	834

RNA	GA	Purpose for Establishment	Status	Acres
Greathouse Peak	Snowies	Alpine tundra plant communities on an alpine plateau composed of calcareous (limestone) substrate	Designated	1,280
Big Snowy – Old Baldy	Snowies	Alpine tundra plant communities on an alpine plateau composed of calcareous (limestone) substrate	Designated	1,866
Minerva Creek	Snowies	Ponderosa pine/snowberry interspersed with meadows	Designated	336
Indian Meadows	Upper Blackfoot	Douglas fir/blue huckleberry, Douglas fir/pine grass, Douglas fir/elk sedge, Subalpine fir/beargrass, Subalpine fir/bluejoint, Subalpine fir/menziesia and wet meadows.	Designated	949
Red Mountain	Upper Blackfoot	Subalpine fir and whitebark pine habitat types, high alpine non forest habitat types, scree and type I and II streams	Designated	1,901
Granite Butte	Upper Blackfoot	Subalpine fir and white bark pine habitat types, montane grassland dominated by rough fescue.	Proposed	394
Poe-Manley	Elkhorns	Montane grassland dominated by rough fescue	Candidate, (alternative D)	4,505

Granite Butte Proposed RNA

The Granite Butte area, located in the Upper Blackfoot GA, was proposed as a potential RNA to represent a montane grassland dominated by rough fescue (*Festuca campestris*) with subalpine fir and whitebark pine habitat types. This site was proposed in the 1986 Helena NF Plan. In addition to an extensive grassland, the site contains a unique ribbon forest/snow glade community and a sedge-rush (*Carex-Juncus*) community. The grassland is in excellent condition and includes key indicators of high productivity. Missoula phlox (*Phlox kelseyi var. missoulensis*) is also present. The ribbon forest consists primarily of whitebark pine (*Pinus albicaulis)* and subalpine fir (*Abies lasiocarpa*), with much of the whitebark pine dying or dead. In the open areas on the edge of the melting snowbank, early spring ephemerals are found. The presence of a low-standard, 2-track road in the area where motorized use was allowed was the limiting factor on formally establishing this area as a RNA. However, the Blackfoot Travel Plan has now designated this trail as nonmotorized.

Poe-Manley Candidate RNA

The Poe-Manley site has been identified as a candidate montane grassland RNA dominated by rough fescue (*Festuca campestris*) under alternative D. This area is located in the Elkhorns GA, in close proximity to the Tizer basin loop and administrative cabin. The grasslands are in excellent condition, with a mix of various grasses and forbs. Rough fescue is the dominant grass species. In Poe Park, there is a population of Missoula phlox (*Phlox kelseyi var. missoulensis*). Only one small area of noxious weeds is present – Canada thistle (*Cirsium arvense*). No domestic livestock grazing is allowed in the area. The forests around these two grassland parks have substantial mortality, especially in lodgepole pine (*Pinus contorta*) and whitebark pine (*Pinus albicaulis*). There is no evidence of roads. The hiking trail through the area receives only light to moderate use.

3.22.10 Research natural areas, environmental consequences

Effects common to all alternatives

Under all alternatives, the 12 existing RNAs would maintain their designations. In these areas, direction in the establishment records and FS manual 4063 would be followed to conserve the plant associations for which they were established.

The Granite Butte area, which has been reviewed and vetted, could be recommended to become an established RNA through a separate decision by the Regional Forester. Final establishment would take place upon completion of the establishment record based on the Research Station Director's concurrence.

The potential for additional RNAs in the future would exist under any alternative. The Northern Region Status and Needs Assessment for Research Natural Areas (Chadde et al. 1996) recommend additional unrepresented plant associations on each NF in Region 1 so that the entire range of associations could be represented in the RNA network.

Effects common to all action alternatives

All action alternatives include the following plan components (Table 167).

Table 167. Summary of proposed plan components for RNAs

Plan component	Expected effects
FW-RNA-DC-01	This DC would ensure that the natural processes within RNAs function with little human influence.
FW-RNA-GDL-01	This GDL would ensure that RNAs are managed and monitored according to their site establishment records and FS manual 4063.
FW-RNA-SUIT-01	The RNAs are not suitable for timber production, although vegetation treatments could occur if consistent with establishment records or management plans.
FW-RNA-SUIT-02	This component ensures that nonmotorized travel is allowed in RNAs, along with motorized access along designated routes only.
FW-RNA-SUIT-03	This component allows livestock grazing to occur if consistent with establishment records or management plans.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Activities related to watershed, soil, riparian, or aquatic habitat would generally not occur in RNAs, and there would be little to no effect related to the management of these resources.

Fire and fuels management

Plan components for prescribed fire and wildfire could affect RNAs. Fire is a primary natural ecosystem process, and all alternatives emphasize the importance of allowing such processes to occur. Prescribed fire and fire suppression tactics would adhere to site establishment records and FS manual 4063, which ensure that natural fires are allowed to burn only within a prescription designed to accomplish objectives specific to the RNA. Further, fires that occur on the broader landscape could influence the type and severity of wildfire that enters RNAs.

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur in RNAs, and provide opportunities for natural fire to alter the vegetation condition of the landscape. Fire on the landscape would generally complement the desire for natural ecological processes within these areas. Plan components are in place to ensure that minimum impact suppression tactics or other tactics appropriate for the protection of the trail values are used.

Timber and vegetation management

Under all alternatives, RNAs are not suitable for timber production. The existing forest plans (alternative A) prohibit timber harvest for any purpose in these areas, and therefore timber management should have no effect. The revised forest plan under the action alternatives allows that some vegetation treatments could occur where consistent with site establishment records and plans. However, generally site records would preclude this as well. Any activities that may occur would have minimal impact to vegetation conditions, or be designed to maintain or restore natural conditions. Timber harvest and other vegetation management activities that occur on the broader landscape could influence the type and severity of wildfire that enters RNAs.

Livestock grazing and management

The existing forest plans (alternative A) prohibit livestock grazing in RNAs, and therefore grazing management should have no effect. The revised forest plan under the action alternatives allows for grazing to occur where consistent with site establishment records and plans. However, generally site records would preclude this. Therefore, grazing would have minimal impact.

Wildlife management

Activities related to wildlife management would generally not occur within RNAs, and therefore there would be little to no effect.

Recreation and scenery management

Under all action alternatives, the ROS setting for established and proposed RNAs is primitive, and the SIO is generally high or very high. Managing for primitive recreation opportunities would not result in substantial impacts to the natural vegetation and natural processes in these areas. Alternative A does not include the concepts of ROS nor SIOs, but the visual quality objectives prescribed for RNAs (retention or preservation) would result in similar effects.

Alternative D includes the Poe-Manley candidate RNA. Unlike the established RNAs, the ROS in this area includes primitive in the central core area during both summer and winter, some areas of roaded natural in the summer; and semi-primitive motorized and semi-primitive nonmotorized in the winter. The summer roaded natural areas and winter semi-primitive nonmotorized areas accommodate the existence of the nearby motorized Tizer Lakes loop route to the west and other routes near the eastern boundary. These routes do not enter the candidate area. The winter semi-primitive motorized area accommodates snowmobile use on the western portion of the candidate area. These uses are compatible with the RNA management guidance, but may do less to protect the desired characteristic of the area than the primitive ROS setting that is applied to the established and proposed RNAs found in all alternatives.

Cultural, historic, and tribal resource management

Activities related to cultural, historic, and tribal resources would generally not occur in RNAs, and therefore there would be little to no effect.

Road access and infrastructure

All action alternatives are similar in terms of plan components for road access and infrastructure. New road and trail construction, or other infrastructure and facilities, would not generally occur in RNAs under any alternative, because FS manual 4063 prohibits new roads, trails, fences, or signs on an established RNA unless they contribute to the objectives or protection of the area.

Minerals management

RNAs are available for minerals activities. However, per FS manual 4063 proposals to offer Federal mineral, oil, and gas leases would be evaluated by the Regional Forester, with concurrence of the Station Director, using standards set forth in FS manual 2820. The proposal with recommendation is forwarded by the Regional Forester to the Chief for the final decision.

Alternative A, no action

The existing forest plans (1986) include components for RNAs, and these would apply to the no-action alternative. The RNAs included in this alternative are the 12 existing areas, some of which were established after the 1986 plans were developed. The expected effects from plan components are summarized in Table 168. Both plans limit most management activities from occurring in these areas, with the exception of prescribed fire.

Table 168. Summary of existing plan components for RNAs

Plan component	Expected effects
Helena NF Management Area N-1	The standards for management area N-1 would ensure that within RNAs the following activities would not occur: improvements, developed or dispersed recreation facilities, wildlife habitat improvements, livestock grazing, timber harvest, mineral sales, utility corridors, road construction, or occupancy special use permits. Insects and disease levels would not be controlled. Prescribed burning could be used to perpetuate the natural diversity of plant communities. Fire suppression would be selected to minimize soil and vegetation disturbance. The visual quality objective would be retention.
Lewis and Clark NF Management Area M	The standards for management area M would allow dispersed recreation and motorized use in RNAs. The visual quality objective would preservation, which allows for ecological changes only. The standards preclude the following activities: wildlife habitat improvements, livestock grazing, timber harvest, occupancy leases for minerals, special use permits, road construction, and trail construction. Prescribed fire could occur when commensurate with the goals for the RNA. Fire suppression response would depend on multiple factors. Changes to the vegetation could be caused by prescribed fire, natural processes, or minor impacts from dispersed recreation and motorized use.

Alternatives B-E

Alternatives B, C, and E would be the same as A with respect to the number and location of designated and proposed RNAs. The effects would be as described under effects common to all action alternatives.

Alternative D would include Poe-Manley as a candidate RNA. This eligibility is based upon an analysis of the site and the value it would add to the RNA network in the Region. The 4,505 acres that comprise this area would be managed as described in Table 169, and would contribute to fulfilling the ecosystem representation assigned to the HLC NF. Vegetation management would be limited to actions that maintain or restore natural processes. This designation would preclude development of future motorized recreation opportunities other than over-snow use in the area.

Cumulative effects

Under all alternatives, the network of RNAs would contribute to the understanding of key ecosystems and plant communities by being part of the broader array of sites that are designated across other NFs in the region. This network would continue to contribute to the conservation of biological diversity, and provide for research and educational opportunities in the plan area. Similar designations are not known to occur on lands of private ownership, nor on state lands in the area, increasing the importance of maintaining them on NFS lands.

Conclusions

All alternatives provide for a network of RNAs across the HLC NF, by including the existing designations of 12 RNAs (16,416 acres) and one proposed RNA (Granite Butte, 394 acres). Alternative D would include the addition of one candidate RNA, Poe-Manley (4,505 acres). The 1986 Forest Plans more explicitly prohibit management activities within RNAs than does the revised plan, which allows for more uses when those uses are consistent with the site establishment record and standards in FS manual 4063.

3.22.11 Tenderfoot Creek Experimental Forest, affected environment

The Tenderfoot Creek Experimental Forest is managed by the Rocky Mountain Research Station and encompasses 9,125 acres of the headwaters of Tenderfoot Creek in the Little Belt Mountains. Research emphasis within the experimental forest was expanded in 1991 to develop and evaluate ecosystem-based treatments for sustaining productivity and biodiversity of lodgepole pine forests and watersheds. A map of the Tenderfoot Creek Experimental Forest can be found in appendix A.

3.22.12 Tenderfoot Creek Experimental Forest, environmental consequences

Effects common to all alternatives

The administrative designation of the Tenderfoot Creek Experimental Forest would remain in place under all alternatives, and potential future research activities based on mutual agreement with the Rocky Mountain Research Station would be conducted in a similar manner.

Effects common to all action alternatives

All action alternatives would contain the same plan components related to the Tenderfoot Creek Experimental Forest. These components and their expected effects are summarized in Table 169.

Table 169. Summary of proposed plan components for Tenderfoot Creek Experimental Forest

Plan component	Expected effects
LB-TCEF-DC-01; 02; 03; 04	The DCs would ensure that desired research and demonstration activities, as agreed upon with the Rocky Mountain Research Station, are supported by the vegetation conditions, facilities, infrastructure, and recreation management in this designated area.
LB-TCEF-SUIT-01	This component allows that while timber harvest may be conducted if it is part of research or demonstration, the area is not suitable for timber production and would not necessarily be managed in a way that emphasizes the production of timber. Timber harvest activities would affect the vegetation of this area when it is programmed as a research activity.
LB-TCEF-SUIT-02; 03	These components ensure that no non-timber forest products could be utilized commercially. Personal use of firewood, Christmas trees, boughs, and surface rock would not occur. This would ensure that such activities would not interfere with research. Other products such as mushrooms and botanical products could be utilized for personal use.
LB-TCEF-SUIT-04	No livestock grazing would occur, and therefore there would be no potential conflict of research activities with this use.
LB-TCEF-SUIT-05	This component allows for motorized travel on designated routes or trails, and would ensure that public access is maintained in the area, as determined in travel plans.
Forestwide and GA plan components	The suite of forestwide and GA plan components include but not limited to components related to wildlife, SIOs, aquatic ecosystems, soils, vegetation, recreation, minerals, roads, and land uses. These components would ensure that these resource values are maintained within the area.

Effects from forest plan components associated with:

Watershed, aquatic ecosystems, riparian, and soil management

Plan components related to watershed, aquatic, riparian and soil resources may limit some research activities specifically with respect to harvest activities (type, location, intensity and/or prescriptions applied). RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used.

Fire and fuels management

Alternative A emphasizes the control of fire in this area, while the action alternatives do not prescribe a particular management response to wildfire. In the action alternatives, plan components for fire and fuels management would encourage an appropriate management response to wildfires, and provide opportunities for natural fire to alter the vegetation condition of the landscape. If fire does occur, it could change the vegetation in the experimental forest and influence potential future research opportunities.

Timber and vegetation management

Under all alternatives, the area is unsuitable for timber production but timber harvest may be used when part of an approved research activity. Timber harvest therefore has the potential to affect vegetation and other resources in this area. Timber plan components would ensure this activity protects other resources.

Livestock grazing and management

Livestock grazing would not be permitted under any alternative, and therefore there would be no effects from livestock grazing management.

Wildlife management

Specific requirements for the management of threatened and endangered wildlife species, such as Canada lynx and grizzly bear, could limit or modify research activities. Considerations relative to the Canada lynx are the most likely to have effects related to timber harvest. Please refer to the discussion about lynx management in the timber specialist section.

Recreation and scenery management

Under the no-action alternative (1986 forest plans), the recreation setting of this area is roaded natural, which would not likely influence activities that may occur within this area for research. With the no-action alternative, the visual quality objective is partial retention or modification, or retention in areas seen from high sensitivity areas. Areas with a partial retention or retention visual quality objective may have some limitations to the harvest that could be conducted for research.

With the action alternatives, in both summer and winter the setting of the area is mostly semi-primitive nonmotorized with some roaded natural and primitive. The plan components associated with these settings would limit the type and extent of harvest that could occur in the semi-primitive (harvest would be constrained) and primitive (no harvest could occur). The scenic quality objectives under the action alternatives is high for most of this area, which would also limit harvest opportunities to meet research objectives. The influence of recreation opportunity settings and scenic quality objectives would likely be somewhat more limiting to harvest for research purposes than the no-action alternative.

Cultural, historic, and tribal resource management

Plan components for cultural, historic, and tribal resources would have similar effects under all alternatives, in that protections for these resources would apply to proposed activities.

Minerals management

Lands within the Tenderfoot Creek Experimental Forest would be available for minerals activities.

Alternative A, no action

The existing 1986 forest plan for the Lewis and Clark NF includes guidance for the Tenderfoot Creek Experimental Forest, as summarized in Table 170. This area is described as management area K, with a goal of managing the experimental forest to meet research objectives.

Table 170. Summary of existing plan components for Tenderfoot Creek Experimental Forest

Plan component	Expected effects
Recreation, 3-53	This section would ensure that recreation and visual quality are managed in a manner that supports research. The roaded natural setting and partial retention/modification visual quality objectives would allow for vegetation modification as needed to meet research purposes. Dispersed recreation would be managed with consideration for research values.
Wildlife, 3-54	This component provides for the maintenance of specific wildlife habitats, such as big-game winter ranges, calving or lambing areas, migration routes, elk summer ranges, and raptor nesting sites. This may somewhat limit research opportunities in specific areas.
Range, 3-54	This component ensures that no livestock grazing would occur, and therefore there would be no potential conflict of research activities with this use.
Timber, 3-54	This component allows for timber to be managed for research needs, and that timber removed is unregulated. Timber harvest activities may therefore affect the vegetation of this area when it is programmed as a research activity.
Soil and water, 3-54	This component allows that state water quality and soil productivity maintenance may be violated if needed for research. Adverse effects could occur to water quality and soils.
Minerals, 3-54	Surface occupancy would not be allowed, and requests for mineral exploration and development would be evaluated and administered through permits and leases.
Land use, 3-54	This component ensures that any new special-use permits would not conflict with the research goals of the area, and the area would not be impacted by utility corridors.
Roads, 3-54	These plan components would minimize public access and limit motorized access to existing roads. Roads could be constructed for research but would be closed to the public.
Mineral access, 3-55	This component specifies that mineral access roads would be constructed or reconstructed to minimum standards, and existing roads used when possible.
Trails, 3-55	Trails would be designed to be compatible with adjacent recreation settings. Trail management would ensure research values are protected.
Protection, 3-55	This component specifies that aggressive “control” fire suppression tactics are generally the appropriate response in this area.

Alternatives B-E

See effects common to all action alternatives.

Cumulative Effects

Under all alternatives, the designation and management of the Tenderfoot Creek Experimental Forest would contribute to ongoing research efforts to better understand treatment methods and the effects of management in lodgepole pine ecosystems, providing information relevant to the HLC NF, other NFs, and lands managed by other federal agencies, the state, and private entities. Experimental forest designations are not known to occur on lands of private ownership, nor on state lands in the area, increasing the importance of this area.

Conclusions

Under all alternatives the administrative designation of this area, and the research activities that occur within it, would be similar. All alternatives would meet research objectives. The primary difference between the no-action alternative and the action alternatives is the ROS setting. The action alternatives may be more limiting to potential future research activities because of inclusion of primitive and semi-primitive recreation opportunity settings within the experimental forest. Alternative A would be permissive to potential vegetation management for research purposes with a recreation opportunity setting of roaded natural across the entire area.

3.22.13 Missouri River Corridor, affected environment

The Missouri River is a nationally recognized river famous for its fishing, outstanding scenery, and the history present along its shores. The area is a primary access route through the Gates of the Mountains, a distinctive limestone cliff formation along this portion of the Missouri River. Recreation use of the Missouri River Corridor is year-round but particularly high during the summer months when water recreation is the most active. A commercial tour boat operation offers boat trips and there are a number of developed and dispersed recreation sites along the banks of the river. This area also provides access to the western portions of the Gates of the Mountain Wilderness. In addition, there are concentrations of cliff nesting raptors in this corridor (also see FW-WLO-DC-03).

3.22.14 Missouri River Corridor, environmental consequences

Effects common to all alternatives

Under all alternatives, the Missouri River Corridor would continue to provide motorized and non-motorized water-based recreation opportunities.

Effects common to all action alternatives

The plan components developed for the Missouri River Corridor would remain the same in all action alternatives. These plan components focus on protecting and enhancing the natural, cultural, and historic values along the Missouri River as well as providing guidance for interpretation and signage. Table 171 summarizes the expected effects of each plan component related to the Missouri River Corridor.

Table 171. Summary of proposed plan components for Missouri River Corridor

Plan component	Expected effects
BB-MISCOR-DC-01; 05; 06	These DCs establish recreation settings and opportunities that are compatible with ecological and cultural/historic features within the corridor.
BB-MISCOR-DC-02; BB-MISCOR-GDL-01	The scenic values within the Missouri River Corridor are valued and will be managed at a High or Very High SIO.
BB-MISCOR-DC-03; 04	The cultural and historic values in the Missouri River Corridor are valued and would be protected and enhanced. The Lewis and Clark National Historic Trail and the Mann Gulch Fire Historic Landscape would be preserved and interpreted to enhance visitor appreciate for the area.
BB-MISCOR-GO-01	This plan component promotes working collaboratively with partners and volunteers to accomplish work within the Missouri River Corridor.
BB-MISCOR-SUIT-01	The Missouri River Corridor would be unsuitable for timber production, although vegetation treatments could occur for reasons of public safety and to enhance the recreation or aesthetic values of the area.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities related to watershed, soil, riparian, or aquatic habitat improvements would influence the management of the Missouri River Corridor, primarily through the management of RMZs. East of the Continental Divide, RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. Plan components for the management of RMZs would help ensure that desirable conditions are maintained or promoted.

Fire and fuels management

Natural, unplanned ignitions and prescribed fires may be used to maintain ecological conditions in the corridor. Plan components for fire and fuels management would encourage an appropriate management response to wildfires and provide opportunities for natural fire to promote and/or enhance the characteristics of the area.

Timber and vegetation management

The Missouri River Corridor is not suitable for timber production, but harvest may be allowed to provide for public safety and enhance the recreational or aesthetic values. Where harvest does occur, it could impact the scenic values, including more open vegetation and stumps, as well as soil disturbance in the short term. Conversely, harvest could be used to improve the scenic quality by creating vistas, mimic vegetation structures that would be created by natural disturbance, promoting healthy vegetation, and mitigating hazard trees in public use areas. Vegetation plan components would help define the objectives for treatments. In addition to harvest, plan components would allow for other vegetation treatments such as tree planting and weed spraying, which could enhance the scenic quality of the corridor.

Recreation and scenery management

Recreation and scenery management plan components would complement the management of the Missouri River Corridor by specifying ROS settings and scenic quality objectives that are consistent with maintaining or moving toward the desired conditions of the corridor, along with providing the facilities and infrastructure needed for the public to access and use the area.

Cultural, historic, and tribal resource management

Plan components for cultural, historic, and tribal resources would complement the management of this area by helping to preserve the unique characteristics of the corridor.

Road access and infrastructure

Plan components for road access and infrastructure would help ensure that roads that may occur in proximity to the corridors are maintained in a condition that protects the resources of the area.

Minerals management

Lands within the Missouri River corridor would be available for minerals activities.

Alternative A, no action

Under alternative A, the Missouri River corridor would not be identified as an administratively designated area and would continue to be managed according to direction provided in the 1986 Helena NF plan. Recreation and interpretation along the corridor would continue to be managed through site specific and case-by-case management decisions on the Forest. Table 172 displays the plan components from the existing 1986 Helena NF Plan that would provide guidance for the Missouri River Corridor.

Table 172. Summary of 1986 Helena NF plan components for the Missouri River Corridor

Plan component	Expected effects
Helena NF Goals 1, 2, 9, 10, and 18	These goals provide for a range of outdoor recreation opportunities that could be developed for visitor use and satisfaction. Developed recreation sites, boat docks and landings, trails, and interpretive sites in the area would continue to be popular with locals as well as out of state visitors. Commercial boat trips and motorized boat access to the corridor for fishing, camping, and other recreation would continue to affect the recreation of the area. Additionally, the corridor would continue to provide access to the Gates of the Mountains wilderness.
Helena NF Objectives	The Missouri River corridor provides motorized boat access to a diverse ecosystem. The objectives that provide guidance include recreation, visual, cultural, water, fish and wildlife.
Helena NF Management Areas R-1 and R-2	The R-1 management area provides direction for large blocks of undeveloped lands suited for dispersed recreation. There are larger blocks of undeveloped lands along the Missouri River corridor that receive dispersed recreation activities. Off of the main corridor of the river, these lands would provide semi-primitive non-motorized recreation settings. Management Area R-2 provides direction for developed recreation settings along the river.

Plan component	Expected effects
	Developed recreation sites within the corridor are Meriwether Picnic area, the Meriwether and Coulter boating sites, and the Coulter Campground. These sites would continue to provide access to the Missouri River Corridor and undeveloped lands adjacent to the river.

Alternatives B-E

See effects common to all action alternatives.

Conclusions

Under alternative A, the Missouri River corridor would not be identified as an administratively designated area and would continue to be managed according to direction provided in the 1986 Helena NF plan. Recreation and interpretation along the corridor would continue to be managed through site specific and case-by-case management decisions on the Forest. In alternatives B- E, plan components for the Missouri River Corridor would be established. By providing the plan components outlined in the action alternatives, the HLC NF would meet the purpose and need of the revised forest plan, ensuring that the river corridor is managed for the natural and cultural resources that make this unique area.

3.22.15 Smith River Corridor, affected environment

The Smith River is a nationally recognized river noted for its fishing, outstanding scenery, and the opportunities it provides for a 60-mile float through private, state, and NFS lands during the late spring and early summer months. The majority of the Smith River Corridor is located in the Little Belts GA. However, the southern portion lies within the Dry Range which is located within the Big Belts GA. HLC NFS lands bordering the Smith River are heavily utilized for recreation. The FS manages the lands along the Smith River through a cooperative agreement with MTDFWP.

3.22.16 Smith River Corridor, environmental consequences

Effects common to all alternatives

Under all alternatives, the Smith River Corridor would continue to provide water-based recreation opportunities and recreation special use permits for outfitter guide operations. Additionally, the revised forest plan would not alter the cooperative agreement between the FS and MTDFWP for the overall management of the Smith River corridor as the Smith River State Park.

Effects common to all action alternatives

The plan components developed for the Smith River Corridor would be the same in all action alternatives. These plan components focus on protecting and enhancing the natural and cultural values along the Smith River. Table 173 summarizes the expected effects of plan components for the Smith River Corridor.

Table 173. Summary of proposed plan components for Smith River Corridor

Plan component	Expected effects
LB-SMITH-DC-01; 04	These DCs guide the recreation settings and opportunities and ensure that they are compatible with ecological and cultural/historic features within the corridor.
LB-SMITH-DC-02; LB-SMITH-GDL-01	High scenic values are desired within the Smith River Corridor and these values would be managed at High or Very High SIOs.
LB-SMITH-DC-03	The DC for the cultural and historic values is to conserve, protect, and/or enhance the identified values in the Smith River Corridor. Interpretation would be provided to enhance visitor appreciation for the area.
LB-SMITH-GO-01	This plan component promotes working collaboratively with partners and volunteers to operate, maintain, and deliver river floating opportunities in the Smith River Corridor.

Plan component	Expected effects
LB-SMITH-SUIT-01	The Smith River Corridor would be unsuitable for timber production, although vegetation treatments could occur for reasons of public safety and enhancing the recreation or aesthetic values along the river.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities related to watershed, soil, riparian, or aquatic habitat improvements would influence the management of the Smith River Corridor, primarily through the management of RMZs. East of the Continental Divide, RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. Plan components for the management of RMZs would help ensure that desirable conditions are maintained or promoted.

Fire and fuels management

Natural, unplanned ignitions and prescribed fires may be used to maintain ecological conditions in the corridor. Plan components for fire and fuels management would encourage an appropriate management response to wildfires and provide opportunities for natural fire to promote and/or enhance the characteristics of the area.

Timber and vegetation management

The Smith River Corridor is not suitable for timber production, but harvest may be allowed to provide for public safety and enhance the recreational or aesthetic values of the corridor. Where harvest does occur, it could impact the scenic values in the corridor, including more open vegetation and stumps, as well as soil disturbance in the short term. Conversely, harvest could be used to improve the scenic quality by creating vistas, mimic vegetation structures that would be created by natural disturbance, promoting healthy vegetation, and mitigating hazard trees in public use areas. Vegetation plan components would help define the objectives for treatments. Plan components would allow for other vegetation treatments such as tree planting and weed spraying, which could further enhance the scenic quality of the corridor.

Recreation and scenery management

Recreation and scenery management plan components would complement the management of the Smith River Corridor by specifying ROS settings and scenic quality objectives that are consistent with maintaining or moving toward the desired conditions of the corridor, along with providing the facilities and infrastructure needed for the public to access and use the area.

Cultural, historic, and tribal resource management

Plan components for cultural, historic, and tribal resources would complement the management of this area by protecting the unique characteristics of the area.

Road access and infrastructure

Plan components for road access and infrastructure would help ensure that roads that may occur in proximity to the corridors are maintained in a condition that protects the resources of the area.

Minerals management

Lands within the Smith River Corridor would be available for minerals activities.

Alternative A, no action

Under alternative A, the Smith River corridor would not be identified as an administratively designated area and would continue to be managed according to direction provided in the 1986 Helena and Lewis and Clark NF Plans. There is no specific direction in either existing Forest Plan but there is overall direction for dispersed recreation areas, cultural and natural resources, and eligible WSRs (Lewis and Clark NF Plan only) that would apply. Table 174 displays the components from the existing 1986 forest plans that would provide guidance for the Smith River Corridor in alternative A.

Table 174. Summary of existing plan components for the Smith River Corridor from the 1986 HLC NF plans

Plan component	Expected effects
Helena NF Goals 1, 2, 9, 10, and 18	These components provide for a range of outdoor recreation opportunities that could be developed for visitor use and satisfaction. Developed recreation sites, boat docks and landings, trails, and interpretive sites within the area would continue to be popular with locals as well as out of state visitors. Permitted river float trips to the area for fishing and camping would continue to affect the many natural and cultural features in the river corridor.
Helena NF Objectives	The Smith River corridor provides non-motorized boat access to a diverse ecosystem along the Smith River. The objectives in the 1986 Helena NF Plan would provide guidance for this area would be recreation, visual, cultural, water, fish and wildlife.
Helena NF Management Area R-1	The R-1 management area provides direction for large blocks of undeveloped lands suited for dispersed recreation. The Smith River flows through larger blocks of undeveloped lands interspersed with private lands that have more development and the undeveloped lands would provide semi-primitive non-motorized recreation settings.
Lewis and Clark NF Goals 1, 3, 7, and 11	These plan components provide for the protection and improvement of visual quality, high quality wildlife and fish habitat, quality and quantity of water, and protecting the existing condition and outstandingly remarkable values of eligible WSRs.
Lewis and Clark NF Objectives	The Smith River corridor provides non-motorized boat access to a diverse ecosystem along the Smith River. The objectives in the 1986 Lewis and Clark NF Plan provide guidance for recreation, visual, cultural, water, wildlife and fish and WSRs.
Lewis and Clark NF Forestwide Standards W-1, W-2, W-3	The forestwide standards for eligible wild, scenic, and recreation rivers on the Lewis and Clark NF focus on protecting the outstandingly remarkable values identified for the eligible rivers.

Alternatives B-E

See effects common to all action alternatives.

Conclusions

In all alternatives, the Smith River Corridor would continue to be managed through cooperative agreement with MTDFWP. Under alternative A, the Smith River Corridor would not be identified as an administratively designated area and would continue to be managed according to direction provided in the 1986 forest plans. Designated dispersed recreation sites along the river corridor and outfitter and guide special use permits would continue to be managed through site-specific and case-by-case management decisions. In alternatives B- E, plan components for the Smith River Corridor would be established. By providing the plan components outlined in the action alternatives, the HLC NF would meet the purpose and need of the revised forest plan, ensuring that the river corridor is managed for the natural and cultural resources that make it a unique and special place.

3.22.17 South Hills Recreation Area, affected environment

The proposed South Hills Recreation Area is located just to the south and west and adjacent to the community of Helena, Montana. It is approximately 50,180 acres in size and extends to MacDonald Pass and the Continental Divide. This large landscape includes lands in and around private land ownership, shares boundaries with the City of Helena, and has shared jurisdiction with the City of Helena on many of the trails nearest the community. Additionally, the area includes large portions of nonmotorized inventory roadless areas as well as portions of the Continental Divide National Scenic Trail. This area is identified for alternatives B, C, and D. It is not included in alternatives A or E.

3.22.18 South Hills Recreation Area, environmental consequences

Effects common to all action alternatives

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and management activities for aquatic ecosystems and soil management would affect the management of the South Hills Recreation Area. The plan components that may have the greatest influence are those associated with RMZs. East of the Continental Divide, RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative.

Vegetation treatments such as prescribed fire and harvest that may occur in the South Hills Recreation Area would be limited or modified in RMZs. Riparian area plan components may limit or influence recreation-related activities, such as trail construction or maintenance, within the RMZs. The area on which these components apply is greater with the action alternatives than with the no-action alternative east of the Continental Divide.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur within the South Hills Recreation Area, and provide opportunities for natural fire to influence the vegetation condition of these areas. If fire does occur, it may alter the aesthetic quality of the landscape and may also create short term barriers to certain recreation uses (for example, dead trees that need to be cleared from trails). However, the potential negative impacts from fire would be ameliorated by fire and fuels plan components that emphasize hazardous fuel mitigation in high-use areas such as the South Hills Recreation Area. Fire management activities may help meet the desired conditions described in DI-SHRA-DC-03 related to resilience and low fire hazard.

Timber and vegetation management

The South Hills Recreation Area would not be suitable for timber production, but timber harvest may occur for other resource purposes, specifically for resource management objectives compatible with the recreation values of the area (DI-SHRA-SUIT-01). Harvest could be used to move towards the desired conditions described in DI-SHRA-DC-03. Plan components associated with timber harvest would ensure that all resource protection measures are met. Plan components related to desired vegetation conditions could influence whether vegetation treatments (such as harvest or management-ignited fires) are conducted, and help define the objectives for those treatments.

Livestock grazing and management

Livestock grazing could occur in portions of the South Hills Recreation Area. While livestock grazing itself has the potential to degrade plant communities through factors such as invasive plant spread and damage to riparian areas, plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components should help protect the ecological integrity of the area.

Recreation and scenery management

Plan components for recreation settings, opportunities, and access along with scenery management would complement the management of the South Hills Recreation Area and ensure that potential recreation and other activities, such as restoration treatments, would be consistent with its desired conditions.

Cultural, historic, and tribal resource management

Plan components related to cultural, historic, and tribal resource would have little to no effect on the South Hills Recreation Area.

Road access and infrastructure

Where road or trail maintenance, construction, or re-construction activities occur they would be guided by road access and infrastructure plan components which include protections for other resources.

Minerals management

Lands within the South Hills Recreation Area would be available for minerals activities.

Alternative A, no action

There is currently no direction for the proposed South Hills Recreation Area in the 1986 Helena NF Plan. However, there is plan direction for roadless areas and dispersed recreation areas that would apply to this area of the Forest. The following plan components from the existing 1986 Helena NF Plan would provide guidance for recreation uses within the area commonly considered the South Hills Recreation Area. This information is summarized in Table 175.

Table 175. Summary of existing Helena NF plan components for landscapes in the South Hills Recreation Area

Plan component	Expected effects
Helena NF Goals 1 and 2	These plan components provides for a range of outdoor recreation opportunities that could be developed for visitor use and satisfaction. Trails and trailheads in the area known as the South Hills would continue to be popular with locals as well as out of state visitors. Development of additional trails and trailhead facilities may be necessary to accommodate growth in recreation.
Helena NF Roadless Objective	Mount Helena IRA is located in the area. Additionally, the Lazyman Gulch area, also located within the area known as the South Hills, was formally established as an IRA in 2001. Management of these IRAs for their roadless characteristics would continue into the future.
Helena NF Management Area R-1	The R-1 management area provides direction for large blocks of undeveloped lands suited for dispersed recreation. These lands include the Mount Helena area which is located within the area commonly referred to as the South Hills. The focus in this management area is providing a variety of primitive and semi-primitive non-motorized recreation opportunities. Motorized activities are generally prohibited in this area and recreation facilities provide access to and support dispersed recreation. Management area-specific standards apply to recreation, visual quality, wildlife, range, timber, water/soils, minerals, protection, and facilities. Due to the proximity to populated areas, there is an emphasis of construction of trailhead facilities and wildlife suppression for this area. Specific restrictions apply to motorized recreation access, livestock animal use months, timber harvest, minerals, and road construction.

Alternatives B and C

Alternatives B and C identify the South Hills Recreation Area as an area to be managed with specific direction and emphasis. The focus of this area would be on dispersed nonmotorized recreation use provided by a network of trails throughout the area. These areas are supported by facilities such as trail treads and trailheads.

Due to the popularity of the proposed South Hills Recreation Area and the increased recreation use that this area receives, additional protections would be necessary to ensure safety and to reduce damage to natural and cultural resources. As a result, mountain bike activities would be permitted to occur on FS established roads and trails only. Mountain bike use off of established roads and trails would be prohibited in alternatives B and C.

This area would provide a semi-primitive nonmotorized recreation setting, although there are smaller pockets within the overall recreation area that would provide remote and more solitary experiences. Table 176 summarizes the expected effects of each plan component related to the South Hills Recreation Area in alternatives B and C.

Table 176. Summary of proposed plan components for South Hills Recreation Area (alternatives B and C)

Plan component	Expected effects
DI-SHRA-DC-01; 02	These DCs establish the South Hills Recreation Area as a non-motorized area available for a variety of dispersed, trail-oriented, non-motorized recreation activities.
DI-SHRA-DC-03	This DC provides direction to manage the vegetation in the South Hills Recreation Area to support safe recreation experiences. This would include creating vegetative conditions that are resilient to fire disturbances, promote low fire hazards near values at risk, emphasize fire resistant species, and manage for open stands more resistant to wildfire.
DI-SHRA-GO-01	This plan component promotes working collaboratively with partners and volunteer to accomplish work within the South Hills Recreation Area.
DI-SHRA-SUIT-01	The South Hills Recreation Area would not be suitable for timber production, although vegetation treatments could occur if consistent with the recreation values of the area.
DI-SHRA-SUIT-02	Mountain bike activities would be suitable in the South Hills Recreation Area on FS established roads and trails. Mountain bike activities off of designated roads and trails would be prohibited.

Alternative D

Alternative D is similar to alternatives B and C in that it also identifies the South Hills Recreation Area as an area to be managed with specific direction and emphasis. The focus of the South Hills Recreation Area in alternative D would also be on dispersed non-motorized recreation use provided by a network of trails throughout the area. Alternative D responds to comments received during pubic scoping asking the Forest to consider an alternative that increases the amount of RWAs and primitive recreation opportunities on the Forest. Commenters also asked the Forest to consider an alternative in the South Hills Recreation Area that would not allow mountain bike uses in portions of the area.

In response to these comments, alternative D identified a RWA in the Colorado Gulch area. This RWA would be managed for a primitive ROS setting, providing a recreation area within the South Hills Recreation Area where solitude and primitive recreation opportunities would be provided. Motorized and mechanized means of transportation (including bicycles) would not be allowed within the RWA.

The plan components for alternative D are the same as those developed for alternatives B and C above, except for the following plan component, described in Table 177 below.

Table 177. Summary of additional proposed plan component for South Hills Recreation Area (alternative D)

Plan component	Expected effects
DI-SHRA-SUIT-03	This plan component prohibits mountain bike use within the Colorado Mountain RWA and would create a primitive ROS setting within the overall South Hills Recreation Management Area.

Alternative E

Alternative E responds to comments received during pubic scoping asking the Forest to consider an alternative that did not identify RWAs and that increased the amounts of NFS lands available for timber harvest. In response to these comments, the South Hills Recreation Area would not be identified as a special area in alternative E. By not identifying this area for special recreation management, a subset of these lands would be available for timber production.

Recreation uses of this area would continue unaltered from the existing condition unless impacted by future timber harvesting, road construction, or travel planning. Due to the focus of timber management in this alternative, the ROS settings would shift, resulting in an increase in motorized ROS settings and a decrease in the amount of semi-primitive nonmotorized ROS settings.

There would be no specific plan components for the South Hills Recreation Area for alternative E.

Conclusions

Alternatives A and E do not identify a specific area designation for this area. Recreation would continue to be managed through site-specific and case-by-case management decisions on the Forest. Travel plans would provide guidance on where motorized uses could and could not occur.

Alternatives B and C would establish the South Hill Recreation Area as an administratively designated area on the HLC NF. By providing the plan components in these alternatives, the HLC NF would meet the purpose and need of the revised forest plan, ensuring that the South Hills Recreation Area is managed in the long term for its semi-primitive nonmotorized recreation uses.

Alternative D would establish the South Hill Recreation Area as an administratively designated area on the HLC NF. It also would meet the purpose and need of the revised forest plan by providing plan components that would ensure that it is managed for nonmotorized recreation uses into the future. The only exception would be that in addition to semi-primitive non-motorized settings, this alternative would also provide an area within the South Hills Recreation Area that provides primitive recreation opportunity settings. This primitive area would prohibit the use of mountain bikes.

3.22.19 Elkhorn Wildlife Management Unit, affected environment

The Elkhorn Mountains are an island mountain range that lies in Broadwater, Jefferson, and Lewis and Clark Counties - approximately 18 air miles southeast of Helena, MT. This prominent mountain range is approximately 21 miles long and 19 miles wide and NFS lands within this mountain range total approximately 160,000 acres. The landscapes and the vegetation have been substantially altered by historic placer and lode mining, free range grazing, and recreation. Additionally, in the early years of European settlement, the area was heavily hunted and the populations of many big game species in the area were depleted. These influences have had serious and lasting impact on the natural resources of the area and the protection and restoration of this important landscape are some of the primary reasons it has been designated as a wildlife management area.

Although a portion of the Elkhorns GA is located on and administered by the Beaverhead-Deerlodge NF, the components found in HLC NF revised forest plan would apply to the entire area.

In 1986-1987, both the Helena and Deerlodge Forest Plans included goals and standards for management of the Elkhorns. Two amendments to the Helena Forest Plan, Amendments 10 and 11, were established in 1995. These amendments provide direction for the Elkhorns in future management of the vegetative component on this landscape.

In the interest of managing this ecosystem with an emphasis on fish and wildlife values, the BLM; MTDFWP; and the Helena and Beaverhead-Deerlodge NFs entered into a memorandum of understanding in 1992 to provide consistent management across administrative boundaries. In 2013, the Natural

Resource Conservation Service signed on as a partner. Additionally, there are two citizens groups involved with the Elkhorns: the Elkhorn Working Group and the Elkhorn Restoration Committee.

The Elkhorn Working Group was initially established in 2002 to advise the MTDFWP, and the BLM in the development of collaborative recommendations related to wildlife/livestock management strategies in the Elkhorns. Over time, the Elkhorn Working Group has become a catalyst for self-sustaining, local responsibility for problem solving in the Elkhorns. The Elkhorn Working Group is composed of local landowners; representatives of business, sporting, and environmental communities; and employees from the FS, counties, BLM, and MTDFWP.

The Elkhorn Restoration Committee has its roots as a subcommittee of the Elkhorns Working Group. The goal of the Elkhorns Restoration Committee is to work with agency staff, organizations, and other interested parties to develop site-specific proposals for landscape restoration in the Elkhorns.

3.22.20 Elkhorn Wildlife Management Unit, environmental consequences

Effects common to all alternatives

The administrative designation of the Elkhorns Wildlife Management Unit would remain in place under all alternatives. Even though the plan components would be structured differently, all alternatives include components that would ensure the area is managed in a manner consistent with the Elkhorn Management Unit designation and the recommendations within the Final Report on the Elkhorn WSA (USDA 1981b).

Effects common to all action alternatives

All action alternatives would contain the similar plan components related to the Elkhorns Wildlife Management Unit. The primary difference between the action alternatives and the no-action alternative is that the land would be managed by a suite of plan components that apply forestwide, to the entire Elkhorns GA, or to specific land allocations within the GA (such as ROS settings). The land would not be divided into management units, as was done in the 1986 plans. Revised plan components are reflective of the plan components from the 1986 Helena NF Plan, but have been modified to meet the new 2012 Planning Rule direction.

Plan components relevant to the Elkhorns Wildlife Management Unit and their expected effects are summarized in Table 178. There are also additional plan components that apply to the Elkhorns GA that are not directly related to the purpose of the wildlife management unit, although they apply to the same landbase. These components are summarized as appropriate in other resource sections.

Table 178. Summary of proposed plan components for Elkhorns wildlife management unit

Plan component	Expected effects
EH-WMU-DC-01	This DC establishes that the Elkhorn Mountains GA would support native species and emphasize seclusion as a habitat feature.
EH-WMU-GO-01, 02, 03, 04, 05	These GOs would help ensure that the Elkhorn wildlife management unit is managed seamlessly across ownership boundaries, in close cooperation with Montana Fish, Wildlife, and Parks as well as other agencies.
EH-WMU-GDL-01	This GDL would ensure that management activities would not have negative impacts to wildlife and wildlife habitats.
EH-WMU-SUIT-01; 02	These SUIT statements would result in the Elkhorns being unsuitable for timber production, but the utilization of harvest and prescribed fire would be emphasized to achieve purposes other than timber production, such as restoration, wildlife habitat improvements, hazardous fuel reduction, and protection of values at risk.

Plan component	Expected effects
EH-WMU-SUIT-03	This component would ensure that elk are not disturbed by motorized travel in elk wintering areas from the end of hunting season to the spring, which would limit stress and minimize displacement from forage and cover when food is scarce and energetic demands are high.
EH-WL-DC-01	This DC would help ensure that habitat for the needs of species with seclusion as a requirement is available.
EH-WL-STD-01	This STD would ensure that the most current recommendations or interagency efforts to maintain separation of bighorn sheep from domestic sheep and goats would be followed.
EH-WL-GDL-01, 02	These GDLs would ensure that activities or permits (including grazing, special uses, and others) would be designed to minimize impacts to wildlife, through measures such as timing, location, access, and retention of vegetation as needed.
EH-ACCESS-DC-01	This DC ensures that the Elkhorns Wildlife Management Unit provides dispersed nonmotorized recreation opportunities, and that authorized motorized recreation opportunities occur in defined areas and within defined timeframes.
EH-ACCESS-GDL-01	This GDL would ensure that access to private inholdings or mining claims would protect wildlife habitat.
EH-ACCESS-SUIT-01	This plan component prohibits the use of mountain bikes in a “core area” of the Elkhorns GA (alternative C only). This would create a more undeveloped recreation setting in this area.
EH-RT-STD-01 and 02	This STD establishes direction for when and where new permanent roads may be constructed and prohibits the establishment of a permanent road bisecting the Elkhorns Mountain Range. These actions support maintaining and enhancing an undeveloped setting in the core of the Elkhorns GA.
EH-RT-GDL-01	This GDL instructs that roads constructed for exploration or development of leasable minerals should avoid identified elk winter range, big-game calving areas or other identified wildlife habitats in which wildlife are known to be sensitive to disturbance or displacement. Permanent roads should meet the wildlife habitat objectives.
EH-TIM-GDL-01	This plan component would limit the harvest of timber and other forest products in elk winter range to the non-winter season. The effect of this would be to reduce the potential to disturb elk while they are using winter range resources, and the timing limitations may lower the feasibility of some harvest projects.
EH-EMIN-GDL-01, 02	These GDLs would limit the disturbance associated with energy and minerals activities that occurs during timeframes, or in locations, that are known to be sensitive for wildlife.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and management activities for aquatic ecosystems and soil management would affect the management of the Elkhorns Wildlife Management Unit. The plan components that may have the greatest influence are those associated with RMZs. East of the Continental Divide, RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. Vegetation treatments such as prescribed fire and harvest that may occur would be limited within RMZs, or modified to comply with plan components for those areas. The area on which these components apply is greater with the action alternatives than with the no-action alternative.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur within the Elkhorns wildlife management unit, and provide opportunities for natural fire to influence the vegetation condition of this area.

Timber and vegetation management

Under all alternatives, timber harvest and other vegetation management activities, such as reforestation, prescribed fire, and fuel reduction activities could occur within the Elkhorn Wildlife Management Unit.

Plan components would ensure that these activities improve wildlife habitat, restore or maintain desired vegetation conditions, reduce hazardous fuels, and/or to protect values at risk. Prescribed fire could potentially be utilized anywhere in the GA. Projects with a purpose of restoration or maintenance of desired vegetation conditions could include maintaining or increasing nonforested plant communities, reducing conifer encroachment, promoting large trees and open forests, and increasing or promoting species such as limber pine, ponderosa pine, aspen, and whitebark pine.

While the Elkhorns GA would be unsuitable for timber production, timber harvest could be utilized in areas that do not specifically preclude this activity (such as primitive recreation settings). Table 179 displays the area where harvest could be allowed, excluding IRAs. While some very limited amounts of harvest could potentially occur in these areas, it would be restricted by the terms of the 2001 Roadless Area Conservation Rule, and due to accessibility is unlikely to occur in the Elkhorns Wildlife Management Unit. Timber harvest could occur on a similar area under all alternatives.

Table 179. Acres[1] and proportion of lands unsuitable for timber production where harvest can occur in the Elkhorns GA, outside of IRAs

Alternative A	Alternative B/C	Alternative D	Alternative E
83,026 (51%)	86,482 (54%)	84,376 (52%)	86,482 (54%)

3. The acres of NFS lands unsuitable for timber production, but where harvest may occur. Excludes lands where harvest would not be permitted for any purpose, such as designated wilderness, WSAs, RWAs, RNAs, or primitive recreation settings. The total also excludes IRAs, where harvest would be greatly limited.

The modeling done to analyze terrestrial vegetation included treatment constraints and opportunities in the Elkhorns GA, as well as expected natural disturbances and processes. Please refer to the terrestrial vegetation section and appendix B for the expected trend of vegetation in the Elkhorns.

Livestock grazing and management

Livestock grazing may occur in portions of the Elkhorns wildlife management unit. While livestock grazing has the potential to degrade plant communities through factors such as invasive plant spread and damage to riparian areas, plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components would help protect the ecological integrity of the area.

Wildlife management

Forestwide and Elkhorns GA plan components for wildlife management would complement the specific wildlife management plan components associated with the Elkhorns Wildlife Management Unit.

Recreation and scenery management

Plan components for recreation settings, opportunities, and access along with scenery management would complement the management of the Elkhorns Wildlife Management Unit and ensure that potential recreation and other activities, such as restoration treatments, would be consistent with its desired conditions for wildlife habitat.

Cultural, historic, and tribal resource management

Plan components related to cultural, historic, and tribal resource would have little to no effect on the Elkhorns Wildlife Management Unit.

Road access and infrastructure

Where road or trail maintenance, construction, or re-construction activities occur they would be guided by road access and infrastructure plan components which include protections for other resources.

Minerals management

The Elkhorns would be available for minerals activities.

Alternative A, no action

The existing 1986 Forest Plan for the Helena NF includes guidance for the Elkhorn Wildlife Management Unit, as summarized in Table 180.

Table 180. Summary of existing plan components for Elkhorns Wildlife Management Unit

Plan component	Expected effects
Management Area Elkhorns-1	The plan components provide direction for lands in the lower Crow Creek, Johnny Gulch, Slim Sam, lower Indian Creek, Kimber Gulch, Whitehorse Creek, Spokane Creek and Sheep Creek drainages in the norther, southern, and eastern portions of the Elkhorn Mountain Range. The focus is elk winter range, with goals including but not limited to improving vegetation through livestock management and prescribed fire. MA-specific standards apply to recreation, visual quality, wildlife, range, timber, water/soils, minerals, protection, and facilities. These standards would result in promoting winter elk security and elk winter range values. Specific restrictions apply to motorized winter recreation, livestock AUMs, timber harvest, minerals, and open roads.
Management Area Elkhorns-2	The plan components provide direction for lands in the unroaded areas within the central and western portions of the Elkhorns. This includes areas in the higher elevations (6,500 to 9,400 feet) in the upper Beaver Creek drainage, Casey Peak, High Peak, Casey Meadows, the upper Tizer Basin, Crow Peak, and Elkhorn Peak. The focus is maintaining or enhancing mountain goat and elk summer range. Goals for this area provide for other resource objectives, if they can be accomplished with minimal development while optimizing mountain goat and elk summer habitat. Specific standards apply to recreation, visual quality, wildlife, range, timber, water/soils, minerals, protection, and facilities. These standards would result in improving security for wildlife species and mountain goat and elk summer habitat. Restrictions apply to motorized summer recreation, livestock AUMs, timber harvest, minerals, and road construction.
Management Area Elkhorns-3	The plan components provide direction for lands in high elevations (6,000-7,000 feet) in the east-central and northeast portions of the Elkhorns. This includes portions of the Tizer Basin, Crow Creek drainage, and numerous small drainages. The focus of this management area is elk calving and summer range. Goals also focused on maintaining and enhancing moose, mule deer, and other wildlife habitat if they are compatible with elk calving and summer habitat. Management area-specific standards apply to recreation, visual quality, wildlife, range, timber, water/soils, minerals, protection, and facilities. These standards would result in improving security for elk calving and summer habitat. Specific restrictions apply to limiting motorized dispersed recreation, livestock AUMs, timber harvest, minerals, and road locations and densities.
Management Area Elkhorns-4	The plan components emphasize big game habitat management in the northwest portion of the Elkhorns Mountain Range. This are includes the McClellan Creek drainage and number of smaller drainages that drain west into Prickly Pear Creek. The focus is the optimization of moose, elk, and mule deer habitat and the maintenance or improvement of water quality and stream stability in McClellan Creek which contributes to the municipal water supply for East Helena. Specific standards apply to recreation, visual quality, wildlife, range, timber, water/soils, minerals, protection, and facilities. These standards would result in maintaining and enhancing big game wildlife habitat. Specific restrictions apply to motorized uses, livestock animal use months, timber harvest, minerals, and road locations and densities.

Alternatives B and E

Under alternatives B and E there would be no anticipated changes to recreation from the existing condition. The “core” area of the Elkhorns would be largely encompassed by an IRA, which would contribute to the availability of secluded habitat conditions. Potential mechanized use of the trails in this area could result in wildlife disturbance or displacement during the summer months, but this is not likely to be substantially greater than the displacement caused by foot or equestrian travel. Over-snow motorized use would be allowed as currently designated by travel plans. Where it is permitted, this use has the potential to displace or disturb wildlife during the winter months. Refer to appendix A for a map of the ROS settings for these alternatives.

Alternative C

The core of the Elkhorns holds special significance for many people. During scoping, the public asked for the FS to consider prohibiting the use of mountain bikes in this core area to provide a more undeveloped recreation setting. In alternative C, mountain bikes would be prohibited from using approximately 60 miles of nonmotorized trails in a core area of the Elkhorns GA (see map in appendix A). These nonmotorized trails would be open to other nonmotorized uses.

This feature of alternative C would eliminate the potential of mountain bikes to disturb or displace wildlife in the core area; this effect would generally only occur in the summer months, which is a less vulnerable time for most wildlife species as compared to winter. Excluding mountain bikes may incrementally improve the quality of habitat for species that require seclusion. However, foot and equestrian travel could still occur, and the magnitude of this effect would be negligible.

Additionally, alternative C changes the winter ROS setting in a portion of the area from semi-primitive motorized, which allows for over-snow motorized uses (including snowmobiling), to semi-primitive non-motorized, which would prohibit those uses. This occurs on an area in the northwestern portion of the GA (see map in appendix A). Snowmobiling would continue to be allowed within roaded natural settings along roads that are open for this activity. By reducing over-snow motorized use, the quality of habitat for species that require seclusion would be improved in these areas in the winter in alternative C as compared to alternatives A, B, D and E. This improvement would correspond to the time of year when species such as elk are most vulnerable to stress.

Alternative D

Alternative D responds to comments received during pubic scoping asking the Forest to consider an alternative that identified a need to provide additional primitive, undeveloped recreation opportunities in the Elkhorns GA. This was accomplished by specifying a primitive ROS setting for an area in the central Elkhorns (see appendix A for a map). This results in a shift in the ROS settings, increasing the amount of primitive classes in both summer and winter seasons. A primitive ROS setting would prohibit the use of motorized uses in this area. This would create changes to the winter recreation uses in this area where motorized over-snow uses are currently authorized by the winter travel plan. Creating this primitive area would reduce the acres available to over snow winter recreation by 17,878 acres.

The area specified with a primitive ROS setting is generally the same as the Elkhorns Core area identified in alternative C where no mechanized use would occur. However, under alternative D mechanized use would be allowed in this area, while motorized uses would not. Excluding motorized uses in the winter would contribute to the availability and quality of habitat for species requiring seclusion, and reduce the potential for displacement or disturbance of these species during a time when they are the most vulnerable to stress. This is offset somewhat because the area where motorized over-snow use is prohibited in alternative C does not overlap this area. Therefore, while the overall net potential improvement to secluded habitat would be greatest in alternative D, in some specific locations alternative C contributes to habitat quality to a greater degree.

Cumulative Effects

Changing human population

Additional stressors that may increase in the future is increasing population, with resulting increasing demands and pressures on public lands. Locally, at present populations are increasing in the counties on the west side of the plan area, but are declining or stable in other areas. These changes may lead to increased demands for recreational use, including hunting, in the Elkhorns Wildlife Management Unit. This pressure may elevate the importance of providing for habitat needs of wildlife.

Management of adjacent lands

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. The Elkhorns Wildlife Management Unit encompasses portions of the Beaverhead-Deerlodge NF as well state, private, and BLM lands. This area is unique in that a memorandum of understanding is in place to ensure seamless management of the area occurs across agency boundaries.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 181, for those plans applicable to the Elkhorns Wildlife Management Unit.

Table 181. Summary of cumulative effects to the Elkhorns Wildlife Management Unit from other resource management plans

Resource plan	Description and Summary of effects
Beaverhead-Deerlodge National Forest Plan	To ensure seamless management, the entire Elkhorns Wildlife Management Unit is guided by the HLC NF Forest Plan. Therefore there is no potential for conflict with the Beaverhead-Deerlodge NF plan with respect to this area.
Montana Statewide Forest Resource Strategy (2010)	This plan guides forest management on state lands. It includes many concepts that are complementary to revised plan components for the HLC NF, including providing wildlife habitat. This strategy supports the management of the Elkhorns Wildlife Management unit which occurs cooperatively across agencies.
BLM Resource Management Plans (RMP)	BLM lands in the Elkhorns Wildlife Management Unit is managed by the Butte field office. The Butte plan was recently revised (2009). This plan contain components that complement the HLC NF forest plan (all alternatives) and supports the management of the area cooperatively across agencies.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily non-forested, and calls for managing for fire-resilient vegetation as well as restoration of native vegetation. This plan would be generally complementary to the management of the Elkhorns Wildlife Management Unit with regards to promoting the health of native vegetation. However, the disturbances that occur in this area may displace wildlife and increase the importance of seclusion on lands of other ownerships.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for wildlife. This plan would be complementary to the habitat goals for the Elkhorn Wildlife management unit, and support the management of the area cooperatively across agencies.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. Where WUI occurs in the Elkhorns Wildlife Management Unit, these plans would support an emphasis on restoration and fuels reduction, which is consistent with revised plan components.

Conclusions

- Under all alternatives, the Elkhorns Wildlife Management Unit would be managed in a manner consistent with its original purpose for establishment.
- The action alternatives place a greater emphasis on restoration activities to improve wildlife habitat and to meet other resource objectives as compared to alternative A.
- The effects of alternatives B and E would be generally the same as alternative A. Mechanized use on nonmotorized trails has the potential to disturb wildlife in the summer months. Where it is permitted, motorized over-snow use has the potential to displace or disturb wildlife in the winter.

- In alternative C, the exclusion of mechanized use in the Elkhorns Core area may incrementally increase or improve the quality of habitat for species that require seclusion. However, foot and equestrian travel would still occur, and wildlife are generally less vulnerable when this use would occur (summer); therefore, the magnitude of this effect would be negligible.
- In alternative C, habitat quality for species that require seclusion would be improved in an area in the northwestern part of the GA due to exclusion of motorized over-snow uses. This improvement would correspond to the time of year when species such as elk are most vulnerable.
- In alternative D, the area in the Elkhorns Core would be designated as a primitive ROS setting, where mechanized use would be allowed but motorized uses would not, including over-snow uses. The overall net potential improvement to secluded habitat would be greatest in alternative D.

3.22.21 Kings Hill Scenic Byway, affected environment

The Kings Hill Scenic Byway is a 71-mile long National Forest Scenic Byway that begins at the junction of US Highways 89 and 12 near White Sulphur Springs, MT. Approximately 40 miles of the byway passes through NFS lands located in the Little Belts GA. The route provides access to NFS campgrounds, numerous dispersed camping opportunities, cross-country and downhill skiing, snowmobile play areas, and numerous trails and roads. A number of interpretive signs along the route highlight the many scenic, historic, and recreation features found along the scenic byway. Some of these signs are located on NFS lands but several are located on private and state lands and provide interpretations to these lands as well.

3.22.22 Kings Hill Scenic Byway, environmental consequences

Effects common to all alternatives

Under all alternatives, the Kings Hill Scenic Byway would continue to be emphasized for providing access to and interpretation of the landscape and history of the area, and the many outdoor recreation opportunities accessed by the route.

Effects common to all action alternatives

Plan components developed for the Kings Hill Scenic Byway would remain the same in all action alternatives. These plan components focus on protecting and enhancing the scenic qualities along the route as well as providing guidance for interpretation and signage in the area. Table 182 summarizes the expected effects of each plan component related to the Kings Hill Scenic Byway.

Table 182. Summary of proposed plan components for Kings Hill Scenic Byway

Plan component	Expected effects
LB-KHSB-DC-01	This DC ensures that the scenic quality along the Kings Hill Scenic Byway is natural appearing and provides high scenic values.
LB-KHSB-DC-02 and 03	This DC ensures that the interpretive and recreation infrastructure located along the Kings Hill scenic byway protect, compliment, and promote the intrinsic scenic values along this route, and is cohesive and enhances the appreciation of the natural and cultural landscapes of this area.
LB-KHSB-GO-01	This GO aims to update, promote, and maintain the interpretation and signing along the scenic byway with assistance from partnerships with local and state highway districts and volunteers.
LB-KHSB-GDL-01	This GDL provides direction for the protection of scenic quality during the implementation of management activities along the Kings Hill Scenic Byway. This guidance should provide a consistent approach to the management of scenery along the route.
LB-KHSB-SUIT-01	Lands adjacent to the Kings Hill scenic byway would not be suitable for timber production but timber harvest may be used to improve or enhance the scenic quality along this route.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities associated with aquatic ecosystems and soil management would have no measurable influence on the King's Hill Scenic Byway.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur near the King's Hill Scenic Byway, and provide opportunities for natural fire to alter the vegetation condition of the landscape. When fire does occur, whether natural or management-ignited, it could change the scenery visible from the road, including charred vegetation in the short term as well as re-growth in the longer term. Fire on the landscape is a natural process that would generally complement the scenic quality objectives for the King's Hill Scenic Byway.

Timber and vegetation management

The area surrounding the King's Hill Scenic Byway is unsuitable for timber production, but harvest and other vegetation management activities could occur to provide for public safety and/or to enhance the recreational and scenic values of the area. Where harvest does occur, it could impact the scenic values visible from the road, including more open vegetation and stumps, as well as soil disturbance in the short term. However, harvest could be used to improve the scenic quality by creating vistas, mimic vegetation structures that would be created by natural disturbance, promote healthy vegetation, and remove hazardous trees. Vegetation plan components would help define the objectives for treatments. In addition to harvest, plan components would allow for other vegetation treatments such as tree planting and weed spraying, which could further enhance the scenic quality of the byway. All vegetation treatments would be designed to meet the required SIO of the byway (high).

Livestock grazing and management

Plan components and activities associated with livestock grazing are not likely to have an effect on the King's Hill Scenic Byway.

Recreation and scenery management

Recreation and scenery management plan components would complement the management of the King's Hill Scenic Byway by specifying ROS settings and scenic quality objectives that are consistent with maintaining or moving toward the desired conditions of the byway, along with providing the facilities and infrastructure needed for public access and interpretation.

Wildlife management

Plan components and activities associated with wildlife management are not likely to have an effect on the King's Hill Scenic Byway.

Cultural, historic, and tribal resource management

Plan components and activities associated with cultural, historic, and tribal resource management are not likely to have an effect on the King's Hill Scenic Byway.

Road access and infrastructure

Plan components associated with road access and infrastructure would have little effect on the management of the King's Hill Scenic Byway because the highway itself is not maintained by the FS.

Minerals management

Lands along the Kings Hill Scenic Byway would be available for mineral activities.

Alternative A, no action

Table 183 summarizes the existing Forest Plan components for the Kings Hill Scenic Byway. A number of plan components in the 1986 Lewis and Clark NF Plan guide the management of the visual resource within the seen areas from this major route. The Kings Hill Scenic Byway is also managed through the Scenic Byway Master Plan, a separate plan developed in 1992 that provides guidance for the interpretation sites along the scenic byway as it passes through the Forest.

Table 183. Summary of existing plan components for Kings Hill Scenic Byway

Plan component	Expected effects
Lewis and Clark NF Goal 1	This goal provides for resource development and use activities so long as land and resource quality and productivity are protected and/or improved. This direction includes the consideration of natural beauty.
Lewis and Clark NF Objectives	Visual resource management would be emphasized in areas seen from identified visually sensitive roads and trails.
Lewis and Clark NF Forest-wide Standard A-8	Highway 89, Kings Hill Scenic Byway, is identified as a Sensitivity Level 1 viewpoint. Seen areas from Sensitivity Level 1 roads occur in different management areas with different prescriptions, however, views from them are important and would be managed to reflect visual quality objectives.
Lewis and Clark NF Management Area A	This management area identifies the high scenic values near US Highway 89 (Kings Hill Scenic Byway). Scenic values would be protected, maintained or enhances along this highway. The visual quality objectives of retention and partial retention would be met.
Lewis and Clark NF Forest Plan Amendment 16	This plan amendment recognizes the importance of the scenic values along US Highway 89 and increase the number of acres next to the route to protect and enhance those scenic values.

Alternatives B-E

See effects common to all action alternatives.

Conclusions

There is currently no specific direction for the Kings Hill Scenic Byway in the 1986 Lewis and Clark Forest Plan. In alternative A, the no-action alternative, direction for the scenic byway would continue to be provided through the Scenic Byway Master Plan, a separate plan developed in 1992 to provide guidance for the interpretative sites along the scenic byway as it passes through the Forest.

In the action alternatives, (alternatives B- E) all plan components for the Kings Hill Scenic Byway would remain the same. By providing the plan components outlined in the action alternatives, the HLC NF would meet the purpose and need of the revised forest plan, ensuring that the nature and purposes for which the Kings Hill Scenic Byway was identified is enhanced and/or protected for present and future generations.

3.22.23 Badger Two Medicine, affected environment

The area commonly known as the Badger Two Medicine encompasses approximately 129,600 acres at the northern end of the Rocky Mountain Range GA. The majority of this area is located within the Badger-Two Medicine Traditional Cultural District, an area acknowledged for its significance to the oral traditions and culture practices of the Blackfeet people, who have used the lands for traditional purposes for generations and continue to value the area as important to maintaining their community’s continuing cultural identity.

The Badger Two Medicine also falls within the 1895 Agreement with the Indians of the Blackfeet Indian Reservation in Montana, which states that the Blackfeet Nation will retain treaty rights to extract timber, fish, animals, and other resources in the Badger Two Medicine area.

3.22.24 Badger Two Medicine, environmental consequences

Effects common to all alternatives

Under all alternatives, the Badger Two Medicine would continue to provide primitive and semi-primitive nonmotorized recreation opportunity settings. The Badger Two Medicine Traditional Cultural District would remain intact and would continue to acknowledge the significance of this area to the Blackfeet people. The 1895 Agreement with the Indians of the Blackfeet Indian Reservation in Montana would continue to provide the Blackfeet Nation with treaty rights to extract timber, fish, animals, and other resources in the Badger Two Medicine area.

Variances for travel for traditional and cultural purposes would be permitted to meet treaty obligations with the Blackfeet Nation and to protect or enhance the Badger Two Medicine Traditional Cultural District in all of the alternatives.

Effects common to all action alternatives

The plan components developed for the Badger Two Medicine area would remain the same in all action alternatives. These plan components focus on protecting and enhancing the natural and cultural values throughout the Badger Two Medicine area. Table 184 summarizes the expected effects of each plan component related to the Badger Two Medicine.

Table 184. Summary of proposed plan components for Badger Two Medicine

Plan component	Expected effects
RM-BTM-DC-01	This DC identifies that the Badger Two Medicine is a special area of the Blackfeet Nation and should be managed as a large undeveloped landscape with important traditional and cultural values.
RM-BTM-DC-02	This DC recognizes the outstanding natural and ecological environment of the Badger Two Medicine area and provides for management actions only to the extent that they do not detract from the natural settings and are in harmony with the purposes of the Badger Two Medicine Traditional Cultural District.
RM-BTM-DC-03	This DC acknowledges that the Badger Two Medicine has value for education and research opportunities.
RM-BTM-STD-01	This STD ensures that the Badger Two Medicine is managed in close consultation with the Blackfeet Nation to fulfill Blackfeet treaty rights and the federal trust respectively. The area shall protect and honor the Blackfeet reserved rights and sacred lands. The uses of the area must be compatible with desired conditions with compatibility determined through government to government consultations.
RM-BTM-STD-02	Management activities in the Badger Two Medicine shall not pose adverse effects to the Badger Two Medicine Traditional Cultural District. Management activities shall consider research and ethnographic research as they relate to the Blackfeet cultural land-use identities.
RM-BTM-STD-03	Blackfeet tribal members shall have access to the Badger Two Medicine for the exercise of reserved treaty rights, and opportunities to practice spiritual, ceremonial, and cultural activities.
RM-BTM-SUIT-01	Lands within the Badger Two Medicine would not be suitable for timber production but timber harvest may be used to emphasize habitat restoration, hazardous fuel reduction, and support tribal treaty rights.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and management activities for aquatic ecosystems and soil management may affect the management of the Badger Two Medicine. The plan components that may have the greatest influence are those associated with RMZs. East of the Continental Divide, RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. Vegetation treatments such as prescribed fire and harvest that may occur would be limited within RMZs, or modified to comply with plan components for those areas. Riparian area plan components may also limit or influence recreation-related activities, such as trail construction or maintenance, within the RMZs. The area on which these components apply is greater with the action alternatives than with the no-action alternative.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur within the Badger Two Medicine area, and provide opportunities for natural fire to influence the vegetation condition of this area.

Timber and vegetation management

The Badger Two Medicine area is not suitable for timber production, but timber harvest may occur for other resource purposes, specifically for habitat restoration, hazardous fuel reduction, and to support tribal treaty rights (RM-BTM-SUIT-01). Plan components associated with timber harvest would ensure that all resource protection measures are met. Plan components related to desired vegetation conditions could influence whether vegetation treatments (such as harvest or management-ignited fires) are conducted, and help define the objectives for those treatments.

Livestock grazing and management

While livestock grazing itself has the potential to degrade plant communities through factors such as invasive plant spread and damage to riparian areas, plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components would help protect the ecological integrity of the area.

Recreation and scenery management

Plan components for recreation settings, opportunities, and scenery management would complement the management of the Badger Two Medicine area by establishing ROS settings and SIOs consistent with the desired conditions for the area.

Cultural, historic, and tribal resource management

Plan components related to cultural, historic, and tribal resource would help preserve these important features of the Badger Two Medicine area.

Road access and infrastructure

Where road or trail maintenance, construction, or re-construction activities occur they would be guided by road access and infrastructure plan components which include protections for other resources.

Minerals management

In 2006, Public Law 109-432 withdrew the lands in the Badger Two Medicine area from mineral entry. Mineral activities may still occur within the areas that have been withdrawn as long as a proponent has demonstrated they have a valid existing right.

Alternative A, no action

Under alternative A, the Badger Two Medicine would not be identified as an administratively designated area and would be managed according to direction provided in the 1986 Lewis and Clark Forest Plan. There is no specific direction for the Badger Two Medicine in the existing 1986 Forest Plan but there is overall direction for cultural and natural resources that would apply. The Badger Two Medicine Traditional Cultural District would remain intact and would continue to acknowledge the significance of this area to the Blackfeet people. The 1895 Agreement with the Indians of the Blackfeet Indian

Reservation in Montana would continue to provide the Blackfeet Nation with treaty rights to extract timber, fish, animals, and other resources in the Badger Two Medicine area.

Table 185 displays the general plan components from the existing 1986 Lewis and Clark NF Plan that would provide guidance for the Badger Two Medicine in alternative A.

Table 185. Summary of existing plan components for the Badger Two Medicine area

Plan component	Expected effects
Lewis and Clark NF; Goals 3, 7, 8, and 9	These plan components provide for the protection and improvement high quality wildlife and fish habitat, quality and quantity of water, and protecting the existing condition of the Badger Two Medicine area.
Lewis and Clark NF; Objectives	The objectives in the 1986 Lewis and Clark NF Plan provide guidance for recreation, visual, cultural, water, soils, and wildlife and fish habitats found within the Badger Two Medicine.
Lewis and Clark NF; Forest-wide Standards A-7, A-8, C-1, C-2, C-3, C-4, C-5, N-2, N-3, F-3, H-1, and H-2	The Forest-wide standards for the affected resources within the Badger Two Medicine on the Lewis and Clark Forest focus on protecting the cultural, historic, scenic, and natural resource values within this area.

Alternatives B, C, and E

The plan components for the Badger Two Medicine area are the same in all of the action alternatives and are noted above in the effects common to all action alternatives section.

Alternative D

Alternative D responds to comments received during pubic scoping asking the Forest to consider an alternative that increases the amounts of primitive recreation opportunities on the forest. In response to these comments, the entire Badger Two Medicine would be managed for a primitive ROS setting. Establishing this area as a primitive setting would limit the development of facilities and the type and extent of management activities that would occur within the area.

Despite the primitive ROS class changes, the plan components for the Badger Two Medicine area are the same in alternative D as they are in all of the other action alternatives.

Conclusions

Under all alternatives, the Badger Two Medicine would continue to provide primitive or semi-primitive non-motorized recreation opportunity settings. The Badger Two Medicine Traditional Cultural District would remain intact and would continue to acknowledge the significance of this area to the Blackfeet people. The 1895 Agreement with the Indians of the Blackfeet Indian Reservation in Montana would continue to provide the Blackfeet Nation with treaty rights to extract timber, fish, animals, and other resources in the Badger Two Medicine area.

Under alternative A, the Badger Two Medicine would not be identified as an administratively designated area and would continue to be managed according to direction provided in the 1986 Lewis and Clark Forest Plan.

In alternatives B- E, plan components for the Badger Two Medicine would be established and would be the same for all action alternatives. Alternative D would manage the area for a primitive ROS setting which would limit the construction of facilities and the management of natural resources within the area. While this change would affect overall recreation settings, the plan components would remain the same as all of the other action alternatives.

By providing the plan components outlined in the action alternatives, the HLC NF would meet the purpose and need of the revised forest plan, ensuring that the Badger Two Medicine is managed for the significant cultural and natural resources that make this area a unique and special place.

3.23 Congressionally Designated Areas

3.23.1 Introduction

The term “designated area” refers to a specific area on a landscape that has been established by statute, regulation, or policy, and once established the designation continues until a subsequent decision by the appropriate authority removes the designation. Designated areas within the Forest have been given permanent designation to maintain their unique special character or purpose.

Land management plans may include recommendations to establish additional or modify existing previously designated areas. Some designations, such as RWAs and eligible WSRs, may be designated or established concurrent with a plan decision, while others may not.

This section analyzes the effects of a new forest plan to the areas that are currently designated congressionally by law. It also analyzes the recommendation of additional areas for potential future congressional designations. The following existing designated areas will be covered in this section:

- Designated Wilderness Areas
- WSAs
- Continental Divide National Scenic Trail
- Lewis and Clark National Historic Trail
- Lewis and Clark National Historic Trail Interpretive Center
- Rocky Mountain Front Conservation Management Area

The section also covers the following recommendations for additional designated areas:

- RWAs
- Eligible WSRs

Issues

A number of issues were raised during the scoping period for the proposed action. Some of these issues arose from within the FS and some were brought forward by the public. The issues that drove alternatives for congressionally designated areas were:

- The amount and location of RWAs.
- The allowance or restriction of motorized over-snow uses, motorized trail use, and mechanized means of transport, including bicycles, within RWAs.

Other issues that were analyzed include:

- The identification of eligible WSR segments and outstandingly remarkable values for those rivers.
- Plan components associated with the Continental Divide National Scenic Trail, Lewis and Clark National Historic Trail, Lewis and Clark National Historic Trail Interpretive Center and Rocky Mountain Front Conservation Management Area.

Measurement indicators

Effects to RWAs resulting from the proposed action and alternatives are measured using the following indicators:

- Acres of RWA
- Acres open to motorized over snow use within RWAs
- Miles of motorized trail within RWAs
- Miles of nonmotorized trail open to mechanical means of transport (including bicycles) within RWAs

The alternatives are compared qualitatively for the other designated areas, with respect to their overall management and desirable characteristics.

Analysis areas

The geographic scope of the analysis changes by the designated area being analyzed. The following describes the analysis area used for each of the congressionally designated areas and areas proposed for future designation. These analysis areas form the scope for cumulative effects. The temporal scope for effects is the life of the plan (approximately 15 years).

- **Wilderness:** the congressionally determined boundaries of the Bob Marshall, Scapegoat, and Gates of the Mountains wilderness areas, including recent 2014 additions to those wilderness areas.
- **Wilderness Study Areas:** the congressionally determined boundaries of the Big Snowies and Middle Fork Judith WSAs.
- **Continental Divide National Scenic Trail**: the Continental Divide National Scenic Trail corridor on the HLC NF.
- **Lewis and Clark National Historic Trail:** the Lewis and Clark National Historic Trail corridor on the HLC NF.
- **The Lewis and Clark National Historic Trail Interpretive Center:** the congressionally determined boundary of the Lewis and Clark National Historic Trail Interpretive Center as well as the buildings and facilities associated with the interpretive site.
- **Rocky Mountain Front Conservation Management Area:** the congressionally determined boundary of the Rocky Mountain Front Conservation Management Area.
- **Recommended wilderness**: the proposed boundaries for each RWAs are developed for each alternative based on the wilderness inventory and evaluation process.
- **Eligible wild and scenic rivers**: the eligible WSR segments were determined through the WSR process. The analysis area for the rivers includes the identified segments and associated corridor where plan components apply (1/4 mile on either side of the river).

3.23.2 Regulatory framework

Public Law 92-395 (1972): Identifies and designates by law the Scapegoat Wilderness Area on the Lolo, Helena, and Lewis and Clark National Forests.

National Defense Authorization Act for Fiscal Year 2015 (Public Law 113-291) The stated purpose for this conservation management area is to “conserve, protect, and enhance for the benefit and enjoyment of present and future generations the recreational, scenic, historical, cultural, fish, wildlife, roadless, and ecological values of the Conservation Management Area”. The law directs the management of motorized vehicles on roads and trails, decommissioning of temporary roads, grazing, vegetation management, noxious weed management, and nonmotorized recreation opportunities. This law also created additions to both the Bob Marshall and the Scapegoat Wilderness Areas.

Montana Wilderness Study Act of 1977 (Public Law 95-150): This act identified 9 different areas as WSAs within the state of Montana and required the Secretary of Agriculture to conduct studies on these areas to determine their wilderness suitability. Two of the WSAs fall within the HLC NF: Middle Fork Judith and the Big Snowies.

Final Impact Statement, Middle Fork Judith and Big Snowies Montana Wilderness Study Act Areas, 1982: This study was conducted as a requirement of the Montana Wilderness Study Act of 1977. Its purpose was to determine whether these areas were suitable for inclusion as wilderness in the National Wilderness Preservation System.

Wild and Scenic Rivers Act of October 2, 1968 (P.L. 90-542, 82 Stat. 906, as amended): This act establishes a National WSRs System with three classes of river systems: wild, scenic, and recreation. The purpose of the act was to protect the river "…for the benefit and enjoyment of present and future generations."

Public Law 100-552, establishing the Lewis and Clark Interpretive Center: This law authorized the FS to plan, build, and manage an interpretive facility to "further the public's understanding and provide appropriate interpretation of the scope and accomplishments of the Lewis and Clark Expedition" of 1804-1806.

Public Law 113-291: National Defense Authorization Act for Fiscal Year 2015: This act includes approximately 195,073 acres of federal lands managed by the FS and approximately 13,087 acres of federal land managed by the BLM. The stated purpose for this conservation management area is to "conserve, protect, and enhance for the benefit and enjoyment of present and future generations the recreational, scenic, historical, cultural, fish, wildlife, roadless, and ecological values of the Conservation Management Area."

3.23.3 Assumptions

Congressionally designated areas on the HLC NF have all been designated through an act of Congress and the direction for these areas is provided by the associated enabling laws. It is assumed that the HLC NF will manage these areas according to these enabling laws indefinitely or until the current laws are superseded or supplemented by new and/or additional laws.

3.23.4 Best available scientific information used

The Forest used the best available data and science relevant to inform the analysis for the new forest plan components for designated areas on the forest. Data sources included GISs for mapping, the latest information from the National Visitor Use Data project, information stored in the corporate data base, and site-specific knowledge from forest personnel.

3.23.5 Designated wilderness, affected environment

In 1964 Congress passed the Wilderness Act of 1964 (P.L. 88-577) and defined wilderness as a place "in contrast with those areas where man and his own works dominate the landscape… where earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain… an area of undeveloped Federal lands retaining its primeval character and influences, without permanent improvements or human habitation, which is protected and managed to preserve its natural condition and which:

- Generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;
- Has outstanding opportunities for solitude or a primitive and unconfined type of recreation;
- Has at least 5,000 acres or is of sufficient size as to make it practicable its preservation and use in an unimpaired condition;
- May also contain ecological, geological, or other feature of scientific, educational, scenic, or historic value."

The Wilderness Act of 1964 requires the preservation of wilderness character and recognizes multiple values and public benefits found in these areas.

The HLC NF manages three designated wilderness areas: the Bob Marshall, the Scapegoat, and the Gates of the Mountains. Portions of both the Bob Marshall and the Scapegoat lie outside of the plan area on adjacent forests so management of these wilderness areas is shared with surrounding forests. The entire Gates of the Mountains Wilderness lies within the HLC NF and is managed solely by the Forest. These three wilderness areas comprise approximately 20% of the Forest for a total of 565,158 acres. Table 186 describes the three wilderness areas on the HLC, the GAs in which they are found, and their total acres.

Table 186. Designated wilderness areas

Wilderness	GA	Total Wilderness Acres within the HLC-NF
Gates of the Mountains	Big Belts	28,440
Bob Marshall	Rocky Mountain Range	352,437
Scapegoat	Upper Blackfoot and Rocky Mountain Range	184,281
Total acres of wilderness in the plan area		**565,158**

Bob Marshall Wilderness

The Bob Marshall Wilderness Area totals approximately 1,059,757 acres. Management of this wilderness is shared between the Flathead NF and the HLC NF. The HLC NF portion of the total wilderness area is approximately 352,437 acres. The “Bob”, as it is commonly referred to, straddles the Continental Divide with elevations that range from 4,000 feet along the valley floor to more than 9,000 feet atop the serpentine Continental Divide. It includes the headwaters of the Flathead River to the west and the Sun River to the east. The Bob is noted for excellent hunting, fishing, scenery, and geology. Its vast beauty is highlighted by a huge escarpment known as the “Chinese Wall.” The wall averages 1,000 feet in height and extends 22 miles along the Continental Divide. Topography ranges from rugged precipitous ridge tops to gentle sloping alpine meadows and forested river bottoms.

Scapegoat Wilderness

The Scapegoat Wilderness Area is approximately 256,647 acres. Management of this wilderness is shared between the Lolo NF and HLC NF. The HLC NF portion is approximately 184,281 acres. Located just south of and bordering the Bob Marshall Wilderness Area, the Scapegoat also straddles the Continental Divide. Most of this wilderness lies between the elevations of 5,000 feet at the Blackfoot River to 9,400 feet at the top of Red Mountain. Topography of the Scapegoat Wilderness Area ranges from rugged ridge tops, to gently sloping alpine meadows, to forested slopes and river bottoms. The massive limestone cliffs of the Scapegoat Mountain are an extension of the “Chinese Wall” in the adjacent Bob Marshall Wilderness.

Gates of the Mountains Wilderness

The Gates of the Mountains Wilderness is located on the east slope of the Continental Divide and, at 28,562 acres, it is one of Montana’s smaller wilderness areas. The Gates of the Mountains Wilderness Area is characterized by massive limestone beds which naturally eroded over millions of years to create the towering cliffs and deep canyons that inspired Captain Meriwether Lewis to call the area “the gates of the Rocky Mountains” during his passage up the Missouri River in 1805. This historical feature is located on the Missouri River adjacent to the wilderness area and is how the wilderness got its name.

3.23.6 Designated wilderness, environmental consequences

Effects common to all alternatives

Since direction for wilderness management is detailed in law, regulation, and agency policy and in specific management plans, the effects to designated wilderness as a result of the revised plan do not differ by alternative. In all alternatives, the acres of the existing Bob Marshall, Scapegoat, and Gates of the Mountains Wilderness Areas would remain the same. There would be no effect to undeveloped or special features and values in any of the alternatives. Significant effects to these wilderness areas are also not expected under any of the alternatives.

A primitive experience would be maintained in the Bob Marshall, Scapegoat, and Gates of the Mountains Wilderness Areas in all alternatives. Natural ecological processes and disturbance would continue to be the primary forces affecting the composition, structure, and patterns of vegetation. Management under all of the alternatives would continue to protect and preserve the wilderness character found within the wilderness areas on the HLC NF.

All alternatives would carry forward the need for wilderness patrols, wilderness rehabilitation of any impacted sites, wilderness education, and wilderness-specific management plans. These activities would be common to all alternatives.

Effects common to all action alternatives

The plan components developed for designated wilderness would remain the same in all action alternatives. Table 187 summarizes the expected effects of each plan component related to designated wilderness areas.

Table 187. Summary of proposed plan components for designated wilderness areas

Plan component	Expected effects
FW-WILD-DC-01	This DC ensures that the key qualities of wilderness character in the Bob Marshall, Scapegoat, and Gates of the Mountains Wilderness Areas contribute to the public purposes for which these wilderness areas were designated.
FW-WILD-DC-02	This DC ensures that the primary forces that affect wilderness character in designated wilderness areas are natural ecological processes and disturbances.
FW-WILD-DC-03	This DC ensures that the large remote areas within the Bob Marshal, Scapegoat, and Gates of the Mountains Wilderness Areas contribute to wildlife species habitat and wildlife movement within and across the Forest.
FW-WILD-DC-04	This DC provides for undisturbed quality habitat for fish, amphibians, and other aquatic-associated species.
FW-WILD-DC-05	This DC ensures that summer and winter recreation opportunities are consistent with the ROS classification of primitive.
FW-WILD-DC-06	This DC ensures that facilities, trails, and signage within designated wilderness areas is minimal, and where present, is constructed of rustic, native, or natural appearing materials to maintain the primitive setting.
FW-WILD-DC-07	This DC ensures that non-motorized and non-mechanized recreation opportunities for exploration, solitude, risk, challenge and primitive recreation are retained within designated wilderness areas.
FW-WILD-DC-08	This DC establishes that opportunities for solitude and primitive recreation would be moderate to high on the existing trail system, and very high when traveling cross country within designated wilderness areas.
FW-WILD-DC-09	This DC ensures that outfitter and guide services within the Bob Marshall, Scapegoat, and Gates of the mountains wilderness areas provide support to recreation opportunities and respond to relevant public need.

Plan component	Expected effects
FW-WILD-GO-01	This GO promotes working collaboratively with Montana Fish, Wildlife, and Parks and the USFWS to manage wildlife resources to protect wilderness character.
FW-WILD-GO-02	The plan components promotes the collaborative efforts between the Lolo, Flathead, and HLC NF in the management of the Bob Marshall Wilderness Complex which includes the Great Bear, Bob Marshall, and Scapegoat wilderness areas.
FW-WILD-GDL-01	This GDL provides direction for the grazing and tethering of recreational stock along water sources within designated wilderness settings.
FW-WILD-GDL-02	This GDL provides management direction for the cave resources in designated wilderness.
FW-WILD-SUIT-01; 02; 03; 04	Designated wilderness areas allow for existing livestock grazing allotments, but are not suitable for timber production or timber harvest, commercial use of non-timber forest products, motorized uses, or mechanical means of transportation.

During scoping, multiple members of the public asked the Forest to consider allowing both recreation aviation (internal airstrips) and mountain biking activities within designated wilderness. Currently, these activities are prohibited by law and are not allowed within the Gates of the Mountains, Scapegoat, and Bob Marshall Wilderness Areas on the HLC NF. The revised forest plan must meet and uphold the current law of the land. Therefore, the plan cannot make designated wilderness areas suitable for these activities.

In all action alternatives wilderness management plans would exist outside of the forest plan. This allows the Forest the ability to provide additional direction for each individual wilderness area. These wilderness management plans would adhere to the plan components of the revised forest plan.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities related to watershed, soil, riparian, or aquatic habitat improvements would have little to no effects related to the overall management within designated wilderness areas.

Fire and fuels management

Natural, unplanned ignitions would continue the long-term ecological processes in these areas. In limited cases, planned ignitions may also occur within designated wilderness for specific, limited purposes. During and following fire, there could be a temporary loss of vegetation, reduction in water quality due to sedimentation, and increased air pollution. However, these effects are part of the natural ecological processes which are essential to wilderness character in designated wilderness areas. Changes in trail access due to down timber resulting from fire activity may disrupt recreation access patterns in wilderness areas.

Timber and vegetation management

Designated wilderness areas are withdrawn from timber production and are not suitable for timber harvest. There would be no effect to designated wilderness from harvest or other vegetation management.

Livestock grazing and management

Existing range allotments would continue to be managed as specified within permits in all alternatives. New or expanded livestock grazing allotments would not be allowed.

Wildlife management

Activities related to wildlife management would have little to no effects related to the overall management of designated wilderness areas.

Cultural, historic, and tribal resource management

Activities related to cultural, historic, and tribal resource management would have little to no effects related to the overall management of designated wilderness areas.

Minerals management

The Bob Marshall, Scapegoat, and Gates of the Mountains Wilderness Areas have been withdrawn from mineral entry and are not available for new leases or filing of new unpatented mining claims. Mining activities may still occur within designated wilderness areas as long as a proponent has demonstrated they have a valid existing right.

Alternative A, no action

In the no-action alternative, designated wilderness areas would continue to be managed under the 1986 Helena and Lewis and Clark Forest Plans. Amendment 1 in both 1986 Forest Plans provides additional direction through the Bob Marshall Complex Recreation Management Plan. This plan provides baseline information for limits of acceptable change for both the Bob Marshall and Scapegoat Wilderness Areas. Future wilderness and other laws may determine where additional wilderness areas could be allocated.

Table 188 describes the plan components in the 1986 Helena and Lewis and Clark Forest Plans that provide direction for designated wilderness areas.

Table 188. Summary of existing plan components for designated wilderness areas

Plan component	Expected effects
1986 Helena NF Plan, Goals 3, Page II/1	Wilderness values are protected and provide benefit to the public in accordance with the Wilderness Act of 1964.
1986 Helena NF Plan, Objectives; Resource Activities/Summaries, Wilderness, Page II/3	This objective ensures that designated wilderness areas will be managed according to the Wilderness Act of 1964 and emphasizes the importance of wildlife habitat for big game species, significant nongame species, and threatened and endangered species. This objective provides direction for grazing allotments within wilderness, and the gathering of recreation use data for maintaining long-term opportunities for wilderness experiences. It also points to fire management direction for the Scapegoat wilderness.
1986 Helena NF Plan, Forest-wide Standard, Recreation 5 and 6, Page II/15	Standard 5 under Recreation emphasizes the “Pack-In, Pack-Out” policy within dispersed recreation areas and wilderness. Standard 6 provides information to users of remote areas and wilderness about proper camping methods to avoid potential conflicts with humans and bears.
1986 Helena NF Plan, Management Areas P-1 and P-2, Pages III/56 through III/72	Management area P-1 provides direction for the portions of the Scapegoat wilderness located on the Helena NF. Management area P-2 provides direction for the Gates of the Mountain wilderness area.
1986 Helena NF Plan, Forest Plan Amendment 1	This amendment adopts the Bob Marshall, Great Bear, and Scapegoat Wildernesses – Recreation Management Plan, which provides overall direction and consistency for management across the Bob Marshall Wilderness Complex.
1986 Lewis and Clark NF Plan Goal 2, Page 2-2	This goal provides for long-term opportunities for wilderness experiences in the Bob Marshall and Scapegoat wilderness areas.
1986 Lewis and Clark NF Plan, Forest-wide Objectives, Wilderness, Page 2-5	This objective ensures that designated wilderness areas would be managed according to the Wilderness Act of 1964, and emphasizes the importance of wildlife habitat for big game species, significant nongame species, and threatened and endangered species. This objective provides direction for grazing allotments within wilderness and provides direction for the use of Limits of Acceptable Change policy for determining the limits on the amounts and types of recreation use that can be tolerated within wilderness areas.
1986 Lewis and Clark NF Plan, Management Area P, Pages 3-72 t0 3-84	This management area provides direction for the portions of the Bob Marshall and Scapegoat wilderness areas that are located on the Lewis and Clark NF.

Plan component	Expected effects
1986 Lewis and Clark NF Plan, Forest Plan Amendment 1	This amendment adopts the Bob Marshall, Great Bear, and Scapegoat Wildernesses – Recreation Management Plan, which provides overall direction and consistency for management across the Bob Marshall Wilderness Complex.

Alternatives B-E

See effects common to all action alternatives, above.

Cumulative Effects

Portions of the HLC NF adjoin other NFs, each of which have their own plans. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 189.

Table 189. Summary of cumulative effects to designated wilderness from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Lolo, Flathead, and Beaverhead-Deerlodge NFs. All of those plans address designated wilderness. Management of designated wilderness is consistent across all NFs due to law, regulation, and policy. The cumulative effect would be that the management of designated wilderness would be generally complementary. This includes specific adjacent landscapes where shared wilderness management occurs, such as, the Bob Marshall Wilderness Complex where management of the complex is shared between the Flathead, Lolo, and HLC NF.
Montana Statewide Forest Resource Strategy (2010)	This plan guides resource management on state lands. It includes many concepts that are complementary to revised plan components for the HLC NF. State forest lands are more actively managed than NFS lands.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components related to wilderness and would therefore be complementary to the plan components for the HLC NF.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the wilderness characteristics in this area are likely similar to the wilderness area in the adjacent Rocky Mountain Range GA and would likely complement these conditions.
Montana’s State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy. The vegetation conditions described would be complementary to the conditions being managed for with the HLC NF revised forest plan.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.

Conclusions

Since only Congress can establish wilderness areas, the acres and locations of designated wilderness would not vary in any of the alternatives, including alternative A. The action alternatives include plan components that would provide direction for the management of the existing designated wilderness areas on the Forest, including the protection and preservation of existing wilderness character and guidelines for the management of facilities, trails, and outfitter and guide permits within designated wilderness. By providing the plan components outlined in the action alternatives, the HLC NF would meet the purpose and need of the forest plan, ensuring that designated wilderness areas are managed in ways that are ecologically and socially sustainable for present and future generations.

Wilderness management plans would exist outside of the forest plan providing additional wilderness-specific management direction for each individual wilderness area. These wilderness management plans would adhere to the plan components of the revised forest plan.

3.23.7 Recommended wilderness, affected environment

RWAs are lands that contain wilderness characteristics and have potential for inclusion in future wilderness designations. These lands are generally free from roads and other constructed features and have high potential to provide solitude and primitive, unconfined recreation. RWAs are also important for species diversity, protection of threatened and endangered species, protection of watershed scientific research, and various social values.

The current 1986 Helena Forest Plan identifies and provides management direction for three RWAs: Electric Peak, Big Log, and Mount Baldy. These RWAs total approximately 34,365 acres. Of the three, Big Log lies adjacent to the Gates of the Mountains Wilderness area. Both Big Log and Mount Baldy are completely located on the HLC NF. Only a portion of the Electric Peak RWA lies within the HLC NF. The remainder of Electric Peak RWA is located on the Beaverhead-Deerlodge NF. Table 190 identifies the three existing RWAs, the GAs in which they are located, and the number of acres for each.

Table 190. 1986 Helena Forest Plan RWAs

Recommended Area	GA	Adjacent Designated Wilderness	Total Acres	Acres on the HLC NF
Electric Peak	Divide*	N/A	21,556	16,655
Big Log	Big Belts	Gates of the Mountains	9,190	9,190
Mount Baldy	Big Belts	N/A	8,420	8,420
Total Acres of RWAs in the Plan Area				34,265

3.23.8 Recommended wilderness, environmental consequences

Effects common to all alternatives

In all alternatives, natural disturbances, recreation use patterns, and emerging technologies would continue to influence the wilderness characteristics of undeveloped landscapes on the HLC NF.

Effects common to all action alternatives

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and management activities for aquatic ecosystems and soil management would have little effect related to the overall management within RWAs. The plan components that may have the greatest influence are those associated with RMZs. East of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative. Please refer to the RMZ section. The potential effects of RMZ plan components to recreation opportunities within RWAs are discussed in the recreation opportunities section.

Little to no active management would occur in RWAs. However, restoration treatments such as prescribed fire that would occur in RWAs may be limited within RMZs, or modified to comply with plan components for those areas. The area on which these components apply is greater with the action alternatives than with the no-action alternative on landscapes east of the Continental Divide; however, the effect would be minor and insubstantial with regards to the wilderness characteristics of RWAs.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur within RWAs, and provide opportunities for natural fire to promote and/or enhance the wilderness characteristics of these areas. Fire and fuels management plan components also specify the use of minimum impact strategies and tactics to manage wildland fire within RWAs, which would further protect wilderness characteristics.

Timber and vegetation management

There would be no effect to RWAs from plan components related to timber harvest because no timber harvest would be allowed in these areas. Plan components related to desired vegetation conditions could influence whether restoration treatments (such as management-ignited fires) are conducted in RWAs, and help define the objectives for those treatments. Vegetation management activities such as planting of whitebark pine would also be allowed in RWAs. These plan components would help promote and/or enhance the wilderness characteristics of these areas.

Livestock grazing and management

The plan components for the action alternatives do not allow for new or expanded livestock grazing allotments to occur within RWAs; however, existing allotments may be retained. Therefore, the plan components that guide livestock grazing and management would influence RWAs. While livestock grazing itself has the potential to degrade plant communities through factors such as invasive plant spread and damage to riparian areas, plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components should help protect the wilderness characteristics of RWAs, to a greater degree with the action alternatives as compared to the no-action alternative.

Wildlife management

Plan components related to wildlife management would have little to no effect on RWAs.

Recreation and scenery management

Plan components for recreation settings, opportunities, and access along with scenery management would complement the management of RWAs for their wilderness characteristics. In the action alternatives, RWAs have a primitive ROS setting and a very high SIO. These classifications would ensure that potential recreation and other activities, such as restoration treatments, would be consistent with RWAs desired conditions.

Cultural, historic, and tribal resource management

Plan components related to cultural, historic, and tribal resource would have little to no effect on RWAs. The protection of these resources would be consistent with maintaining the wilderness characteristics of these areas.

Road access and infrastructure

Plan components related to road access and infrastructure would have little to no effect on RWAs, because RWAs would not be suitable for road construction or reconstruction and these areas are generally unroaded.

Minerals management

RWAs are discretionarily unavailable for mineral leasing and saleable mineral activity but still open to locatable mineral prospecting, exploration, and development.

Alternative A, no action

In the no-action alternative, the three current RWAs would continue to be managed under the 1986 Helena Forest Plan. Table 191 describes the plan component in the 1986 Helena Forest Plan that provides direction for the three RWAs.

Table 191. Summary of the existing 1986 Helena Forest Plan component for RWAs (alternative A)

Plan component	Expected effects
1986 Helena NF Plan, Management Area P-3, Pages III/73 through III/77	This management area ensures that the three RWAs are managed to maintain their existing wilderness characteristics.

Summer and winter travel plans provide the direction for where motorized uses can and cannot occur within RWAs. Table 192 shows the existing miles of open roads, motorized trail, and non-motorized trail within the three existing RWAs in alternative A. This table also shows the acres open to motorized over snow uses in these RWAs.

Table 192. Miles of existing open road, motorized trail, non-motorized trail, and acres of motorized over snow uses within RWAs (alternative A).

GA	Miles of Open Road	Miles of Motorized Trail	Miles of Nonmotorized Trail	Acres Open to Motorized Over Snow Uses
Big Log	0.6	0	8.0	0
Mount Baldy	0	0	13.3	0
Electric Peak	3.4	0.1	16.1	131.4
Totals	4.0	0.1	37.4	131.4

Big Log

There are no motorized trails or motorized over-snow areas within this RWA. Table 193 and Table 194 describe the open road and nonmotorized trails within the Big Log RWA in alternative A.

Table 193. Open roads in Big Log RWA (alternative A)

Road Number	Road Name	Miles
4140	Hunters Gulch	0.6

Table 194. Nonmotorized trails in Big Log RWA (alternative A)

Trail Number	Trail Name	Miles
252	Big Log Gulch	2.3
255	Hunters Gulch	1.8

Trail Number	Trail Name	Miles
257	Missouri River Canyon	2.9
259	Refrigerator Canyon	1.0
Total		8.0

Mount Baldy

There are currently no motorized recreation uses within the Mount Baldy RWA. Table 195 describes the nonmotorized trails within the Mount Baldy RWA in alternative A.

Table 195. Nonmotorized trails in the Mount Baldy RWA (alternative A)

Trail Number	Trail Name	Miles
149	Needles	2.2
150	Gipsy/Birch Creek	5.2
151	Hidden Lake	3.6
152	Edith Lake	0.7
155	Grace Lake	1.6
Total		13.3

Electric Peak

Table 196, Table 197, and Table 198 describe the open roads, motorized trails, and nonmotorized trails within the Electric Peak RWA in alternative A.

Table 196. Open roads in Electric Peak RWA (alternative A)

Road Number	Road Name	Miles
127	Ontario	0.2
227	Little Blackfoot	2.8
4046	Kading Campground	0.4
Total		3.4

Table 197. Motorized trail in the Electric Peak RWA (alternative A)

Trail Number	Trail Name	Miles
501	Limburger Spring	0.1

Table 198. Nonmotorized trails in the Electric Peak RWA (alternative A)

Trail Number	Trail Name	Miles
326	Kading	<0.1
328	Bison-Blackfoot	1.3
329	Blackfoot Meadows	7.7
330	Bison MT	1.1
337	Continental Divide	1.1
359	Larabee Gulch	2.3
362	Monarch Creek	2.5

Trail Number	Trail Name	Miles
Total		16.1

Alternative B

Alternative B identifies nine (9) areas to be RWAs. These RWAs were identified after the HLC NF conducted a wilderness inventory and evaluation. Identifying an area as RWA in the draft revised forest plan does not create a wilderness, as only Congress has the right to designate wilderness by passing legislation. However, the nine RWAs identified in alternative B would be managed to protect their wilderness characteristics.

The nine RWAs in alternative B are located within five GAs and total approximately 213,076 acres. These RWAs were derived from the original wilderness inventory polygons identified in the first step of the wilderness evaluation process, but do not necessarily include all of those original acres. Boundaries for the individual RWAs are located on naturally occurring ridgelines, stream bottoms, or other locatable features on the landscape to make them more manageable.

Table 199 provides the name of each RWA in alternative B, the inventory polygon it originated from, the GA in which it is located, whether it lies adjacent to existing designated wilderness, and the approximate acres of the RWA.

Table 199. Recommended wilderness (alternative B)

RWA	Wilderness Inventory Polygon	GA	Adjacent Designated Wilderness	Acres
Big Log	BB1	Big Belts	Gates of the Mountains	7,086
Mount Baldy	BB7	Big Belts	NA	8,314
Blackfoot Meadows	D3	Divide	NA	18,296
Deep Creek	LB1	Little Belts	NA	14,490
Big Snowies	S1	Snowies	NA	95,299
Dearborn Silverking	UB1	Upper Blackfoot	Scapegoat	20,088
Red Mountain	UB2a	Upper Blackfoot	Scapegoat	1,901
Arrastra Creek	UB2b	Upper Blackfoot	Scapegoat	8,257
Nevada Mountain	UB10	Upper Blackfoot	NA	39,345
Total				213,076

In alternative B, motorized uses and mechanized means of transport would be considered unsuitable and would not be allowed in RWAs. This is a change from the existing condition on the landscape where some motorized uses and mechanized means of transport (including bicycles) are currently allowed. Overall, motorized recreation uses and mechanical means of transportation (including bicycles) on approximately 11.8 miles of road, less than a mile of motorized trail, and 24,290 acres of motorized over snow areas would not be allowed in RWAs in alternative B.

Mechanized means of transportation (including bicycles) would also be considered unsuitable and would not be allowed within RWAs in alternative B on approximately 205.7 miles of nonmotorized trails. Closing nonmotorized trails to mechanized means of transportation (including bicycles) is a change from the existing condition where recreation via mechanized means of transportation is currently allowed on all nonmotorized trails.

RWAs are characterized as generally being without permanent improvements or human occupation. Mechanized means of transportation (including bicycles) and motorized recreation uses might affect the undeveloped nature (ecological characteristic) and primitive recreation (social characteristic) of these RWAs. In addition, the sounds of motorized recreation uses (such as snowmobiling or off-road vehicle use) could impact the RWA's solitude and primitive recreation (social characteristic). Because of these impacts, motorized and mechanized recreation uses would not be allowed within RWAs in alternative B.

Table 200 shows the overall miles of open roads, motorized trail, and nonmotorized trail that would be closed to motorized uses and mechanized uses (including bicycles) within RWAs in alternative B. This table also shows the acres of motorized over snow areas that would be closed to these motorized uses.

Table 200. Miles of open road, motorized trail, nonmotorized trail, and acres of motorized over-snow uses that would be closed to these uses in RWAs (alternative B)

RWA	Miles of Open Road	Miles of Motorized Trail	Miles of Nonmotorized Trail	Acres Open to Motorized Over Snow Uses
Big Log	0	0	5.3	0
Mount Baldy	0	0	13.6	0
Blackfoot Meadows	0	0	16.3	11.1
Deep Creek	0	0	12.9	0
Big Snowies	11.8	0.1	98.3	13,144.5
Dearborn Silverking	0	0	20.8	16.9
Red Mountain	0	0	<0.1	0
Arrastra Creek	0	0	7.9	2,239.2
Nevada Mountain	0	0	30.5	8,878.3
Totals	**11.8**	**0.1**	**205.7**	**24,290**

Displacement of motorized recreation uses and mechanized means of transportation (including bicycles) from RWAs would occur in alternative B. Closure of these trails and areas may concentrate motorized and mechanized means of transportation uses in other areas identified as suitable for motorized uses by travel planning direction.

The expected effects of the plan components for alternative B are summarized in Table 201. These plan components provide overall management direction for RWAs on the HLC NF.

Table 201. Summary of proposed plan components for RWAs (alternative B)

Plan component	Expected effects
FW-RECWILD-DC-01	This DC ensure that the identified wilderness characteristics, both social and ecological, of the RWAs are protected and preserved.
FW-RECWILD-DC-02	This DC describes the ecological conditions in RWAs, to include natural processes such as natural successions, wildfire, avalanches, and insects and diseases.
FW-RECWILD-DC-03	This DC ensures that RWAs provide outstanding opportunities for solitude or primitive and unconfined recreation.
FW-RECWILD-SUIT-01	This DC ensures that the trail system within RWAs support the identified wilderness characteristics.
FW-RECWILD-DC-05	This DC ensures that outfitter and guide services within RWAs are based on resource condition and identified public need.
FW-RECWILD-GDL-01	This GDL provides direction for restoration activities within RWAs.
FW-RECWILD-GDL-02	This GDL provides for the use of motorized equipment to accomplish restoration or administrative work within RWAs.
FW-RECWILD-SUIT-01	This plan component prohibits motorized recreation uses and mechanical means of transportation within RWAs, except for authorized permitted users, valid existing

Plan component	Expected effects
(Alternatives B and D)	rights, or in emergencies related to public health and safety. Exceptions are established on a case-by-case basis.
FW-RECWILD-SUIT-02	This plan component states that restoration activities, such as management ignited fire and active weed management, are suitable within RWAs.
FW-RECWILD-SUIT-03	This plan component ensures that the use of motorized equipment, such as chain saws, is suitable within RWAs to achieve restoration activities and administrative work.
FW-RECWILD-SUIT-04; 05; 06; and 07	These components provide direction for timber production, timber harvesting, new commercial communication sites, new utility corridors, road construction, road reconstruction, and developed recreation sites and facilities within RWAs. None of these actions are suitable in RWAs.
FW-RECWILD-SUIT-06	This plan component allows for existing livestock grazing allotments but prohibits new or expanded livestock grazing allotments within RWAs.

Direct Effects

Identifying RWAs would create the following closures for motorized and mechanized recreation within the RWAs. These changes are summarized by RWA below.

Big Log

Big Log RWA is located adjacent to the Gates of the Mountain wilderness area in the Big Belts GA. The majority of the Big Log area lies along the southern boundary of the Gates of the Mountains. However, there are also several small isolated parcels on the northern boundary of the wilderness that are included in the RWAs. The majority of the Big Log RWA was identified in the 1986 Helena NF Plan as RWAs.

There are currently no existing motorized recreation uses or open roads within the Big Log RWA in alternative B. However, approximately 5.3 miles of nonmotorized trail would be closed to mechanized means of transport (including bicycles). See Table 202.

Table 202. Nonmotorized trails closed to mechanized means of transport in Big Log RWA (alternative B)

Trail Number	Trail Name	Miles
252	Big Log Gulch	2.1
255	Hunters Gulch	1.8
258	Mann Gulch	0.2
259	Refrigerator Canyon	1.2
Total		5.3

Mount Baldy

Mount Baldy RWA is located in the Big Belts GA. This RWA consists of high elevation ecosystems dotted with a number of alpine lakes and unique granite rock formations (the Needles). The Mount Baldy RWA was identified as one of the three RWAs in the 1986 Helena Forest Plan.

There are currently no motorized recreation uses or open roads within the Mount Baldy RWA in alternative B. However, there are approximately 13.6 miles of nonmotorized trail that would be closed to mechanized means of transport (including bicycles) within this RWA. See Table 203.

Table 203. Nonmotorized trails closed to mechanized means of transport in the Mount Baldy RWA (alternative B)

Number	Name	Miles
149	Needles	2.2
150	Gipsy/Birch Creek	5.7

Number	Name	Miles
151	Hidden Lake	3.4
152	Edith Lake	0.7
155	Grace Lake	1.6
Total		13.6

Blackfoot Meadows

The Blackfoot Meadows RWA is located within the Divide GA. Portions of this RWA were identified as the Electric Peak RWA in the current 1986 Helena Forest Plan. The Blackfoot Meadows RWA is not the exact same acreage or configuration as what has been identified as the Electric Peak RWA. Blackfoot Meadows RWA lies along the Continental Divide National Scenic Trail and includes several mountain peaks that are well over 8000 feet in elevation.

There are no motorized trails or open roads within the Blackfoot Meadows RWA. Approximately 16.3 miles of nonmotorized trail would be closed to mechanized means of transport (including bicycles) within the Blackfoot Meadows RWA. Additionally, an estimated 11.1 acres of motorized over-snow area would also be closed in this alternative. See Table 204.

Table 204. Nonmotorized trails closed to mechanized means of transport in the Blackfoot Meadows RWA (alternative B)

Number	Name	Miles
326	Kading	<0.1
328	Bison-Blackfoot	1.3
329	Blackfoot Meadows	6.9
330	Bison MT	1.0
337	Continental Divide	1.2
359	Larabee Gulch	2.8
362	Monarch Creek	3.0
Total		16.3

Deep Creek

Deep Creek RWA is located in the northwestern corner of the Little Belt Mountains GA. This area is bordered by the Smith River on the west, private lands to the north and south, and by motorized national recreation trails to the south and east. The primary access to this area is from the Smith River, private lands, and from the motorized national recreation trails.

There are currently no motorized recreation uses or open roads within the Deep Creek RWA in alternative B. However, there are 12.9 miles of nonmotorized trail that would be closed to mechanized means of transport (including bicycles) within this RWA. See Table 205.

Table 205. Nonmotorized trails closed to mechanized means of transport in the Deep Creek RWA (alternative B)

Number	Name	Miles
303	North Fork Deep Creek	2.3
308	Temple Gulch	4.5
309	Parker Ridge	4.4
311	Smith River	1.7
Total		12.9

Big Snowies

The Big Snowies RWA is located in the Big Snowies GA south of Lewistown, Montana. The primary ridgeline of this island mountain formation is oriented east-west and is 25 miles long and 10 miles wide. The area is dominated by limestone geology and karst topography which conceals many caves including an ice cave on West Peak. The RWA is also characterized at its highest elevations by a tree-less plateau of alpine with rock and tundra. The Big Snowies RWA is popular with mountain bike users in the summer and snowmobile users in the winter months.

There are 11.8 miles of open road and 0.1 mile of motorized trail within the Big Snowies that would be closed to motorized use and mechanical means of transport in alternative B. There are approximately 98.3 miles of nonmotorized trail that would be closed to mechanized means of transport (including bicycles) within this RWA. Additionally, an estimated 13,144.5 acres of motorized over-snow uses would be closed to motorized use and mechanical means of transport in this alternative. See Table 206, Table 207, and Table 208.

Table 206. Open roads closed to motorized uses and mechanical means of transport in Big Snowies RWA (alternative B)

Road Number	Road Name	Miles
270	Timber Creek	0.1
656	656	1.8
8954	Snowy Ridge	2.4
15862	Webbers Road	0.1
15869	Careless Canyon	0.1
15852	Dry Coulee Loop	0.8
270-A	East Fork Timber	0.7
210001	Permit Road	2.2
410001	Permit Road	1.9
8954001	Permit Road	0.5
8954002	Permit Road	0.1
8954004	Permit Road	1.0
Total		11.8

Table 207. Motorized trail closed to motorized use and mechanical means of transport in the Big Snowies RWA (alternative B)

Trail Number	Trail Name	Miles
652	Southside	0.1

Table 208. Nonmotorized trails closed to mechanized means of transport in the Big Snowies RWA (alternative B)

Trail Number	Trail Name	Miles
403	Grandview	4.1
403-A	Grandview Point	<0.1
405	V.J. Springs	0.1
406	Jump Off Peak	5.3

Trail Number	Trail Name	Miles
410	E FK Big Spring Creek	9.3
445	Crystal Cascades	2.6
445-A	Crystal Cascades Connector	1.1
481	Dry Pole Creek	5.1
483	Logan Ridge	2.3
489	East Fork Cottonwood Creek	8.5
490	West Peak	7.1
490-A	West Peak Alt Spur	1.0
491	Promontory Point	0.4
492	Hidden Basin Wildflower	0.2
493	Ulhorn	18.4
494	Maynard Ridge	5.35
627	Swimming Woman	2.2
627-A	Swimming Woman Alt	2.2
650	Big Snowy Trail	7.5
652	Southside	4.9
654	Neil Creek	2.3
655	Blake Creek Summit	1.8
670	Timber Creek	3.6
671	Bad Canyon	2.8
Total		98.3

Dearborn Silverking

The Dearborn Silverking RWA is located in the Upper Blackfoot GA north and east of Lincoln, Montana. This RWAs lies adjacent to the Scapegoat Wilderness Area in the upper reaches of the Alice Creek and Landers Fork drainages.

There are no open roads or motorized trails within this RWA. However, there are 20.8 miles of nonmotorized trail that would be closed to mechanized means of transportation (including bicycles). Additionally, approximately 16.9 acres of motorized over-snow areas that would be closed to motorized winter uses and mechanical means of transportation (including bicycles). See Table 209.

Table 209. Nonmotorized trails closed to mechanical means of transport in the Dearborn Silverking RWA (alternative B)

Trail Number	Name	Miles
219	East Fork Falls Creek	0.1
420	Silver King Trail	2.9
438	Landers Fork Trail	3.9
440	Continental Divide Trail	6.1
477	Lone Mountain Trail	2.3
481	Mainline Trail	1.2
490	Alice Creek	4.3
Total		20.8

Red Mountain

The Red Mountain RWA is locate south and east of Red Mountain Peak in Red Creek, within the Copper Creek drainage. This small RWA borders the Scapegoat Wilderness Area and is also a RNA).

There are no motorized uses or open roads within this RWA. However there is one very short segment (<0.1 miles) of nonmotorized trail that would be closed to mechanical means of transportation (including bicycles), and is described in Table 210.

Table 210. Nonmotorized trails closed to mechanical means of transport in the Red Mountain RWA (alternative B)

Trail Number	Name	Miles
423	Red Mountain Trail	<0.1

Arrastra Creek

The Arrastra Creek RWA is located in the Upper Blackfoot GA north and west of Lincoln, Montana. This RWAs lies adjacent to the Scapegoat Wilderness Area in the upper reaches of the Beaver Creek and Dry Creek drainages and includes Arrastra Mountain.

There are no open roads or motorized trails within this RWA. However, there are 7.9 miles of nonmotorized trail that would be closed to mechanical means of transportation (including bicycles). Additionally, approximately 2,239.2 acres of motorized over-snow areas would be closed to motorized winter uses and mechanical means of transport. See Table 211.

Table 211. Nonmotorized trails closed to mechanical means of transport in the Arrastra Creek RWA (alternative B)

Trail Number	Name	Miles
482	Arrastra Creek Trail	4.2
483	Dry Creek Trail	1.3
488	Porcupine Basin	2.4
Total		7.9

Nevada Mountain

Nevada Mountain RWA is located south and west of Lincoln, Montana in the Upper Blackfoot GA. This large area includes Nevada Mountain, Black Mountain, and the head end of many drainages such as Nevada Creek and Washington Creek, as well as several smaller drainages that flow into Poorman Creek. Portions of the Continental Divide National Scenic Trail also cross through this RWA.

There are no open roads or motorized trails within this RWA. However, there are 30.5 miles of nonmotorized trail that would be closed to mechanical means of transportation (including bicycles). Additionally, approximately 8,878.3 acres of motorized over-snow areas would be closed to motorized winter uses and mechanical means of transportation (including bicycles). See Table 212.

Table 212. Nonmotorized trails closed to mechanical means of transport in the Nevada Mountain RWA (alternative B)

Trail Number	Name	Miles
337	Continental Divide Trail	4.2
405	Washington Gulch Trail	2.3
440	Continental Divide Trail	6.9
466	Nevada Creek Trail	4.3
467	Gould/Helmville Trail	7.2

Trail Number	Name	Miles
487	Prickly/Nevada Trail	5.6
Total		30.5

Alternative C

Alternative C identifies nine RWAs. These RWAs are the same as those identified in alternative B; see Table 199. The expected effects of the RWA plan components for alternative C are the same as alternative B except that alternative C would allow for the continuation of motorized uses and mechanized means of transportation (including bicycles) within RWAs.

Table 213 provides a summary of the suitability plan component that allows for motorized and mechanized means of transportation to continue within RWAs in alternative C. All other plan components would be the same as described above in Table 201 for alternative B.

Table 213. Summary of proposed plan component for recommended wilderness (alternative C)

Plan component	Expected effects
FW-RECWILD-SUIT-01 (Alternative C only)	This plan component provides direction allows motorized uses and mechanized means of transportation (including bicycles) to occur within RWAs. Motorized recreation uses would continue to be governed by current and updated summer and winter travel plans.

In alternative C, existing and/or updated travel plans would provide direction for where motorized uses would occur and would not occur. Mechanized means of transportation would continue to be allowed on all nonmotorized trails within the RWAs.

Mechanized means of transportation (including bicycles) and motorized recreation uses might affect the undeveloped nature (ecological characteristic) and primitive recreation (social characteristic) of these RWAs. In addition, the sounds of motorized recreation uses (such as snowmobiling or off-road vehicle use) could impact the RWA's solitude and primitive recreation (social characteristic).

Not every person traveling through the RWAs in alternative C would meet a mountain biker or motorized user as these areas are remote and currently have relatively low levels of recreation use. Any type of trail, whether for hikers or horseback riders, could affect the undeveloped wilderness characteristics (ecological characteristic) because a trail is considered a development. Solitude could be affected by noise but could also be affected by encounters with other people who are hiking or horseback riding, particularly if they are traveling in large groups.

Table 214 shows the overall miles of open roads, motorized trail, and non-motorized trail that would continue to be open to motorized and mechanized uses (including bicycles) within RWAs in alternative C. This table also shows the acres open to motorized over-snow areas that would continue to be available in this alternative.

Table 214. Miles of open road, motorized trail, non-motorized trail, and acres of motorized over snow uses that would be open to motorized and mechanical means of transport in RWAs (alternative C)

RWA	Miles of Open Road	Miles of Motorized Trail	Miles of Nonmotorized Trail	Acres Open to Motorized Over Snow Uses
Big Log	0	0	5.3	0
Mount Baldy	0	0	13.6	0

RWA	Miles of Open Road	Miles of Motorized Trail	Miles of Nonmotorized Trail	Acres Open to Motorized Over Snow Uses
Blackfoot Meadows	0	0	16.3	11.1
Deep Creek	0	0	12.9	0
Big Snowies	11.8	0.1	98.3	13,144.5
Dearborn Silverking	0	0	20.8	16.9
Red Mountain	0	0	<0.1	0
Arrastra Creek	0	0	7.9	2,239.2
Nevada Mountain	0	0	30.5	8,878.3
Totals	11.8	0.1	205.7	24,290

Alternative D

Alternative D responds to comments received during pubic scoping asking the Forest to consider an alternative that increased the amounts of RWAs and primitive recreation opportunities on the forest. Alternative D identifies sixteen areas as RWAs. These RWAs include the nine areas identified for alternatives B and C as well as seven additional areas with wilderness characteristics. Additional acreages were also added to the Nevada Mountain and Blackfoot Meadows RWAs in this alternative. In total, the RWAs in alternative D are located across seven GAs and total approximately 474,589 acres.

All of the RWAs were derived from the original wilderness inventory polygons identified in the first step of the wilderness evaluation process, but do not necessarily include all of the original acres of those wilderness inventory polygons. For specific boundary locations of RWAs, see maps provided in appendix A. Table 215 describes the RWA polygons and acres associated with RWAs identified in alternative D.

Table 215. Recommended wilderness in alternative D

RWA	Wilderness Inventory Polygon	GA	Adjacent Designated Wilderness	Acres
Big Log	BB1	Big Belts	Gates of the Mountains	7,086
Camas Creek	BB6	Big Belts	NA	22,350
Mount Baldy	BB7	Big Belts	NA	8,314
Wapiti Peak	CA1	Castles	NA	30,606
Loco Mountain	CR1	Crazies	NA	24,977
Blackfoot Meadows	D3	Divide	NA	26,900
Colorado Mountain	D5	Divide	NA	14,189
Deep Creek	LB1a	Little Belts	NA	14,490
Tenderfoot Creek	LB1b	Little Belts	NA	45,870
Big Horn Thunder	LB 2	Little Belts	NA	47,107
Middle Fork Judith	LB16	Little Belts	NA	62,452
Big Snowies	S1	Snowies	NA	95,299
Dearborn Silverking	UB1	Upper Blackfoot	Scapegoat	20,088
Red Mountain	UB2a	Upper Blackfoot	Scapegoat	1,901
Arrastra Creek	UB2b	Upper Blackfoot	Scapegoat	8,257
Nevada Mountain	UB10	Upper Blackfoot	NA	44,702
Total				474,589

Similar to alternative B, motorized recreational uses and mechanized means of transport (including bicycles) would not be considered suitable and would not be allowed in RWAs in alternative D. Approximately 22.8 miles of road, 59.4 miles of motorized trail, and 79,109 acres of motorized over-snow uses would be closed to motorized recreation uses and mechanical means of transport within RWAs in this alternative. Additionally, mechanized means of transportation (including bicycles) would be considered unsuitable and would not be allowed on approximately 360.2 miles of nonmotorized trails within the identified RWAs.

Table 216 shows the miles of open roads, motorized trail, nonmotorized trail, and acres open to over-snow uses that would not allow motorized and mechanized means of transportation in the RWAs in alternative D.

Table 216. Miles of open road, motorized trail, nonmotorized trail, and acres of motorized over-snow uses that would not be allowed in RWAs in alternative D

GA	Miles of Open Road	Miles of Motorized Trail	Miles of Non-Motorized Trail	Acres Open to Motorized Over-Snow Uses
Big Log	0	0	5.3	0
Camas Creek	0.3	0	16.0	0
Mount Baldy	0	0	13.6	0
Wapiti Peak	6.1	31.9	9.5	26,331.5
Loco Mountain	0	0	23.5	4,753.7
Blackfoot Meadows	0	2.4	22.3	5,107.3
Colorado Mountain	0	0	1.9	1,240.4
Deep Creek	0	0	12.9	0
Tenderfoot Creek	0	5.9	29.7	5,871.7
Big Horn Thunder	2.6	15.7	11.2	2,308.4
Middle Fork Judith	0.7	0	56.0	4,996.3
Big Snowies	11.8	0.1	98.3	13,144.5
Dearborn Silverking	0	0	20.8	16.9
Red Mountain	0	0	<0.1	0
Arrastra Creek	0	0	7.9	2,239.2
Nevada Mountain	1.3	3.4	31.2	13,099.1
Totals	22.8	59.4	360.1	79,109.3

Direct Effects

Big Log

The direct effects are the same as those described above in alternative B.

Camas Creek

Camas Creek RWA is located in the Big Belts GA. This RWA contains the high peaks of Boulder Mountain and Boulder Baldy. Additionally, it contains the Boulder Lakes and Camas Lakes areas.

There are currently 0.3 mile of open road but no other motorized uses within the Camas Creek RWA, and this open road would be closed to motorized use as well as mechanical means of transport in alternative D. There are approximately 16 miles of nonmotorized trail that would be closed to mechanized means of transport. See Table 217 and Table 218.

Table 217. Open road closed to motorized uses and mechanical means of transport in Camas Creek RWA (alternative D)

Road Number	Road Name	Miles
383	Camas	0.3

Table 218. Nonmotorized trails closed to mechanical means of transport in the Camas Creek RWA (alternative D)

Trail Number	Name	Miles
118	Belt Mountain Divide	6.4
140	Camas	2.3
140A	Camas Lake	0.8
141	Pickfoot	1.9
142	Boulder Lakes	4.5
143	Spruce Creek	0.1
Total		16.0

Mount Baldy

The direct effects are the same as those described above in alternative B.

Wapiti Peak

Wapiti Peak RWA is located in the west side of the Castles GA. This RWA contains a series of high peaks including Beartrap Peak, Woodchuck Mountain, Wapiti Peak, Elk Peak, and Castle Mountain. The area is characterized by numerous castle-like outcrops of granite. Most of the higher elevations are covered by forest with large open grasslands dominating the lower elevations.

There are currently 6.1 miles of open road, 31.9 miles of motorized trail, and 26,331.5 acres of motorized over-snow area within the Wapiti Peak RWA. These areas would be closed to motorized uses and mechanical means of transport in alternative D. Additionally, there are approximately 9.5 miles of nonmotorized trail that would be closed to mechanical means of transportation. See Table 219, Table 220, and Table 221.

Table 219. Open roads closed to motorized uses and mechanical means of transport in Wapiti Peak RWA (alternative D)

Road Number	Road Name	Miles
8878	South Castle Lake	2.7
8880	South Castle Lake/Reynolds	0.6
15991	Cumberlin Divide	0.7
15993	Wapiti Burn	0.3
15995	Frontier Road	0.6
15998	Little Oly Can Road	1.2
Total		6.1

Table 220. Motorized trail closed to motorized use and mechanical means of transport in the Wapiti Peak RWA (alternative D)

Trail Number	Trail Name	Miles
618	Willow Creek/Warm Springs Creek	2.1

Trail Number	Trail Name	Miles
622	Castle Elk Connector	3.0
624	Alabough-Castle Lake	1.3
713	Fourmile Creek	0.4
713-A	Fourmile Connector	1.3
716	Grasshopper	2.1
717	Wapiti Peak	6.9
718	Elk Peak	5.3
719	Manger Park	4.8
723	Horse Park	2.5
725	Woodchuck	2.2
Total		31.9

Table 221. Nonmotorized trails closed to mechanized means of transport in the Wapiti Peak RWA (alternative D)

Trail Number	Trail Name	Miles
617	Loweth	0.8
618	Willow Creek/Warm Springs Creek	4.4
622	Castle Elk Connector	0.1
713	Fourmile Creek	1.3
716	Grasshopper	2.9
Total		9.5

Loco Mountain

Loco Mountain RWA is located on the east side of the Crazies GA. This RWA lies at the north end of the Crazy Mountain range and shares a border with the Gallatin NF. The area contains a number of high, craggy peaks that are often covered in talus, scree, and boulder areas. Vegetation on the upper ridges is mostly alpine and lacks forest cover. Glaciation has imparted many of these landforms with sharp and scoured edges.

There are no open roads or motorized trails in the Loco Mountain RWA. Approximately 4,753.7 acres are available for motorized over-snow areas. The motorized recreation uses would be closed in alternative D. Additionally, there are approximately 23.5 miles of nonmotorized trail that would be closed to mechanical means of transportation within this RWA. See Table 222.

Table 222. Nonmotorized trails closed to mechanized means of transport (including bicycles) in the Loco Mountain RWA (alternative D)

Trail Number	Trail Name	Miles
630	Boundary	3.2
630-A	South Boundary	0.6
631	Little Elk	0.6
632	Loco Creek	1.7
633	Loco Creek/Castle Creek Connector	0.8

Trail Number	Trail Name	Miles
634	Groveland	0.4
636	Crow Creek	6.8
640	Shields Big Elk	4.8
641	Castle Creek	4.6
641-A	Old 634 Off Castle	0.0
Total		23.5

Blackfoot Meadows

The size and configuration of the Blackfoot Meadows RWA in alternative D is different from the Blackfoot Meadows RWA identified in alternatives B and C. In alternative D, the RWA would be expanded north of the Little Blackfoot River and would extend along the Continental Divide National Scenic Trail east of Bison Mountain.

In alternative D, there are no open roads within this RWA but there are approximately 2.4 miles of motorized trail which would be closed to motorized uses and mechanical means of transport. Approximately 22.3 miles of nonmotorized trail would be closed to mechanized means of transport. Additionally, an estimated 5,107 acres of motorized over-snow area would be closed to motorized uses and mechanized means of transport. See Table 223 and Table 224.

Table 223. Motorized trails closed to motorized use and mechanical means of transport in the Blackfoot Meadows RWA (alternative D)

Trail Number	Trail Name	Miles
501	Limburger Spring	1.9
1870-T	Baldy Ridge	0.5
Total		2.4

Table 224. Nonmotorized trails closed to mechanized means of transport in the Blackfoot Meadows RWA (alternative D)

Trail Number	Name	Miles
326	Kading	1.6
328	Bison-Blackfoot	1.3
329	Blackfoot Meadows	7.7
330	Bison MT	1.3
337	Continental Divide	4.6
359	Larabee Gulch	2.8
362	Monarch Creek	3.0
Total		22.3

Colorado Mountain

Colorado Mountain RWA is located in the upper reaches of the Colorado Gulch drainage in the Divide GA, south and west of Helena, MT. This RWA lies also extends into the Tenmile watershed on its north and western edges. The busy, dispersed recreation area known as the South Hills makes up its eastern boundary. This RWA also contains Black Mountain and Colorado Mountain.

There are no open roads or motorized trails within this RWAs. Approximately 1,240.4 acres of motorized over-snow area would also be closed to motorized uses and mechanized means of transport in this alternative. Additionally, there is one nonmotorized trail (1.9 miles in length) that would be closed to mechanical means of transportation. See Table 225.

Table 225. Nonmotorized trails closed to mechanized means of transport in the Colorado Mountain RWA (alternative D).

Trail Number	Trail Name	Miles
375	Tenmile Environmental	1.9

Deep Creek

The direct effects are the same as those described above in alternative B.

Tenderfoot Creek

The Tenderfoot Creek RWA is located within the Tenderfoot Creek drainage in the Little Belt Mountains GA. This RWA extends from the Smith river drainage on the west to just west of Williams Mountain in the east. The southern border of the RWA follows Tenderfoot and South Fork Tenderfoot creek and skirts larger parcels of private land on the southern border.

The Tenderfoot Creek RWA does not contain any open roads. However, there are approximately 5.9 miles of motorized trails and 5, 871 acres of motorized over-snow areas that would be closed to motorized uses and mechanical means of transportation in this alternative. Additionally, there are 29.7 miles of nonmotorized trails that would be closed to mechanized means of transportation. See Table 226 and Table 227.

Table 226. Motorized trail closed to motorized uses and mechanical means of transport in the Tenderfoot Creek RWA (alternative D)

Trail Number	Trail Name	Miles
301	Old Baldy	0.1
343	Balsinger to Taylor	0.8
345	Bald Hills	5.0
Total		5.9

Table 227. Non-motorized trails closed to mechanized means of transport in the Tenderfoot Creek RWA (alternative D)

Trail Number	Trail Name	Miles
301	Old Baldy	4.9
310	Bear Gulch	2.7
317	Strawberry Ridge	4.2
331	Cow Coulee	1.5
342	Tenderfoot	12.2
345	Bald Hills	1.2
354	Double Gulch	3.0
Total		29.7

Bighorn Thunder

The Bighorn Thunder RWA is located east of Logging Creek and north of the Divide Road in the Little Belt Mountains GA. This RWA contains the high mountain peaks of Big Horn Mountain and Thunder Mountain. Pilgrim Creek runs north-south and bisects the area.

This RWA contain approximately 2.6 miles of open road, 15.7 miles of motorized trail, and 2,308 acres of motorized over-snow recreation area. Motorized uses and mechanical means of transportation would not be allowed on these roads nor in areas within RWAs. Additionally, there are 11.2 miles of nonmotorized trails that would be closed to mechanized means of transportation in this RWA. See Table 228, Table 229, and Table 230.

Table 228. Open roads closed to motorized uses and mechanical means of transport in Big Horn Thunder RWA (alternative D)

Road Number	Road Name	Miles
839-F	Lower Pilgrim Trailhead	0.1
6384	Log Spur Wilson 9-Part	2.4
838067	839067	0.1
Total		2.6

Table 229. Motorized trail closed to motorized uses and mechanical means of transport in the Big Horn Thunder RWA (alternative D)

Trail Number	Trail Name	Miles
304	Pilgrim Creek	9.3
305	Deer Creek	1.6
315	Tobins Gulch	4.8
Total		15.7

Table 230. Nonmotorized trails closed to mechanized means of transport in the Big Horn Thunder RWA (alternative D)

Trail Number	Trail Name	Miles
304	Pilgrim Creek	2.5
315	Tobins Gulch	<0.1
318	Dry Gulch	2.6
322	Tillinghast Creek	0.0
336	Bighorn	6.0
Total		11.2

Middle Fork Judith

The Middle Fork Judith RWA is located in the Little Belt Mountains GA. This area includes the lower Lost Fork and Middle Fork of the Judith River with the major high points being Yogo Peak, Cabin Mountain, Grendah Mountain, Sandpoint Mountain, and Lost Fork Ridge. A large portion of this RWA is also designated as the Middle Fork Judith WSA. Only the northeastern portion of the WSA is not included in the RWA boundary.

There are 0.7 mile of open road and approximately 4,996 acres of motorized over-snow recreation uses within this RWA. These motorized miles and acres would be closed to motorized uses and mechanical means of transport in alternative D. Additionally, there are approximately 56 miles of nonmotorized trail that would be closed to mechanized means of transport. See Table 231 and Table 232.

Table 231. Open roads closed to motorized uses and mechanical means of transport in Middle Fork Judith RWA (alternative D)

Road Number	Road Name	Miles
825	Middle Fork Judith River	0.1
6538	Middle Fork Cabin #1	0.6
Total		0.7

Table 232. Nonmotorized trails closed to mechanized means of transport in the Middle Fork Judith RWA (alternative D)

Trail Number	Trail Name	Miles
407	Doerr Creek	3.6
409	Lost Fork Judith River	12.2
422	West Fork Lost Fork	5.1
428	Prospect Ridge	5.3
429	King Creek	1.9
433	Burris-Ettien	2.3
434	Halzel Coulee	3.5
436	Sand Point Ridge	4.4
441	Cleveland Creek	7.0
442	Stiner Creek	3.7
444	Woodchopper Ridge	3.4
450	Yogo Creek	3.6
Total		56.0

Big Snowies; Dearborn Silverking; Red Moutain; Arrastra Creek

The direct effects are the same as those described above in alternative B.

Nevada Mountain

The size and configuration of the Nevada Mountain RWA in alternative D is different than the Nevada Mountain RWA identified in alternatives B and C. In alternative D, the Nevada Mountain RWA would be expanded to include a greater portion of Deadman Creek.

There are approximately 1.3 miles open road and 3.4 miles of motorized trails that would be closed to motorized uses and mechanical means of transportation within this RWA in alternative D. In alternative D, 31.2 miles of nonmotorized trail would be closed to mechanical means of transportation. Additionally, an estimated 13,099 acres of motorized over-snow areas would be closed to motorized winter uses and mechanical means of transportation. See Table 233, Table 234, and Table 235.

Table 233. Open roads closed to motorized uses and mechanical means of transport in Nevada Mountain RWA (alternative D)

Road Number	Road Name	Miles
774	Cottonwood Gulch	1.0
774-B1	Cottonwood Gulch Spur B1	0.3
1845	Towsley Gulch	0.0
Total		1.3

Table 234. Motorized trail closed to motorized uses and mechanical means of transport in the Nevada Mountain RWA (alternative D)

Trail Number	Trail Name	Miles
1811-T	Jerusha Gulch	3.4

Table 235. Nonmotorized trails closed to mechanical means of transport in the Nevada Mountain RWA (alternative D)

Trail Number	Name	Miles
337	Continental Divide Trail	5.1
405	Washington Gulch Trail	2.1
440	Continental Divide Trail	6.9
466	Nevada Creek Trail	4.3
467	Gould/Helmville Trail	7.2
487	Prickly/Nevada Trail	5.6
Total		31.2

Alternative E

Alternative E responds to comments received during pubic scoping asking the Forest to consider an alternative that does not identify RWAs and increases the amount of forest lands available for timber production. In response to these comments, alternative E does not include any RWAs.

The miles of open road, motorized trail, nonmotorized trail, and acres open to motorized over-snow uses would be determined by travel plans for these areas. Mechanized means of transportation would continue to be allowed on roads and trails throughout the HLC NF. There would be no plan components for RWAs in alternative E.

Cumulative Effects

Reasonable and foreseeable future actions on the HLC NF include vegetation management, mining, grazing, prescribed burning, and the reduction of fuels in the wildland-urban interface. These actions could impact the wilderness characteristics of solitude, depending on the proximity and pervasiveness of these actions, although typically just the sights and sounds within the RWA are used to determine effects on wilderness characteristics.

Alternatives A, B, C, and D identify RWAs, some of which are located adjacent to designated wilderness. In alternatives B and D, motorized recreation uses and mechanical means of transportation would not be allowed in RWAs. Both the location of these RWAs and the closure of motorized and mechanized means of transport would extend the opportunities for solitude and primitive unconfined recreation into these locations and improve the wilderness characteristics of existing wilderness areas overall.

Alternative C also identifies RWAs, some of which are adjacent to designated wilderness areas. However, existing motorized and mechanized recreational uses would be allowed to continue within these areas in alternative C. While RWAs combined with designated wilderness would still contribute to larger areas with wilderness characteristics, effects from motorized and mechanized recreation uses within RWAs may impact the opportunities for solitude and primitive unconfined recreation in those areas.

Conclusions

In alternative A, the HLC NF would continue to manage three RWAs, for an estimated total of 34,265 acres, as per the guidance found in the 1986 Helena NF Plan. Direction for motorized uses within these areas would be provided by existing travel plans. Mechanical means of transportation would be allowed to continue on existing roads and trails.

All of the action alternatives meet the purpose and need because they are consistent with the 2012 Planning Rule and associated directives, which provides direction to complete a wilderness inventory and evaluation process to determine lands with wilderness characteristics that may be suitable for inclusion in the National Wilderness Preservation System when conducting a forest plan revision.

Alternatives B and C identify nine areas to be RWAs for a total of approximately 213,076 acres. These nine RWAs would be managed to protect their wilderness characteristics. Boundaries for the individual RWAs would be located on naturally occurring ridgelines, stream bottoms, or other locatable features on the landscape to make them more manageable.

In response to public comment, sixteen RWAs would be identified in alternative D, for a total of approximately 474,589 acres. These sixteen areas would be managed to protect their wilderness characteristics and, similar to alternatives B and C, the boundaries for the individual RWAs would be located on naturally occurring ridgelines, stream bottoms, or other locatable features on the landscape to make them more manageable.

In response to public comment, alternative E would not identify any lands as RWAs.

In alternatives B and D, motorized uses and mechanical means of transportation within RWAs would be considered unsuitable and would not be allowed to occur. By closing RWAs to these uses, wilderness characteristics would be most protected and enhanced. In response to public comment, alternative C would allow motorized uses and mechanized means of transportation to continue within RWAs. Table 236 summarizes the acres and allowed uses within RWAs by alternative.

Table 236. Summary of acres and allowed uses in RWAs by alternative

Alternative	Number of RWAs	Acres[1]	Motorized uses	Mechanical means of transportation
A	3	34,265	Allowed per existing travel plans	Allowed
B	9	213, 076	Not allowed	Not allowed
C	9	213, 076	Allowed per existing travel plans	Allowed
D	16	474,589	Not allowed	Not allowed
E	0	0	Allowed per existing travel plans	Allowed

Identifying an area as a RWA through the forest plan does not create a wilderness, as only Congress has the right to designate wilderness by passing legislation. However, RWAs adjacent to designated wilderness can affect existing wilderness areas by providing larger areas with wilderness characteristics.

3.23.9 Wilderness study areas, affected environment

The HLC NF manages two WSAs: the Big Snowy Mountains and the Middle Fork Judith. See Table 237.

Table 237. Montana wilderness study act areas

WSA	GA	Acres
Middle Fork Judith	Little Belts	82,127
Big Snowies	Snowies	87,968
Total Acres		170,095

The Montana Wilderness Study Act of 1977 states that these lands should be managed for their “presently existing wilderness character.” This has been interpreted to include the allowance of those recreation uses that were present in 1977. During scoping, the public informed the Forest that existing mountain biking was a valued recreation activity in WSAs, particularly in the Big Snowies area.

3.23.10 Wilderness study areas, environmental consequences

Effects common to all alternatives

The WSAs on the HLC NF are governed by the terms of the Montana Wilderness Study Act (Public Law 95-150) which are designed to protect and retain wilderness characteristics until Congress makes a final decision about these areas. The Big Snowies and the Middle Fork Judith WSAs will be managed and regulated according to the direction provided in this law.

In all alternatives, the acres of the Big Snowies and Middle Fork Judith WSAs would remain the same. There would be no effect to the existing undeveloped values or special features of these WSAs in any of the alternatives. All of the alternatives would continue to protect and preserve the wilderness characteristics found within the WSAs on the HLC NF.

Effects common to all action alternatives

The plan components for WSAs would remain the same in all action alternatives. See Table 238.

Table 238. Summary of plan components for WSAs

Plan component	Expected effects
FW-WSA-DC-01	This DC ensures an environment in WSAs where ecological process such as natural succession, wildfire, avalanches, insects and disease are the primary forces affecting the environment.
FW-WSA-DC-02	This DC ensures that WSAs provide opportunities primitive recreation, while allowing for recreation uses established prior to the 1977 Montana Wilderness Study Act, if those uses retain the wilderness characteristics of the area.
FW-WSA-SUIT-01; 02; 06	These plan components provides direction for timber production, timber harvesting, new commercial communication sites, new utility corridors, and developed recreation sites and facilities within RWAs. None of these management actions are suitable within RWAs.
FW-WSA-SUIT-03	This plan component states that restoration activities, such as management ignited fire and active weed management, are suitable within WSAs, so long as they protect and/or enhance the wilderness characteristics of these areas.

Plan component	Expected effects
FW-WSA-SUIT-04	This component ensures that the use of motorized equipment, such as chain saws, is suitable in WSAs to achieve restoration activities and administrative work.
FW-WSA-SUIT-05	This plan component provides direction for road construction and reconstruction within WSAs.
FW-WSA-SUIT-07	This plan component allows for existing livestock grazing allotments but prohibits new or expanded livestock grazing allotments within WSAs.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and management activities for aquatic ecosystems and soil management would have little effect related to WSAs. The plan components that may have the greatest influence are those associated with RMZs. East of the Continental Divide, RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. All of the WSAs are east of the Continental Divide.

Little to no active management would occur in WSAs. However, restoration treatments such as prescribed fire that could occur may be limited or modified within RMZs. The area on which these components apply is greater with the action alternatives than with the no-action alternative on landscapes east of the Continental Divide; however, the effect would be minor and insubstantial with regards to the wilderness characteristics of WSAs.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur within WSAs, and provide opportunities for natural fire to promote and/or enhance the wilderness characteristics of these areas. Fire and fuels management plan components also specify the use of minimum impact strategies and tactics to manage wildland fire within WSAs, which would further protect wilderness characteristics.

Timber and vegetation management

There would be no effect to WSAs from plan components related to timber harvest because no timber harvest would be allowed in these areas. Plan components related to desired vegetation conditions could influence whether restoration treatments (such as management-ignited fires) are conducted in WSAs, and help define the objectives for those treatments. Vegetation management activities such as planting of whitebark pine could also be allowed. Vegetation plan components would help promote and/or enhance the wilderness characteristics of these areas.

Livestock grazing and management

The plan components for the action alternatives do not allow for new or expanded livestock grazing allotments to occur within WSAs; however, existing allotments may be retained. Therefore, the plan components that guide livestock grazing and management would influence these areas. While livestock grazing itself has the potential to degrade plant communities through factors such as invasive plant spread and damage to riparian areas, plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components should help protect the wilderness characteristics of WSAs, to a greater degree with the action alternatives as compared to the no-action alternative.

Wildlife management

Plan components related to wildlife management would have little to no effect on WSAs.

Recreation and scenery management

Plan components for recreation settings, opportunities, and access along with scenery management would complement the management of WSAs for their wilderness characteristics. In the action alternatives, WSAs have a primitive ROS setting and a very high SIO. These classifications would ensure that potential recreation and other activities, such as restoration, would be consistent with WSA desired conditions.

Cultural, historic, and tribal resource management

Plan components related to cultural, historic, and tribal resource would have little to no effect on WSAs. The protection of these resources would be consistent with maintaining the wilderness characteristics of these areas.

Road access and infrastructure

Plan components related to road access and infrastructure would have little to no effect on WSAs, because these areas would not be suitable for road construction or reconstruction. However, road reconstruction or rerouting for the purpose of eliminating impacts to natural or cultural resources is allowed, provided the abandoned routs are fully rehabilitated (FW-WSA-SUIT-05); plan components for infrastructure would help ensure this work is done in a manner that protects hydrological resources.

Minerals management

WSAs are discretionarily unavailable for mineral leasing and saleable mineral activity but still open to locatable mineral prospecting, exploration, and development.

Alternative A, no action

In alternative A, the Big Snowies and the Middle Fork Judith WSAs would continue to be managed under the 1986 Lewis and Clark Forest Plan and direction found in Public Law 95-150. Future wilderness and other laws may determine the fate of these WSAs. Table 239 describes the plan components in the 1986 Lewis and Clark Forest Plan that provide direction for the Big Snowies and Middle Fork Judith WSAs.

Table 239. Summary of existing plan components for WSAs (alternative A)

Plan component	Expected effects
1986 Lewis and Clark NF Plan, Objectives – Roadless Areas, Page 2-5	An objective for roadless areas which recognizes over a million acres of roadless on the Lewis and Clark NF. Some of these roadless acres have been identified as WSAs.
1986 Lewis and Clark NF Plan, Geographic Unit Direction, Little Belt Mountains, Middle Fork Judith Pages 4-69 through 4-70	Establishes that the Middle Fork Judith WSA will be managed to protect its wilderness characteristics until Congress acts on the FS's recommendations.
1986 Lewis and Clark NF Plan, Geographic Unit Direction, Snowy Mountains, Big Snowies, Pages 4-89 through 4-90	Establishes that the Big Snowies WSA will be managed to protect its wilderness characteristics until Congress acts on the FS's recommendations.

Alternatives B and C

In alternatives B and C the entire Big Snowies WSA would be identified as a RWA. Therefore, the plan components for RWAs would apply to the Big Snowies WSA in alternatives B and C, rather than the plan components for WSA.

The Middle Fork Judith WSA is *not* identified as a RWA in alternatives B and C. The plan components for WSAs, as described in effects to all action alternatives, above, would apply to the Middle Fork Judith WSA.

Alternative D

In alternative D, the entire Big Snowies WSA would be identified as a RWA. Therefore, the plan components for RWAs would apply to the Big Snowies WSA in alternative D.

In alternative D, a portion, but not all of, the Middle Fork Judith WSA would also be identified as a RWA. The plan components for RWAs would apply to those portions of the Middle Fork Judith WSA that would be identified as RWAs. The portions of the Middle Fork Judith WSA outside of the RWA would follow the plan components for WSAs identified in effects to all action alternatives, above.

Alternative E

In alternative E, neither the Big Snowies nor the Middle Fork Judith WSAs would be identified as RWAs. The plan components for WSAs, identified in effects to all action alternatives, above, would apply.

Conclusions

Since these areas are congressionally designated WSAs, the acres and locations of the Big Snowies and Middle Fork Judith WSAs would not vary in any of the alternatives, including alternative A. In alternative A, the Big Snowies and the Middle Fork Judith WSAs would continue to be managed under the 1986 Lewis and Clark Forest Plan and direction found in Public Law 95-150.

The action alternatives (alternatives B-E) include plan components that would provide direction for the management of the WSAs on the Forest including the protection and preservation of existing wilderness characteristics and guidelines for the management of facilities, utilities, trails, and outfitter and guide permits within WSAs. By providing the plan components outlined in the action alternatives, the HLC NF meets the purpose and need of the forest plan, ensuring that WSAs are managed in ways that are ecologically and socially sustainable for present and future generations.

In alternatives B, C, and D, the Big Snowies WSA would be identified as a RWA. In these three alternatives, activities/management in the Big Snowies WSA would be subject to the more restrictive plan components for RWAs.

Similarly, in alternative D, portions of the Middle Fork Judith WSA would be identified as a RWA. The more restrictive plan components for RWAs would apply to those acres of the Middle Fork Judith that have been identified as such. The acres of the Middle Fork Judith WSA that are not identified as RWA would follow the plan components developed for WSAs.

No RWAs were identified in alternative E so both the Big Snowies and the Middle Fork Judith WSAs would follow the plan components for WSAs in this alternative.

3.23.11 Eligible wild and scenic rivers, affected environment

In 2015, under the direction of the 2012 Planning Rule (36 CFR Part 219), a WSRs eligibility study was conducted on the HLC NF. The 2015 eligibility study process included the review of all named and free-flowing streams/rivers within the HLC NF and a determination of whether these streams/rivers had any outstandingly remarkable values. After the completion of the study, the HLC NF identified 45 rivers as eligible for consideration as wild, scenic, or recreational rivers under the Wild and Scenic Rivers Act. The designation of eligible WSRs pertains only to federally owned lands. Rivers and segments of rivers that pass through private lands were not considered in the eligibility study.

In order for a river to be identified as eligible for WSR designation if must (1) be free flowing, and (2) possess at least one outstandingly remarkable value.

Once identified, a corridor of ¼ mile either side of the eligible river/river segment is identified for the protection and management of the WSR-related values. For management purposes, identified eligible WSR segments are classified as wild, scenic, or recreational.

- **Wild** – Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.
- **Scenic**– Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- **Recreational**– Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Table 240 identifies the eligible rivers, the outstandingly remarkable values present, the preliminary classification, and the mileage associate with each river. For information about the WSRs eligibility study, including maps and documentation, see appendix G of the Draft Plan.

Table 240. Eligible WSRs

Eligible river/river segment	Segment Description	Preliminary Classification	Outstanding Remarkable Value(s)	Miles
Beaver Creek	Segment 1: From mouth to Bridge Creek, west of Nelson Segment 2: From Sheep Gulch to Pike Creek	Recreational Recreational	Recreation, Geology, Fish, Cultural	5.5 3.7
Whites Gulch	From FS boundary west to private boundary.	Recreational	Fish	3.0
Missouri River	Hauser Dam to Cochran Gulch	Recreational	Recreation (Fishing), Geology, Wildlife	2.2
Ray Creek	From FS boundary to headwaters.	Scenic	Fish	3.4
Little Blackfoot River	Segment 1: From mouth to private land boundary near Charter Oaks. Segment 2: From private land boundary south of Sawmill Creek to private land boundary north of Conner's Gulch. Segment 3: From private land boundary north of Kading Campground to the headwaters.	Recreational Recreational Wild	Fish Cultural	0.8 5.0 9.0
High Ore Creek	From FS boundary to headwaters	Scenic	Fish	1.1
Kady Gulch	From FS boundary to mining claim boundary	Recreational	Fish	1.1
South Fork Quartz	From mouth to mining claim boundary	Recreational	Fish	2.2
Skelly Gulch	From FS boundary to headwaters	Recreational	Fish	2.5
Staubach Creek	From FS boundary to headwaters	Scenic	Fish	2.4
North Fork Highwood Creek	From fish barrier to headwaters	Scenic	Fish	3.4
Big Coulee Creek	From natural cascade fish barrier to upper tributary fork	Wild	Fish	2.1

Eligible river/river segment	Segment Description	Preliminary Classification	Outstanding Remarkable Value(s)	Miles
Cottonwood Creek	From FS boundary to headwaters	Scenic	Fish	2.5
North Fork Little Belt Creek	From FS boundary to headwaters	Wild	Fish	2.1
Pilgrim Creek	From cascade fish barrier to headwaters	Wild	Fish	10.7
Middle Fork Judith River	From FS boundary to Big Arch Coulee	Recreational	Cultural	4.7
South Fork Judith River	Segment 1: From Bower Creek to Dry Pole Creek Segment 2: From Bluff Creek to Cabin Creek Segment 3: From Cabin Creek to headwaters	Recreational Scenic Wild	Fish Cultural	3.6 1.3 10.0
Smith River *(FS lands only)*	The Smith River is comprised of 14 small segments of NFS lands interspersed with private lands. Only NFS lands are considered for eligibility. To view individual segments, see detail maps located in the summary.	Scenic	Scenic Recreation Geology Wildlife Cultural	17.1
Tenderfoot Creek	From FS boundary to Iron Mines Creek	Scenic	Recreation, Fish	21.5
South Fork Two Medicine River	Segment 1: From FS boundary to Box Creek Segment 2: From private land boundary to headwaters	Wild Wild	Scenery, Cultural	3.4 9.5
Badger Creek	From FS boundary to confluence with North and South Badger Creeks	Wild	Cultural Scenery	7.2
North Badger Creek	From confluence with main Badger and South Badger Creeks to headwaters	Wild	Fish Cultural	10.4
South Badger Creek	From confluence with main Badger and North Badger Creek to headwaters	Wild	Cultural	10.9
Lee Creek	From mouth to headwaters	Wild	Fish	4.6
Badger Cabin Creek	From mouth to headwaters	Wild	Fish	3.2
Red Poacher Creek	From confluence with North Badger Creek to headwaters	Wild	Fish	3.1
North Fork Birch Creek	From FS boundary to headwaters	Wild	Cultural, Scenery	7.8
Middle Fork Birch Creek	From confluence to the headwaters	Wild	Scenery, Cultural	5.2
South Fork Birch Creek	From FS boundary to headwaters	Wild	Scenery, Recreation, Fish, Wildlife, Cultural	9.8
North Fork Deep Creek	From FS boundary to headwaters	Wild	Scenery	5.3

Eligible river/river segment	Segment Description	Preliminary Classification	Outstanding Remarkable Value(s)	Miles
North Fork Teton River	Segment 1: From FS Boundary to road crossing above Elko Campground (bottom of box canyon) Segment 2: from road crossing to West Fork Campground (through the box canyon) Segment 3: from West Fork Campground to headwaters	Recreation Wild Scenic	Recreation Scenery Fish	5.5 4.1 7.6
Middle Fork North Fork Teton River	From the confluence with North Fork Teton River to headwaters.	Scenic	Fish	6.8
Waldron Creek	From the confluence with North Fork Teton River to headwaters	Recreational	Fish	4.3
North Fork Sun River	From wilderness boundary to the headwaters	Wild	Scenery, Recreation	26.2
South Fork Sun River	From wilderness boundary to headwaters	Wild	Recreation, Wildlife	26.2
West Fork South Fork Sun River	From mouth to junction with Ahorn Creek	Wild	Recreation, Wildlife	8.5
Green Fork Straight Creek	From mouth to headwaters	Wild	Scenery, Geology	5.9
Wood Creek	From below the dam on Wood Lake to the confluence with Straight Creek	Recreational	Wildlife	7.1
Dearborn River	From FS boundary to Whitetail Creek	Wild	Scenery	6.5
Swimming Woman Creek	From FS boundary to headwaters	Scenic	Scenery, Geology	3.9
East Fork Big Spring Creek	From south end of Section 33 to headwaters	Wild	Fish	5.3
Alice Creek	From FS boundary to headwaters	Recreational	Cultural	7.0
Copper Creek	From FS boundary to headwaters	Recreational	Fish	14.0
Landers Fork	From FS boundary to headwaters	Wild	Fish	18.8
Snowbank Creek	From confluence with Copper Creek to headwaters	Scenic	Fish	4.4
Total				**363.4**

3.23.12 Eligible wild and scenic rivers, environmental consequences

Effects common to all alternatives

Under all alternatives, the identified eligible WSRs (and area within ¼ mile on either side of each river) would be managed to protect their free-flowing condition and to preserve and enhance the outstandingly remarkable value(s) for which they were identified.

Effects common to all action alternatives

The plan components developed for eligible WSRs are based on FS policy and remain the same in all action alternatives. Table 241 summarizes the expected effects of each plan component related to eligible WSRs.

Table 241. Summary of proposed plan components for eligible WSRs

Plan component	Expected effects
FW-WSR-DC-01	This DC establishes that all eligible WSRs/river segments will retain their free-flowing condition and the outstandingly remarkable value for which they were identified.
FW-WSR-GDL-01	This guideline provides interim protection measure for the eligible WSRs and lands ¼ mile on either side of these rivers.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities related to watershed, soil, riparian, or aquatic habitat improvements would have a minor effect to eligible WSRs due to the protections already in place for these areas with interim protection measures (FW-WSR-STD-01).

East of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative. The standard for eligible WSR management defines a ¼ mile area on either side of the stream where interim protection measures apply; this area would encompass RMZs. Plan components for the management of RMZs are consistent with the interim protection measures.

Fire and fuels management

Natural, unplanned ignitions and prescribed fires are used as tools to maintain ecological conditions within river corridors. These fire and fuels management tools may remain so long as they maintain the outstandingly remarkable values and free flowing nature of the identified rivers. Plan components for fire and fuels management would encourage an appropriate management response to wildfires and provide opportunities for natural fire to promote and/or enhance the characteristics of these areas.

Timber and vegetation management

Eligible wild classified rivers are not suitable for timber production and timber harvest is not allowed. Therefore, there would be no effects from timber harvest on those segments. On eligible recreational or scenic classified rivers, timber production is not suitable but timber harvest is allowed for multiple-use purposes, for salvage logging, and to achieve desired vegetation conditions, so long as the outstandingly remarkable values of the river or river segment are not affected. Plan components related to desired vegetation would help define the objectives for any harvest treatments that could occur in these areas.

Livestock grazing and management

Livestock grazing is common on the HLC NF and may potentially affect the outstandingly remarkable values along eligible WSRs. Grazing, along with existing and new facilities necessary for grazing allotments, may remain so long as the outstandingly remarkable values and free flowing nature of the identified rivers is maintained.

While livestock grazing itself has the potential to degrade plant communities through factors such as invasive plant spread and damage to riparian areas, plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components should help protect eligible WSRs, to a greater degree with the action alternatives as compared to the no-action alternative.

Recreation and scenery management

Although eligible WSR corridors may be used for camping, canoeing, hiking, and other activities, the impacts are expected to remain at existing levels. In order to provide an essentially primitive character, eligible segments classified as wild generally would not have developed recreation sites. Dispersed camping and day-use sites may occur in river corridors. In segments classified as scenic or recreational, recreation development would be allowed when such sites would protect and maintain the outstandingly remarkable values for which the river was deemed eligible. Trail maintenance work can be expected to have little if any impact in the river corridors.

Cultural, historic, and tribal resource management

Plan components for cultural, historic, and tribal resources would complement the management of eligible WSRs.

Road access and infrastructure

Plan components for road access and infrastructure would help ensure that roads that may occur within eligible WSR corridors are maintained in a condition that protects the hydrological resources of those areas.

Minerals management

Eligible rivers with scenic or recreation classification areas are not withdrawn for mineral entry and are suitable for mineral exploration and development while protecting and maintaining the outstandingly remarkable values for which the river was identified. Eligible segments classified as wild would not be available for mineral material development upon designation.

Alternative A, no action

Under alternative A, the eligible WSRs would be managed under direction provided in the 1986 Helena and Lewis and Clark Forest Plans. Table 242 describes the plan components in the 1986 Helena and Lewis and Clark Forest Plans that provide direction for eligible WSRs.

Table 242. Summary of existing plan components for the eligible WSRs.

Plan component	Expected effects
1986 Helena NF Plan Goal 19, Page II/2	This goal provides direction to protect stream segments found eligible for classification under the Wild and Scenic Rivers Act until suitability studies are complete.
1986 Helena NF Plan Objective, Resource Activity/ Summaries Wild and Scenic Rivers, Page II/6	This objective lists the eligible stream segments identified in the 1989 eligibility study and provides direction to protect and/or maintain the outstandingly remarkable resource values and potential classification until suitability studies can be completed.
1986 Helena NF Plan Forest-wide Standards, Wild and Scenic Rivers, Page II/36	These forestwide standards provide direction for the following located on or adjacent to eligible WSRs: hydroelectric power, water supply, flood control, range, timber production, mining, road construction, motorized travel, utilities, recreation development, structures, and fisheries.
1986 Helena NF Plan; Implementation/Monitoring, Page IV/6	This forestwide monitoring requirement requires the monitoring of any action that would adversely impact eligible river qualifications or potential classifications.
1986 Lewis and Clark NF Plan Goal 11, Page 2-3	This goal protects the existing condition of the eligible WSRs, and maintains or enhances the outstandingly remarkable resource value(s) for each river while providing for public recreation and resource uses which do not adversely impact or degrade those values.
1986 Lewis and Clark NF Plan Objectives, Wild and Scenic Rivers, Page 2-9	This objective identifies the rivers that were found to be eligible in the 1989 eligibility study and provides interim direction to protect and/or maintain the

Plan component	Expected effects
	outstandingly remarkable resource values and potential classification until suitability studies can be completed.
1986 Lewis and Clark NF Plan Forest-wide Management Standards W-1, W-2, and W-3 Pages 2-75 through 2-81	These standards provide management direction for the following activities located on or adjacent to eligible WSRs: hydroelectric power, water supply, flood control, range, timber production, mining, road construction, motorized travel, utilities, recreation development, structures, and fisheries.

Alternatives B- E

See effects common to all alternatives.

Conclusions

Under all alternatives, the identified eligible WSRs would be managed to protect their free-flowing condition and to preserve and enhance the outstandingly remarkable value(s) for which they were identified. Alternative A would manage the eligible rivers as per the direction from the 1986 Helena and Lewis and Clark Forest Plans. These plans provide interim direction for the eligible streams and emphasize the need for suitability studies for these rivers.

Similar to alternative A, the plan components of alternatives B-E provide interim management direction for the identified eligible rivers. All of the action alternatives would meet the purpose and need because they are consistent with the 2012 Planning Rule and associated directives, which provides direction to complete an eligible WSR study on all free flowing streams when conducting a forest plan revision.

3.23.13 Continental Divide National Scenic Trail, affected environment

Approximately 273 miles of the Continental Divide National Scenic Trail are located on the HLC NF (Table 243). An estimated 65 miles of the trail is located within the Upper Blackfoot GA, approximately 68 miles are located within the Divide GA, and approximately 140 miles are located within the Rocky Mountain GA.

Table 243. Continental Divide National Scenic Trail segments

Trail Name	Trail #	GA	County	Miles
Continental Divide	337	Divide	Lewis and Clark	68
Two-Med-Heart Butte	101	Rocky Mountain Range	Pondera	4
North Fork Badger	103	Rocky Mountain Range	Pondera	1
North Fork Sun	110	Rocky Mountain Range	Teton	4
Rock Creek	111	Rocky Mountain Range	Lewis and Clark	12
Open Fork	116	Rocky Mountain Range	Lewis and Clark	6
North Fork Red Shale	130	Rocky Mountain Range	Lewis and Clark	7
Summit Campground Cutoff	133	Rocky Mountain Range	Glacier	2
Elk Calf Mountain	137	Rocky Mountain Range	Glacier and Pondera	10
Lee Creek-Sidney Creek	141	Rocky Mountain Range	Pondera	5
Kip Creek	142	Rocky Mountain Range	Pondera	3
Elbow Creek	145	Rocky Mountain Range	Pondera	4
Muskrat Creek	147	Rocky Mountain Range	Pondera	7
North Wall	174	Rocky Mountain Range	Lewis and Clark	11
Wall Trail	175	Rocky Mountain Range	Lewis and Clark	6

Trail Name	Trail #	GA	County	Miles
My Lake	194	Rocky Mountain Range	Lewis and Clark	4
South Fork Sun	202	Rocky Mountain Range	Lewis and Clark	13
West Fork Sun	203	Rocky Mountain Range	Lewis and Clark	16
Dearborn River	206	Rocky Mountain Range	Lewis and Clark	9
Blacktail-Landers Fork	207	Rocky Mountain Range	Lewis and Clark	3
Straight Creek	212	Rocky Mountain Range	Lewis and Clark	10
Elbow Pass	248	Rocky Mountain Range	Lewis and Clark	3
Continental Divide National Scenic Trail	440	Upper Blackfoot	Lewis and Clark	65
Total				273

3.23.14 Continental Divide National Scenic Trail, environmental consequences

Effects common to all alternatives

All of the alternatives would continue to manage the trail as outlined in the 2009 Continental Divide National Scenic Trail Comprehensive Management Plan. Additionally, all alternatives carry forward the need for rehabilitation of any impacted sites along the trail, education and interpretation along the trail, and implementation of Continental Divide National Scenic Trail management plans.

Effects common to all action alternatives

The portions of the Continental Divide Trail on the Rocky Mountain Range GA are located within the Bob Marshall and the Scapegoat Wilderness areas. Natural ecological processes and disturbance would continue to be the primary forces affecting the composition, structure, and patterns of vegetation in these areas. The primitive recreation opportunity setting with wilderness would ensure the trail is managed for a primitive experience.

The remainder of the Continental Divide Trial is located within the Divide and Upper Blackfoot GAs. In these GAs, the trail passes though undeveloped areas as well as areas where timber management, road building, and mining have historically been present. As the trail corridor is managed according to the plan components, the visual effects of these past activities would continue to fade.

Plan components developed for the Continental Divide National Scenic Trail remain the same in all action alternatives. Table 244 summarizes the expected effects of each of these plan components.

Table 244. Summary of proposed plan components for the Continental Divide National Scenic Trail

Plan component	Expected effects
FW-CDNST-DC-01	This DC ensures that the Continental Divide National Scenic Trail provides high-quality primitive and/or semi-primitive hiking and horseback riding opportunities and other compatible non-motorized activities, in a highly scenic setting along the Continental Divide. The significant scenic, natural, historic, and cultural resources along the trail corridor are conserved. The trail provides users with expansive views of the surrounding landscapes.
FW-CDNST-DC-02	This DC ensures that foreground views, up to ½ mile either side of the trail, are natural-appearing and generally appear unaltered by human activities. Middleground and background views consider the effects on scenic integrity and trail experience as seen from trail segments.

Plan component	Expected effects
FW-CDNST-DC-03	This DC ensures that the trail corridor provides primitive and/or semi-primitive non-motorized ROS settings. The trail may pass through more developed settings to provide a continuous route.
FW-CDNST-DC-04	This DC ensures a variety of access points along the trail.
FW-CDNST-DC-05	User conflicts along the trail are managed so that they are infrequent.
FW-CDNST-DC-06	This DC ensures that the trail is maintained, signed, and passable and that alternate routes are established when portions of the trail are temporarily closed due to natural events or for public safety purposes.
FW-CDNST-DC-07	Interpretation along the trail enhances visitor experiences and increases awareness of the cultural and historic features along the trail.
FW-CDNST-GO-01	This component promotes working collaboratively with partners, volunteers, communities, and federal, tribal, and state land and wildlife managers to conserve the valuable natural, wild land, scenic, historic and cultural resources along the trail.
FW-CDNST-OBJ-01	This objective works to maintain the entire length of the trail and to reroute selected portions in order to improve scenic viewing opportunities, reconstruct trail to standard, and/or provide nonmotorized experiences.
FW-CDNST-STD-01; 02	These STDs prohibit surface occupancy for oil and gas or geothermal energy leasing activities and common variety mineral extraction within the Continental Divide National Scenic Trail corridor.
FW-CDNST-STD-03	This STD prohibits new motorized recreation events on the trail, thereby supporting the primitive and semi-primitive settings along the trail, but does provide for exceptions in sections that are currently along motorized routes.
FW-CDNST-GDL-01	This guideline provides direction for the retaining or promoting the primitive and/or semi-primitive non-motorized ROS settings along the trail.
FW-CDNST-GDL-02; 03; and 06	These GDLs protect and enhance the scenic quality of the Continental Divide National Scenic Trail by being consistent or making progress toward achieving the SIOs of high and/or very high within the foreground of the trail (up to 1/2 mile either side of the trail).
FW-CDNST-GDL-04	This GDL ensures that the Continental Divide National Scenic Trail is not located onto routes open to motorized recreation uses.
FW-CDNST-GDL-05; 07	These GDLs promote natural-appearing settings by providing direction for minimal facility development along the trail and by ensuring that linear utilities and rights-of-way are limited to a single crossing of the trail unless additional crossings are documented as the only prudent and feasible alternative.
FW-CDNST-GDL-08	This GDL provides direction for the construction of new or temporary roads or motorized trails across or adjacent to the trail.
FW-CDNST-GDL-09	This GDL restricts the use of the trail as a landing or temporary road during vegetative management activities and limits the hauling or skidding of logs along or across the Continental Divide National Scenic Trail.
FW-CDNST-GDL-10	This GDL ensures that minimum fire suppression tactics are used with unplanned fires in the foreground (up to ½ mile either side) of the trail.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities related to aquatic ecosystems and soil management would generally have little effect to the Continental Divide National Scenic Trail, because the trail most often follows ridgetops rather than stream bottoms. Where the trail does cross or parallel streams, plan components related to RMZs would help maintain the scenic quality of those areas, and therefore complement the management of the trail.

East of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which

SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur near the Continental Divide National Scenic Trail, and provide opportunities for natural fire to alter the vegetation condition of the landscape. When fire does occur, whether natural or management-ignited, it could change the scenery visible from the trail, including charred vegetation in the short term as well as re-growth in the longer term. Fire on the landscape would generally complement the scenic quality objectives for the trail. Plan components are in place to ensure that minimum impact suppression tactics or other tactics appropriate for the protection of the trail values are used.

Timber and vegetation management

Many stretches of the trail lie within designated wilderness, where timber harvest is prohibited. Other stretches are in inventoried roadless, where timber harvest is largely constrained. However, some stretches of this trail are located in areas where harvest could occur, including both areas that are suitable for timber production and those unsuitable for timber production where harvest can occur for other purposes. Alternative D would have the least amount of overlap with the trail corridor in both lands suitable for timber production and unsuitable lands where harvest could occur for other purposes, largely as a function of RWAs. Alternative A has the most overlap of lands suitable for timber production, while alternative E has the most overlap of unsuitable lands where harvest may occur for other purposes.

Where harvest does occur, it could impact the scenic values visible from the trail, including more open vegetation and stumps, as well as soil disturbance in the short term. Conversely, harvest could be used to improve the scenic quality by creating vistas, mimic vegetation structures that would be created by natural disturbance, and promote healthy vegetation. Vegetation plan components would help define the objectives for treatments that may occur near the trail. In addition to harvest, plan components would allow for other vegetation treatments such as tree planting and weed spraying, which could further enhance the scenic quality of the trail.

While harvest could have the potential to degrade the scenic quality along the trail, such effects are unlikely to occur because of plan components to maintain a high or very high SIO within ½ mile of either side of the trail (FW-CDNST-GDL-02, 03). Guidelines also limit harvest-related activities such as temporary roads, skidding, hauling, and log landings (FW-CDNST-GDL-08, 09, 10).

Livestock grazing and management

Livestock grazing allotments could occur along or in proximity to the trail; therefore, plan components for livestock grazing would have an effect. Evidence of grazing, including cows, cow patties, grazed vegetation, and weeds could occur. However, plan components for livestock grazing emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components should help protect the scenic quality of the trail, to a greater degree with the action alternatives as compared to the no-action alternative.

Recreation and scenery management

Recreation and scenery management plan components would complement the management of the Continental Divide National Scenic trail by specifying ROS settings (primitive and semi-primitive nonmotorized) and scenic quality objectives (high or very high) that are consistent with maintaining or moving toward the desired conditions of the trail, along with providing the facilities and infrastructure (such as signs) needed for the public to access and use the trail system.

Cultural, historic, and tribal resource management

Plan components for cultural, historic, and tribal resources would complement the management of the Continental Divide National Scenic Trail.

Road access and infrastructure

Plan components for the Continental Divide National Scenic Trail include objectives and guidelines that encourage nonmotorized use. To the extent that the trail itself or motorized routes in proximity to the trail may be maintained, reconstructed, or relocated, the plan components for access and infrastructure would ensure that this work is done in a manner that has minimal impacts to other resources. These components would therefore complement the management of the trail.

Minerals management

Plan components for minerals management would have little to no effect on the Continental Divide National Scenic Trail, because components are in place that preclude surface occupancy and common variety mineral extraction within the trail corridor.

Alternative A, no action

Under alternative A, the Continental Divide National Scenic Trail would continue to be managed under direction provided in the 1986 Helena and Lewis and Clark Forest Plans. Additionally, the 2009 Continental Divide National Scenic Trail Comprehensive Management Plan and FS Handbook direction, would continue to provide management guidance for the trail.

Table 245 describes the plan components in the 1986 plans that provide direction for the Continental Divide National Scenic Trail.

Table 245. Summary of existing plan components for the Continental Divide National Scenic Trail.

Plan component	Expected effects
1986 Helena NF Plan Forest-wide Standard, Recreation 4, Page II/15	This standard defers to the direction provided in the 2009 Comprehensive Management Plan for the Continental Divide National Scenic Trail.
1986 Helena NF Plan Forest-wide Standard, Visual 1, Page II/15	The visual quality along the Continental Divide National Scenic trail will be the same as those identified for the management areas through which the trail passes.
1986 Helena NF Plan Management Areas H-1 and H-2, Pages III/17 and III/20	Mentions Continental Divide National Scenic Trail but does not provide any trail-specific direction.
1986 Lewis and Clark NF Plan, Forest-wide Management Standard L-3 (1) and (2), Page 2-65	(1) These standards refer to the management direction along the trail provided in the National Trails System Act. (2) The management of the trail will be done in coordination with the Glacier National Park, especially in regard to developments along Marias Pass.
Lewis and Clark NF Management Area P, Page 3-83	This management area provides direction for the Continental Divide National Scenic Trail in the Bob Marshall and Scapegoat wilderness areas. The specific route locations were identified once the 2009 Comprehensive Management Plan was developed. Individual inquiries regarding the trail would be handled on a case-by-case basis and an assigned trail coordinator would be responsible for any inquiries.

Alternatives B- E

See Effects common to all action alternatives, above.

Conclusions

In alternative A, the no-action alternative, the Continental Divide National Scenic Trail would continue to be managed as per guidance found in the 1986 Helena and Lewis and Clark NF Plans, the Continental Divide National Scenic Trail Act of 1978, the 2009 Continental Divide National Scenic Trail Comprehensive Management Plan, and FS Handbook direction. In the 1986 Helena NF Plan, the visual quality along the trail would be the same as the visual quality identified for the management areas through which the trail passes.

Alternatives B-E would meet the purpose and need by providing specific plan components for the Continental Divide National Scenic Trail. These plan components would remain the same in all action alternatives and support the scenic trail legislation and the 2009 Comprehensive Management Plan by establishing guidance and direction for the trail within the Forest Plan. The visual quality along the trails would be consistent with or make progress toward achieving the SIOs of high and/or very high within the foreground of the trail (up to 1/2 mile either side of the trail).

3.23.15 Lewis and Clark National Historic Trail, affected environment

Approximately 12.9 miles of the 3,700 mile long trail are located on the HLC NF. Recreation sites within the plan area that specifically tie to the Lewis and Clark National Historic Trail include the Lewis and Clark National Historic Trail Interpretive Center in Great Falls, Montana, as well as Lewis and Clark Pass in Alice Creek in the Upper Blackfoot GA, and Meriwether Day Use site within the Big Belts GA.

3.23.16 Lewis and Clark National Historic Trail, environmental consequences

Effects common to all alternatives

Since the trail is established by law, all of the alternatives would continue to manage the trail as outlined in that legislation. Additionally, all alternatives would carry forward the need for continued education and interpretation along the trail and the need to work with partner groups.

Effects common to all action alternatives

Plan components developed for the Lewis and Clark National Historic Trail remain the same in all action alternatives. Table 246 summarizes the expected effects of each of these plan components.

Table 246. Summary of proposed plan components for the Lewis and Clark National Historic Trail

Plan component	Expected effects
FW-LCNHT-DC-01	This DC promotes the opportunity to for forest visitors to learn about the 1805-1806 journey of the Lewis and Clark Expedition through the HLC NF.
FW-LCNHT-DC-02	This DC ensures that the Lewis and Clark National Historic Trail is clearly marked and identified.
FW-LCNHT-DC-03	This DC provides direction for the accuracy and delivery of interpretive and education themes along the Lewis and Clark National Historic Trail.
FW-LCNHT-GO-01	This plan component promotes working collaboratively with partners and volunteers to maintain the trail and deliver accurate and quality education and interpretation along the Lewis and Clark National Historic Trail.
FW-LCNHT-STD-01	This STD ensures that new sites and cultural landscapes along the Lewis and Clark National Historic Trail are documented and evaluated for nomination and inclusion in the National Register of Historic Places.
FW-LCNHT-GDL-01	This GDL provides direction for the protection of the natural and cultural resources along the Lewis and Clark National Historic Trail.

Plan component	Expected effects
FW-LCNHT-GDL-02	This GDL provides direction for the protection of scenic quality along the trail. This guidance would provide a consistent approach to the management of scenery.
FW-LCNHT-SUIT-01	This plan component provides for the suitability of timber production. Specifically, lands along the Lewis and Clark National Historic Trail are not suitable for timber production. However, timber harvest may be used to provide for public safety and enhancing the scenic and recreation values along the trail.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and activities related to aquatic ecosystems and soil management would generally have little effect to the Lewis and Clark National Historic Trail. Where the trail crosses or parallel streams, plan components related to RMZs would help maintain the scenic quality of those areas, and therefore complement the management of the trail.

East of the Continental Divide (the majority of the HLC NF), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur near the Lewis and Clark National Historic Trail, and provide opportunities for natural fire to alter the vegetation condition of the landscape. When fire does occur, whether natural or management-ignited, it could change the scenery visible from the trail, including charred vegetation in the short term as well as re-growth in the longer term. Fire on the landscape would generally complement the scenic quality objectives for the trail.

Timber and vegetation management

Relatively little of the Lewis and Clark National Historic Trail lies on NFS lands within HLC NF, and for the most part it is within or adjacent to designated wilderness areas. Further, plan components are in place stating that areas within ¼ mile of the trail are unsuitable for timber production. Therefore, plan components associated with timber harvest and vegetation management would have little effect to the management of the trail. Timber harvest could be visible in the distance from some parts of the trail. While harvest could have the potential to degrade scenic quality, such effects are unlikely to occur because of plan components to maintain a high or very high SIO.

Livestock grazing and management

Livestock grazing allotments could occur along or in proximity to the trail. Evidence of grazing, including cows, cow patties, grazed vegetation, and weeds could occur. However, plan components for livestock grazing emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components should help protect the scenic quality of the trail, to a greater degree with the action alternatives as compared to the no-action alternative.

Recreation and scenery management

Recreation and scenery management plan components would complement the management of the Lewis and Clark National Historic trail by specifying ROS settings and scenic quality objectives that are consistent with maintaining or moving toward the desired conditions of the trail, along with providing the facilities and infrastructure (such as signs) needed for the public to access and use the trail system.

Cultural, historic, and tribal resource management

Plan components for cultural, historic, and tribal resources would complement the management of the Lewis and Clark National Historic Trail by further protecting the resources that are integral to the value and purpose of the trail.

Road access and infrastructure

The Lewis and Clark National Historic Trail generally lies in nonmotorized areas. To the extent that routes in proximity to the trail may be maintained, reconstructed, or relocated, the plan components for access and infrastructure would ensure that this work is done in a manner that has minimal impacts to other resources. These components would therefore complement the management of the trail.

Minerals management

Areas along the Lewis and Clark National Historic Trail may be discretionarily unavailable for mineral leasing and saleable mineral activity but still open to locatable mineral prospecting, exploration, and development.

Alternative A, no action

In the no-action alternative, the Lewis and Clark National Historic trail would continue to be managed as per guidance under the National Parks and Recreation Act of 1978 and the direction provided for this trail in the 1986 Helena Forest Plans. The 1986 Lewis and Clark Forest Plan does not make any mention of the Lewis and Clark National Historic Trail as most of the route is located off-forest in the Lewis and Clark portion of the HLC NF. Table 247 describes the plan components in the 1986 Helena Forest Plans that provide direction for the Lewis and Clark National Historic Trail.

Table 247. Summary of existing plan components for the Lewis and Clark National Historic Trail

Plan component	Expected effects
1986 Helena NF Plan Goals 1 and 2, Page II/1	These plan components provides for a range of outdoor recreation opportunities, including motorized and non-motorized recreation opportunities.
1986 Helena NF Plan, Forest-wide Standards, Cultural Resources, Page II/16	Provides direction for minimal disturbance along the Lewis and Clark National Historic Trail and interpretive sites during normal management practices.
1986 Helena NF Plan appendix B, Sensitive Viewing Areas, Page B/1	The Missouri River is identified as a Sensitivity Level 1 viewpoint and would be managed for the Retention Visual Quality Objectives in the foreground and Partial Retention Visual Quality Objectives in the middleground and background viewing distances.

Alternative B-E

See effects common to all action alternatives, above.

Conclusions

In alternative A, the no-action alternative, the Lewis and Clark National Historic Trail would continue to be managed as per guidance found in the National Parks and Recreation Act of 1978 and the 1986 Helena Forest Plan. The 1986 Lewis and Clark Forest Plan does not make any mention of the Lewis and Clark National Historic Trail as most of the route is located off-forest in the Lewis and Clark portion of the HLC NF. Alternatives B-E meet the purpose and need by providing plan components for the Lewis and Clark National Historic Trail. These plan components would remain the same in all action alternatives and support the National Parks and Recreation Act of 1978 by establishing guidance and direction for the trail within the Forest Plan.

3.23.17 Lewis and Clark National Historic Trail Interpretive Center, affected environment

The Lewis and Clark Interpretive Center, which opened its doors to the public on May 5, 1998. The building is approximately 25,000 square feet and includes a 158 seat theater, a 6000 square foot exhibit hall, and a 1500 square foot resource center that is used for education programming, training center, and reception area. It was established to further the public's understanding and provide appropriate interpretation of the scope and accomplishments of the Lewis and Clark Expedition, within the State of Montana and along the Lewis and Clark National Historic Trail. As an economic driver and top rated attraction, the Lewis and Clark Interpretive Center serves not only Great Falls, but the community at large by educating visitors to the Great Falls area and the HLC NF. It also continues to be a resource for providing school programs to schools throughout Montana.

3.23.18 Lewis and Clark National Historic Trail Interpretive Center, environmental consequences

Effects common to all alternatives

Since the Lewis and Clark National Historic Trail Interpretive Center was established by public law, all of the alternatives would continue to manage the center as outlined in that legislation. Additionally, all alternatives would carry forward the need for continued education and interpretation at the interpretive center and the need and desire to work with partner groups to strengthen those interpretive and educational messages. These activities are common to all alternatives.

Effects common to all action alternatives

The plan components developed for the Lewis and Clark National Historic Trail Interpretive Center remain the same in all action alternatives. Table 248 summarizes the expected effects of each plan component related to the interpretive center.

Table 248. Summary of proposed plan components for the Lewis and Clark National Historic Trail Interpretive Center

Plan component	Expected effects
FW-LCIC-DC-01; 02; 03	These desired conditions provide direction for the interpretive and education themes and exhibits at the Lewis and Clark Interpretive Center.
FW-LCIC-GO-01	This component promotes working collaboratively with partners and volunteers to operate, maintain, and deliver education and interpretation at the Lewis and Clark Interpretive Center.
FW-LCIC-GO-02	This goal focuses on the economic contributions of the Lewis and Clark Interpretive Center to the local community and the State of Montana.

Effects from forest plan components associated with:

Forest plan components associated with other resource management such as aquatic resources, soil, fire and fuels, timber and vegetation management, livestock grazing, wildlife management, recreation and scenery, cultural and historic resources, and road access and infrastructure would not have an effect to the Lewis and Clark National Historic Trail Interpretive Center due to its location.

Minerals Management

While the land that the Lewis and Clark National Historic Trail Interpretive Center is located on have not been withdrawn from mineral entry, it is not likely that this area would be affected by future minerals management.

Alternative A, no action

In the no-action alternative, the Lewis and Clark National Historic Trail Interpretive Center would continue to be managed as per guidance under Public Law 100-552 and the general direction provided in the 1986 Lewis and Clark NF Plan. There is no specific direction for the interpretive center provided by the 1986 Lewis and Clark Forest Plan. Table 249 describes the goals in the 1986 Lewis and Clark Forest Plan that provide general direction for the Lewis and Clark National Historic Trail Interpretive Center.

Table 249. Summary of existing 1986 Forest Plan goals that provide general direction for the Lewis and Clark National Historic Trail Interpretive Center

Plan component	Expected effects
1986 Lewis and Clark NF Plan Goals 8 and 9, Page 2-2	Goals 8 and 9 mention the development of closer ties with local communities, governments, local Indian tribes, individuals and private groups for continued resource management and economic development.
1986 Lewis and Clark NF Plan Goal 10, Page 2-3	Goal 10 recognizes the need for public education programs in all FS planning to develop cooperative and mutually supportive relationships that will benefit both community and agency futures.

Alternative B-E

See effects common to all action alternatives, above.

Conclusions

In alternative A, the Lewis and Clark National Historic Trail Interpretive Center would continue to be managed as per guidance under Public Law 100-552 and the general direction provided in the 1986 Lewis and Clark NF Plan. There is no specific direction for the interpretive center provided by the 1986 Lewis and Clark Forest Plan. Alternatives B-E meet the purpose and need by providing plan components for the Lewis and Clark National Historic Trail Interpretive Center. These plan components remain the same in all action alternatives and support Public Law 100-552 by establishing specific guidance and direction for the interpretive center within the Forest Plan.

3.23.19 Rocky Mountain Front Conservation Management Area, affected environment

On December 19, 2014, President Obama signed into effect Public Law 113-291. Language within this law established the Rocky Mountain Front Conservation Management Area. The conservation management area includes approximately 195,073 acres of NFS lands and approximately 13,087 acres of federal land managed by the BLM. Under Public Law 113-291, the purpose for the conservation management area is to "conserve, protect, and enhance for the benefit and enjoyment of present and future generations the recreational, scenic, historical, cultural, fish, wildlife, roadless, and ecological values of the Conservation Management Area". The law also directs the management of motorized vehicles on roads and trails, decommissioning of temporary roads, grazing, vegetation management, noxious weed management, and nonmotorized recreation opportunities.

3.23.20 Rocky Mountain Front Conservation Management Area, environmental consequences

Effects common to all alternatives

Since the conservation management area is established by Public Law 113-291, all of the alternatives would continue to manage the area as outlined in that legislation. There is currently no direction provided for this area in the 1986 Lewis and Clark NF Plan.

Effects common to all action alternatives

The plan components developed for the conservation management area remain the same in all action alternatives. Table 250 summarizes the expected effects of each plan component related to the conservation management area.

Table 250. Summary of proposed plan components for the Rocky Mountain Front Conservation Management Area

Plan component	Expected effects
FW-CMA-DC-01	This DC ensures the conservation management area conserves, protects, and enhances the recreational, scenic, historic, cultural, fish, wildlife, roadless, and ecological values of the area for the benefit and enjoyment of present and future generations.
FW-CMA-DC-02	This DC provides direction for the management of vegetation for the public health and safety, ROS settings and user experiences, enhanced scenic values, and the protection of facilities and infrastructure.
FW-CMA-DC-03	This DC provides access to non-motorized trail opportunities in primitive and semi-primitive ROS settings.
FW-CMA-STD-01; 02	These STD provide direction for the construction of new or temporary roads, and the restoration of these roads after vegetation management along these roads has occurred.
FW-CMA-GDL-01	This GDL provides for the control, prevention, and eradication of invasive species with the conservation management area.
FW-CMA-SUIT-01	This plan component provides for the suitability of timber production. Specifically, lands within the conservation management area are not suitable for timber production. However, timber harvest may be used to meet other resource objectives.
FW-CMA-SUIT-02	This suitability plan component allows for grazing to continue within conservation management areas on the forest.

Effects from forest plan components associated with:

Aquatic ecosystems and soil management

Plan components and management activities for aquatic ecosystems and soil management would complement the overall management of the Rocky Mountain Front Conservation Management Areas by promoting the ecological integrity of watersheds, soil, and aquatic habitats.

East of the Continental Divide (where the conservation management area occurs), RMZs would be adopted and result in more acres being subject to riparian area plan components as compared to the no-action alternative, in which SMZs would be used. Potential vegetation treatments such as prescribed fire that may occur in the conservation management area may be limited within RMZs, or modified to comply with plan components for those areas. The area on which these components apply is greater with the action alternatives than with the no-action alternative.

Fire and fuels management

Plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur within the conservation management area, and provide opportunities for natural fire to promote the desired condition.

Timber and vegetation management

The Rocky Mountain Front Conservation Management Area is unsuitable for timber production. Timber harvest could occur for other purposes, although opportunities would be limited due to other regulations such as those specified for IRAs. Where it does occur, harvest may be used to help meet the desired conditions for the area, including enhancing public health and safety, scenic values, and protecting facilities and infrastructure (for example, mitigating hazardous fuels). Plan components for harvest would ensure that it is conducted in a manner that protects other resources. Plan components related to desired vegetation conditions could influence whether harvest or other treatments (such as management-ignited fires) are conducted, and help define the objectives for those treatments.

Livestock grazing and management

The plan components for the action alternatives allow for livestock grazing. While livestock grazing itself has the potential to degrade plant communities through factors such as invasive plant spread and damage to riparian areas, plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. These components should help protect the ecological values of the conservation management area, to a greater degree with the action alternatives as compared to the no-action alternative.

Recreation and scenery management

Plan components for recreation settings, opportunities, and access along with scenery management would complement the management of the Rocky Mountain Front Conservation Management area.

Cultural, historic, and tribal resource management

Plan components related to cultural, historic, and tribal resource would complement the management of the Rocky Mountain Front Conservation Management area.

Road Access and infrastructure

New or temporary road construction within the Rocky Mountain Front Conservation Management area would generally not occur, with a few specific exceptions (RM-CMA-STD-01). To the extent that re-location, decommissioning, or road construction occurs, the plan components for road access and infrastructure would ensure that other resource values are protected.

Minerals management

In 2006, Public Law 109-432 withdrew the lands in the Rocky Mountain Range GA from mineral entry. The conservation management areas fall within these lands that have been withdrawn. Mineral activities may still occur within the areas that have been withdrawn as long as a proponent has demonstrated they have a valid existing right.

Alternative A, no action

In the no-action alternative, the conservation management area would continue to be managed as per guidance under Public Law 113-291. There is currently no direction provided for this area in the 1986 Lewis and Clark NF Plan.

Alternative B-E

See effects common to all action alternatives, above.

Conclusions

In alternative A, the conservation management area would continue to be managed as per guidance under Public Law 113-291. There is currently no direction provided for the conservation management area in the 1986 Lewis and Clark NF Plan. Alternatives B-E would meet the purpose and need by providing plan components for the conservation management area. These plan components would remain the same in all action alternatives and support the legislation by establishing guidance and direction for the conservation management area within the forest plan.

3.24 Cultural, Historical, and Tribal Resources

3.24.1 Introduction

Cultural and historical resources

Cultural resources are defined by the National Historic Preservation Act and by FS Manual 2200, section 2360, as objects or definite locations of human activity, occupation, or use identifiable through field survey, historical documentation, or oral evidence. Cultural resources can be prehistoric, historic, or archaeological sites, structures, places, or objects and traditional cultural properties.

Areas of tribal importance

The FS has obligations under the American Indian Religious Freedom Act of 1978 to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian (Public Law 95-341). Executive Order 13007 of 1996 further directs federal agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and to avoid adversely affecting such sites. Consultation with recognized tribal governments is further defined and required by the Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601), the 1992 amendments to the National Historic Preservation Act, and the 1999 revisions to the implementing regulations in 36 CFR Part 800; Protection of Historic Properties. These obligations are applicable to all management actions no matter where they occur on the forest.

Indicators

Key indicators used to measure the effects of alternatives are:

- Potential ground disturbance: management activities and natural disturbances can both pose a threat to sacred sites and other cultural and historical resources.
- Ease of access: the ability to access sacred sites is important to local Tribes. At the same time, greater access to some cultural and historical resources could lead to detrimental effects such as vandalism and looting.

These measurement indicators were identified and defined through consultation with Tribes. Consultation provides the opportunity for Tribes to identify potential effects to tribal interests, including to native knowledge, tribally affiliated cultural resources, sacred sites, treaty rights, and religious freedom. Ground disturbance is a key consideration for effects, as ground disturbance may negatively impact sacred sites and areas. These impacts can be further exacerbated by interactions with fire, weather events, human actions, and environmental change. Access to sacred areas to exercise religious ceremonies and freedoms is another key consideration for effects. Management actions that change access could either beneficially or negatively impact the exercise of treaty rights and expression of religious freedom.

3.24.2 Regulatory framework

Laws and executive orders

Historic Sites Act of 1935 (16 USC 461-467) declares that is it a national policy to preserve for public use historic sites, buildings, and objects of national significance for the benefit of the people of the U.S.

National Historic Preservation Act of 1966 (public laws 89-665, as amended, 91-243, 94-422, 94-458 and 96-515) establishes a program for the preservation of historic properties throughout the United States. It created the National Register of Historic Places, State Historic Preservation Offices and the Section 106 review process.

- **Section 106** requires each agency to take into account the effects of its actions on historic properties, prior to approving expenditure of federal funds on an undertaking or prior to issuing any license. Furthermore, an agency must afford the Advisory Council on Historic Preservation (an independent federal agency created by the National Historic Preservation Act) an opportunity to comment on any of the agency's undertaking that could affect historic properties.
- **Section 101(a) (8)** gives the Secretary of Interior the responsibility and authority to assess "significant threats" to properties included in, or eligible for inclusion in, the National Register in order to: determine the kinds of properties that may be threatened, ascertain the causes of the threats, and develop and submit to the President and Congress recommendations for appropriate action.
- **Section 110 (a) (2) (A)** directs federal agencies to establish "a preservation program for the identification, evaluation, and nomination to the National Register of Historic Places, and protection of historic properties" to "ensure that such properties under the jurisdiction or control of the agency are identified, evaluated, and nominated to the National Register." This requires development of a schedule for the identification, evaluation, and nomination of unrecorded sites.
- **Section 111** encourages Federal Agencies to out-lease historic properties and retain the proceeds to fund preservation activities. If an agency determines the historic real property isn't needed for current or projected agency purposes, under National Historic Preservation Act Section 111, they may lease (or exchange with comparable historic property) the property with any person or organization, if the agency determines that the lease or exchange will adequately ensure the preservation of the historic property.
- **Section 470ii** (c) states that "Each federal land manager shall establish a program to increase public awareness of the significance of the archaeological resources located on public lands and Indian lands and the need to protect such resources." It further directs that an annual report of such progress will be submitted to Congress.
- **Section 470mm** directs federal agencies to:
    - Develop plans for surveying lands under their control to determine the nature and extent of archaeological resources on those lands;
    - Prepare a schedule for surveying lands that are likely to contain the most scientifically valuable archaeological resources; and
    - Develop documents for the report of suspected violations of this act and establish when and how those documents are to be completed by officers, employees, and agents of their respective agencies.
- **Subdivision 1, Chapter 3001** directs the federal government to assist in the establishment of preservation programs on Indian lands. This directive emphasizes the use of partnerships to expand and accelerate preservation programs.

Archaeological Resources Protection Act of 1979 (Public Law 96-95) and Regulations 43 CFR Part 7 establish a permit process for the management of cultural sites on federal lands which provides for consultation with affected tribal governments.

Archaeological and Historic Preservation Act of 1974 (16 USC 469) amends the 1960 Reservoir Salvage Act by providing for the preservation of significant scientific, prehistoric, historic and archaeological materials and data that might be lost or destroyed as a result of flooding, the construction of access roads, relocation of railroads and highways, or any other federally funded activity that is associated with the construction of a dam or reservoir.

Native American Graves Protection and Repatriation Act of 1990 (public law 101-601, 25 United States Code 3001-3013) **and Regulations 43 CFR Part 10** addresses the rights of lineal descendants and members of Indian tribes and Alaska Native and native Hawaiian organizations to certain human remains and precisely defined cultural items. It covers items currently in federal repositories as well as future discoveries. The law requires federal agencies and museums to provide an inventory and summary of human remains and associative funerary objects. The law also provides for criminal penalties in the illegal trafficking in Native American human remains and cultural items.

Executive Order 12866 of 1993, Regulatory Planning and Review: Enhances planning and coordination with respect to both new and existing regulations. Makes process more accessible and open to the public. Agencies shall seek views of tribal officials before imposing regulatory requirements that might affect them.

Executive Order 13287 of 2003, Preserve America reinforces the federal government policy for "protection and enhancement of America's historic treasures, and to recognize and treat cultural resources as assets. Federal agencies shall advance this policy through the protection of, continued use of, and reinvestment in, the federal government's historic buildings and sites and by conforming to the highest standards of care for, and consideration of, the unique cultural heritage of communities, and of the Nation." Each agency is directed to: (a) review its regulations, management policies, and general operating procedures for compliance with Section 110 of the National Historic Preservation Act, and (b) develop annual goals and measures as part of their compliance with the Government Performance and Results Act (P.L. 103-62) and report annually on the protection of historic and archeological properties within its care. The order also encourages the formation of partnerships with Indian tribes, state and local governments, and the private sector to promote public understanding of the preservation and use of historic properties.

Executive Order 13007 of 1996, Indian Sacred Sites directs federal agencies to, to the extent practicable, accommodate access to and ceremonial use of sacred sites by Indian religious practitioners while avoiding adversely affecting the sites and maintaining the confidentiality of the sites.

Executive Order 12898 of 1994: Environmental Justice in Minority Populations and Low- Income Populations directs federal agencies to focus on the human health and environmental conditions in minority and low-income communities, especially in instances where decisions may adversely impact these populations.

Executive Order 13175 of 2000, Consultation and Coordination with Indian Tribal Governments: Provides direction for consultation with tribal governments for formulating or implementing policies that have tribal implications. Also provides direction regarding consultation and coordination with Indian Tribes relative to fee waivers. Calls upon agencies to use a flexible policy with tribes in cases where proposed waivers are consistent with applicable federal policy objectives. It directs agencies to grant waivers in areas where the agency has the discretion to do so, when a tribal government makes a request. When a request is denied, the agency must respond to the tribe in writing with the rationale for denial.

Executive Order 11593 of 1971, Protection and Enhancement of the Cultural Environment, states that the federal government will provide leadership on preserving, restoring, and maintaining the historic and cultural environment of the Nation. It directs federal agencies through federal plans and programs to preserve cultural resources and contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historic, architectural, or archaeological significance. It orders federal agencies to locate, inventory, and nominate to the National Register all properties under their control or jurisdiction that meets the criteria for nomination. It also directs federal agencies to exercise caution during the interim period to ensure cultural resources under their control are not inadvertently damaged, destroyed, or transferred.

American Indian Religious Freedom Act of 1978 (Public Law 95-341 as amended and Public Law 103-344): The Act states that "...it shall be the policy of the United States to protect and preserve for American Indians their inherent right for freedom to believe, express, and exercise the traditional religions of the

American Indian, Eskimo, Aleut, and Native Hawaiians, including but not limited to access to site, use and possession of sacred objects, and the freedom to worship through ceremonies and traditional rites."

- Agencies must make a good faith effort to understand how Indian religious practices may come into conflict with other forest uses and consider any adverse impacts on these practices in their decision-making practices. The consideration of intangible, religious, ceremonial, or traditional cultural values and concerns which cannot be tied to specific cultural sites/properties could be considered under American Indian Religious Freedom Act.

Religious Freedom Restoration Act of 1993 (Public Law 103-141): Established a higher standard for justifying government actions that may impact religious liberties.

Other regulation, policy, and guidance

36 CFR 800 implements regulations for National Historic Preservation Act, Section 106. It provides explicit direction for the identification of sites, the determination of project effects on sites, requirements for consultation with state historic preservation offices, and the Advisory Council on Historic Preservation; and how to develop agreements.

36 CFR 60 sets forth basic procedures of evaluation and nomination of sites to the National Register of Historic Places, procedures for the operations of state historic preservation officers, and minimum qualification standards for cultural resource professionals.

36 CFR 79 establishes standards, procedures, and guidelines to be followed by federal agencies to preserve collections of prehistoric and historic material remains and associated records that are recovered in conjunction with federal projects and programs under certain federal statutes. This action should ensure that federally-owned and administered collections of prehistoric and historic materials remains and associated records are deposited in repositories that have the capability to provide adequate long-term curatorial services.

36 CFR 261 Prohibitions in Areas Designated by Order; Closure of National Forest System Lands to Protect Privacy of Tribal Activities (2011): "provides regulations regarding special closures to provide for closure of NFS lands to protect the privacy of tribal activities for traditional and cultural purposes to ensure access to NFS land, to the maximum extent practicable, by Indian and Indian tribes for traditional and cultural purposes".

36 CFR 223.239 and .240 Sale and Disposal of National Forest System Timber, Special Forest Products, and Forest Botanical Products: Section 223.239 provides regulations for free-use without a permit for members of Tribes with treaty or other reserved rights related to special forest products. Also free-use without a permit upon the request of the governing body of a Tribe. Section 223.240 provides regulations regarding harvest of special forest products by Tribes with treaty or other reserved rights.

The following elements authorize and guide cultural resource management activities on the HLC NFs.

- Heritage Program Managed to Standard Performance Measures, 2011
- National Historic Preservation Act Programmatic Agreement regarding the Maintenance of Historic Buildings by the Region 1 Historic Preservation Team, 1992, as amended, and protocols
- National Historic Preservation Act Programmatic Agreement regarding the Management of Cultural Resource on National Forests in Montana, Programmatic, 2015, as amended, and protocols (Eastside Site Identification Strategy, travel management, bark beetle-hazard tree)
- Northern Region Historic Structure Assessment and Historic Preservation Plan
- Preserving Montana, The Montana Historic Preservation Plan, 2013-2017
- Historical Overview of the Helena and Deerlodge National Forest (Beck, 1989)
- Overview: Ecological and Cultural Prehistory of the Helena and Deerlodge NF (Knight 1989)

- Ethnographic Overview of Selected Portions of the LCNF and Adjacent BLM lands (Deaver 1995)
- Lewis & Clark Trail on the Helena NF Preservation Plan (Scott 2001)
- Charter Oak Mine and Mill Preservation Plan (Davis 2003)
- Mann Gulch Fire Historic Landscape Preservation Plan (Randall 2014)

3.24.3 Assumptions

- Only ~10% of the HLC NF has been inventoried for cultural resources. It is likely that additional cultural resources exist in areas that have not yet been inventoried.
- Increases in access can have a negative impact on cultural and historical resources due to unauthorized use, vandalism, and looting.

3.24.4 Best available scientific information used

Heritage specialists determine whether existing cultural resource data is adequate to complete the environmental analysis and disclose potential effects on cultural resources. If the information is insufficient, additional research and inventory is undertaken as needed. Where additional inventory is needed, heritage personnel design a survey strategy to locate all historic properties within the area of potential effect. This strategy is designed in accordance with the criteria defined in "Site Identification Strategy Prepared for the East Side Forest". If a survey discovers previously unknown cultural resources, those resources are recorded and their National Register eligibility status determined in consultation with the Montana State Historic Preservation Office. Both background research and fieldwork are documented in a Section 106 report submitted to the State Historic Preservation Office. The Heritage Specialist consults with the State Historic Preservation Office to determine the nature of the project's effects on significant properties. If needed, the Heritage Specialist and the State Historic Preservation Office work together to determine appropriate project redesign, restrictions, designation of sensitive areas, or mitigation measures. The heritage specialist coordinates recommendations, actions, and monitoring with the project leader, the State Historic Preservation Office, and interested Tribal preservation officials.

Tribal knowledge and perspectives on cultural resources also represent a valuable source of information that can complement formal resource surveys and research. Their different systems of knowledge and belief are increasingly being accommodated in agency cultural resource management practices. Traditional cultural knowledge, sacred sites, and other places of tribal importance are now part of agency government-to-government and National Historic Preservation Act dialogue and interaction with tribes, and the HLC NF's heritage program will continue to consider traditional knowledge as an important source of information.

3.24.5 Affected environment

Central Montana was once a kaleidoscope of indigenous (American Indian) cultures. The plan area is the ancestral homeland and travel way of native bands now referred to as the Blackfeet, Chippewa Cree, Confederated Salish and Kootenai, Crow, Eastern Shoshone, Gros Ventre, Assiniboine, Sioux, Nez Perce, Northern Arapahoe, Northern Cheyenne, Shoshone-Bannock and the Little Shell Tribes (Aaberg et al 2007; Deaver 1995;(Knight, 1989). Most prominent among the groups found in the plan area were those historically known as the Blackfeet, Gros Ventre, Salish, Kootenai and Metis. Today, these groups retain an active culture with an unbroken tie to the greater plan area.

Aboriginal use of the plan area over the centuries is thus manifest in hundreds of archaeological sites in addition to sacred sites and other areas of traditional cultural importance. The arrival of the Lewis and Clark and the Corps of Discovery to the plan area in 1805 marks the beginning of the historic period for central Montana. Following the Corps of Discovery's eastward departure from the plan area in 1806, a slow trickle and then a tide of trappers and explorers entered central Montana. The discovery of gold in and around Helena ushered in a wave of settlement and land use that transformed the plan area's natural and political landscape (Beck, 1989). The first farming of the plan area began in the fertile river valleys adjacent to the mining camps (ibid). The entry of the railroads into the area boosted the agricultural industry considerably. Not only did railroad access provide transport for produce, it sought out and attracted farmers to Montana. The late 1910s and early 1920s brought severe drought and depression. The cattle industry in the plan area began with the use of the Oregon Trail in the 1840s. Continued mining and small scale lumbering, ranching and homesteading typified the use of the plan area during the 1870s and 1880s. The first several decades of Forest administration saw each forest following similar trends as other NFs in the interior Northwest. Mapping of the forest occurred along with the establishment of initial communication lines, fire lookout locations and administrative sites.

The history of the plan area left behind hundreds of cultural and historic resources, and their condition varies by resource class, location, and age. Site monitoring and condition assessments of historic properties show a range of condition from "excellent" to "destroyed". Taken as a whole, historic properties across the plan area exist in fair condition.

3.24.6 Environmental consequences

Effects common to all alternatives

Compliance with the National Historic Preservation Act Section 106, and all other applicable federal laws and regulations, are required for all FS undertakings, regardless of the chosen alternative. The identification, evaluation, nomination, protection, and interpretation of cultural and historic resources would occur under all alternatives. Coordination and consultation with interested parties would also continue in accordance with federal laws and regulations. Sites eligible for listing in the National Register of Historic Places would be evaluated and formally nominated to the Register. Protection protocols and mitigation measures would be used to preserve resources that are inadvertently discovered. All alternatives thus provide protection for cultural resources consistent with National Historic Preservation Act.

The effects to tribal interests are defined by tribes during consultation. Current management direction and requirements for consultation have been designed to ensure that areas on NFS lands that are important to Native Americans are not inadvertently impacted by the FS. Because management direction is required to follow all federal laws and regulations in respect to American Indian Rights and Interests, related effects are the same across all alternatives.

Effects common to all action alternatives

All action alternatives contain plan components that explicitly state the desired conditions for cultural, historical, and tribal resources and provide guidance for achieving these desired conditions (See Table 251). Collectively, these plan components serve to ensure that potential adverse effects from land management and visitor use are avoided or minimized. The action alternatives also contain plan components designed to ensure that tribal knowledge and values are considered in management decisions and to provide access to the forest for traditional and ceremonial uses.

Table 251. Summary of revised plan components for cultural, historic, and tribal resources

Plan component	Intent and Expected effects
FW-CR-DC-01, 03, 04	These DCs would help ensure that the public has the opportunity to visit and learn about cultural and historical sites as well as participate in conservation activities through volunteer programs.
FW-CR-DC-02; FW-RSUP-DC-04	These DCs are designed to ensure that historic buildings continue to provide for functional use while also reflecting local history and identity.

Plan component	Intent and Expected effects
FW-CR-GO	These goals outline a process for supporting cultural resource inventories, research, management, and preservation through the use of cooperative agreements and partnerships as well as consultation with Native American tribes and traditional cultural practitioners.
FW-CR-GDL	This GDL is designed to ensure that maintenance of significant sites is designed in a way that includes conservation and preservation measures.
FW-CONNECT-DC-02, 03; FW-CONNECT-DC-GO-08, 09; FW-CONNECT-OBJ-02, 03; FW-CONNECT-GDL-01	Collectively, these plan components help to ensure that cultural and historic resources are conserved and appreciated through the provision of high-quality interpretive and educational programming that promotes conservation and stewardship. The guideline stresses that education should emphasize stewardship principles such as “Leave no Trace” to help minimize potential visitor impacts to natural and cultural resources.
BB-MISCORR-DC-03,04, 05	These components apply to the historically and culturally significant Missouri River Corridor and are designed to protect its unique cultural values and enhance appreciation of its history through education. DC-05 ensures that the historical and cultural resources are not degraded by potential increases in visitor use.
RM-BTM-DC-01	These components apply to the Badger Two Medicine Area, which has significant traditional and cultural value to the Blackfeet people. Plan components are designed to protect the cultural values of this area and ensure access for tribal members for ceremonial and cultural activities.
FW-TRIBAL-DC	These desired conditions recognize the importance of accommodating traditional, cultural, and religious uses of the forest that are essential to sustaining the way of life and cultural integrity of local tribes. Together, they ensure that sustainable populations of culturally significant flora and fauna remain available for harvest and that access to the Forest for the exercise of treaty rights is accommodated.
FW-TRIBAL-GO	These goals are designed to ensure that consultation with tribal members and the development of collaborative relationships enhances both knowledge and conservation efforts.
FW-REC-DC-04, 07; FW-RSUP-DC-02	These DCs are designed to ensure that recreation facilities, infrastructure, and their use do not harm cultural sites and resources.

Effects from forest plan components associated with:

Infrastructure and access

All action alternatives include plan components designed to provide public access to key cultural and historical resources while also ensuring adequate protection for these resources. While the development and maintenance of infrastructure such as roads and trails has the potential to affect cultural and historical resources through ground disturbance, both plan components and legal direction ensure that any potential effects are considered and mitigated. Roads, trails, camping areas, and other infrastructure would be designed in such a way as to minimize any negative impacts associated with their construction and use.

Ease of access affects the degree of visitor use, and visitors have the potential to harm cultural and historical resources either inadvertently via trampling, which could expose sites and adversely affect their physical integrity, or through vandalism and looting, which result in the degradation or loss of cultural and historical artefacts. The proximity of sensitive cultural resources, such as rock art, rock shelters, historic structures, and Traditional Cultural Properties, to designated routes or areas is important when determining where resources could be susceptible to greater threats or risks. To minimize potential adverse effects, plan components associated with recreation infrastructure direct the construction of trails and barriers where needed to protect sensitive resources. Plan direction associated with visitor education can also help to minimize impacts from visitor use. Increased access may also have a positive impact on cultural and historical resources if it increases the rate of discovery of new cultural or historical sites.

Motorized vehicle use can be particularly harmful due to the potential for increases in both ground disturbance and ease of access. Unauthorized, user-created routes and areas can negatively affect historical and cultural resources. Direct effects of motorized use include physical damage resulting in or from erosion, down-cutting, rutting, or displacement of cultural features. Because adverse effects on cultural resources have been observed where motorized users have gone off road, the action alternatives provide direction to close and rehabilitate unauthorized recreation routes (FW-ACCESS-DC-01, GDL-01) in an effort to minimize future damage. Indirect effects associated with motorized vehicle uses include vandalism and looting, and can occur outside of designated routes and areas, such as at adjacent dispersed camping areas. Any adverse effects can be mitigated through compliance with plan direction and Section 106 of the National Historic Preservation Act.

The action alternatives also emphasize collaborating with tribal partners to ensure continued access to culturally significant areas. While tribes may traditionally have reached these places by foot or horseback, today, motorized vehicles are essential for reaching some locations, especially for elders who can no longer walk long distances. The Forest would consult with tribes when access and recreation management activities may impact treaty rights and/or cultural sites and cultural use. There is some potential risk to sacred sites where American Indians conduct ceremonies that require privacy. If a road were built to or near such a site, the associated increase in visitation could make it difficult to conduct ceremonies there, undermining the important cultural practice. A tribe could request the HLC NF to temporarily close the site to nontribal members for a short period under the 2008 Farm Bill Authority.

Sacred sites are likely to be located in these areas. There is still a potential that landscape integrity and sacred sites may be affected because of the activities that are permitted under the action alternatives. However, prior to implementing resource management activities impacts on Tribal government and Tribal practices would be assessed and consultation requirements fulfilled.

Recreation management

Recreation can potentially affect cultural, historical, and tribal resources through its effects on both ground disturbance and visitor use. Ground disturbance may occur either directly, through the construction and management of recreation sites, or indirectly, through the use of motor vehicles for recreation. All action alternative contain plan components designed to avoid or mitigate these effects. As described above, new roads, campsites, trails, and other recreation infrastructure would be designed in a way that minimizes any adverse effects from construction and protects cultural and historical resources from the effects of future visitor use.

Recreation plan components emphasize providing opportunities for visitors to connect with and learn about both the natural *and cultural* environment. These opportunities could help to instill a sense of stewardship in forest visitors, potentially minimizing impacts to cultural and historical sites through careless use or direct vandalism.

The HLC NF manages portions of both the Continental Divide National Scenic Trail and the Lewis and Clark National Historic Trail, both of which have significant cultural and historical value. Plan components associated with management of these trails ensure that they conserve important cultural and historical resources while allowing visitors an opportunity to learn about the local history. The action alternatives all emphasize the use of partnerships to help protect cultural resources along these trails and enhance visitor experiences through the development of interpretive materials and programs.

Eligible wild and scenic rivers

Several of the river segments that are identified as eligible to become WSRs are eligible at least in part due to their outstanding cultural value. Eligible WSRs must be managed to maintain the outstanding remarkable values for which they have been identified, which could result in greater protection for these river segments. Plan direction further specifies that any recreation facilities "must be located and designed to harmonize with the natural and cultural settings” (FW-WSR-STD-01), which would ensure that any development would not detract from the cultural value.

Recreational use does have the potential to affect cultural and historic resources near eligible rivers, but the recreation plan components described above would also apply near eligible WSRs and would serve to avoid or mitigate any adverse effects associated with visitor use.

Vegetation management

The plan components for vegetation management, including timber harvest and planned or unplanned ignitions, have the potential for adverse effects to cultural resources. The adverse effects can be caused by machinery and vehicles, including tree felling, skidding, and burning of slash piles and construction or reconstruction of roads. Any adverse effects can be mitigated through compliance with Section 106 of the National Historic Preservation Act.

All action alternatives include plan components that would help to restore vegetation to its natural condition and maintain resilient forests, which may provide protection to cultural and historical resources that could be negatively impacted by severe wildfires or other disturbances. Maintaining the integrity of ecosystems and associated plants and wildlife may also enhance the ability of tribes to harvest native species with cultural value and ensure that vegetation at sacred sites resembles what it would have historically.

Minerals

Mineral activities such as mining and oil and gas exploration can have adverse effects on tribal resources and culturally important landscapes, but the action alternatives include plan components designed to avoid or mitigate these effects. The Forest would consult with tribes when mineral management activities may impact treaty rights, cultural sites, or traditional uses. The action alternatives place a greater emphasis on ongoing communication and collaboration with tribal stakeholders compared to alternative A.

Alternative A, no action

The existing forest plans are focused on Section 106 compliance and do not consider a balance between compliance, stewardship, and protection of cultural and historical resources. However, numerous federal laws and regulations exist for the protection and enhancement of these resources regardless of any forest plan direction. Compliance with federal laws and regulations would continue.

Alternative A does not include identified traditional/cultural special areas. Therefore, it does not provide the Forest with specific direction for the management of these areas. Alternative A does have a forestwide standard for cultural resources that requires the Forest to consult with Native American traditional religious leaders on any project having the potential to affect Native American cultural sites and practices.

Alternatives B - E

Protection of cultural and historic resources is expected to be higher under all action alternatives, compared to alternative A, due to more specific and actionable plan components and collaborative management approaches. For alternatives B - E the plan directions are the same and only the size and location of the land allocations change, resulting in differences in the potential for active management, motorized recreation, and public access.

Differences in the potential for ground disturbance

More management can mean more potential for harm related to ground disturbance. At the same time, an increase in projects may result in the discovery of new cultural resources and would provide the heritage program an opportunity to conduct National Historic Preservation Act Section 106 inventories, which in turn creates a more complete picture of how people have used the landscape. More motorized recreation could also increase the possibility of disturbance to sensitive cultural and historical resources.

Alternative E would treat fewer acres due to its emphasis on timber harvest, so it has the lowest potential for ground disturbance to cultural and historical resources due to management activities. All other alternatives treat more acres that alternative E and the amount does not differ, so they would have a similar possibility of ground disturbance from management. Any impacts from land management would be small and could be avoided or mitigated by following plan direction and complying with applicable laws and regulations.

Alternative E has the greatest number of roads and trails open to motorized recreation, followed by A, C, B, and then D. Alternative E thus has the greatest potential for ground disturbance from motorized recreation while alternative D has the least due to its emphasis on RWAs. These impacts are also expected to be small, and would be further minimized by following the plan direction in the action alternatives.

Differences in public access and associated impacts

Greater public access can also mean more potential harm to cultural and historical resources due to trampling, vandalism, and looting. Different alternatives propose different amounts of RWAs or differences in motorized and mechanized access within them, which can affect ease of access and visitor use. Alternative D would provide the most RWAs, and therefore, the greatest protection to cultural, historical, and tribal resources through limited use. Alternative E does not recommend any RWAs, and so provides the least protection from visitor use and active land management. While alternatives B and C recommend the same amount of wilderness, alternative C allows existing motorized and mechanized recreation to continue, which would potentially result in greater access and greater impacts due to ground disturbance from motorized vehicles.

Differences in tribal access for traditional and ceremonial uses

While roads can increase access and consequently the potential for harm from visitor use, they also provide access for managing cultural sites and visiting areas of tribal importance. Those alternatives with the least motorized access (alternatives D and B) could have a negative effect on tribal access, even though lack of access may also help to preserve and protect tribal resources from use and vandalism by non-tribal members. All action alternatives would rely on forestwide elements specific to American Indian Rights and Interests to recognize impacts that may result from wilderness and primitive management.

Cumulative Effects

Cumulative effects, over time, can include loss and damage to cultural, historical, and tribal resources. The effects that past activities have had on cultural, historical, and tribal resources are reflected in the current condition of these resources as described in the affected environment section.

Cultural, historical, and tribal resources on many of the lands surrounding the HLC NF are also protected by law. All federal land management agencies must follow the same federal laws and regulations in regards to cultural resources. All state owned land must follow the Montana State Antiquities Act as amended 1995 or the administrative rules written by the State Historic Preservation Office in 1999. Private land is not required to follow any laws or regulations in regards to cultural resources, with the exception of human skeletal remains. If human skeletal remains are found on public or private land the Montana Human Skeletal Remains and Burial Site Protection Act (1999) applies, or applicable federal laws.

Conclusions

Management actions that result in ground or structural disturbance have the potential for effects to cultural resources and sacred sites, but all action alternatives include components designed to avoid or minimize any adverse effects. Furthermore, potential effects are identified, detailed, and disclosed during site-specific analysis, which gives the FS the opportunity to determine appropriate mitigation, avoidance, and protection measures. Thus, the consequences to cultural resources from actions associated with other programs such as fire and fuels management, access and recreation, vegetation management and non-native invasive plant management programs are estimated to be minimal or avoidable under all alternatives.

Visitor use also has the potential to harm cultural and historical resources, and so differences in access can affect the potential for harm and associated mitigation measures. All action alternatives contain components designed to minimize this risk using education and strategic placement of recreation infrastructure to protect sensitive resources. Access to sacred sites is also a key issue for local Tribes. While some alternatives do provide fewer restrictions on access, the Forest would collaborate with Tribes to accommodate access to and ceremonial use of sacred sites under all alternatives.

3.25 Lands

3.25.1 Introduction

This section addresses land ownership administration, adjustments, and special uses of NFS lands on the Forest. Management of NFS land includes surveying, marking, and posting of ownership boundaries, acquisition, conveyance and exchange of lands and interests in lands, disposition of title claims and encroachments, acquisition of rights-of-way, and authorization and management of land use authorizations to protect resource values and interest of the public managed by the FS.

Adjustments of land ownership can occur through congressionally mandated conveyances, exchanges, and acquisitions, or through discretionary FS administrative activities.

Land occupancy and use by private parties and other government entities is managed through the issuance of special use authorizations. Authorized special uses on the HLC NF include industrial or commercial uses, private uses, and a variety of recreational uses.

All occupancy, use, or improvements on NFS lands that are not directly related to timber harvest/forest products, grazing, mining activities, and recreation are referred to as ‘lands special uses.’ The most common lands special uses include: roads, utilities, storage facilities, communications sites, research, water transmission, and commercial filming. Recreation special uses include: resorts, ski areas, outfitter and guides, and a variety of uses that provide access and use of NFS lands by commercial ventures.

3.25.2 Regulatory framework

The following is a select set of statutory authorities that govern landownership adjustments and the issuance and administration of special use authorizations on the HLC NF. They are briefly identified/described below to provide context to the management and evaluation of these resources. There are multiple other laws, regulations and policies not described below that also guide the management of these programs; see FSM 2700, 5400, and 5500 for a comprehensive listing.

Law and executive orders

Occupancy Permits Act of March 4, 1915 (16 U.S.C. § 497 et seq.) as amended: This act authorizes use and occupancy on NFS land for recreational purposes including resorts and recreation residences.

General Exchange Act of March 20, 1922 (16 U.S.C. 485, 486): This act authorized the FS to consolidate its holdings in NFs where a large percentage of private lands were intermingled with NFS lands. It made possible the exchange of inholdings within NFs for private lands of equal value and within the same state.

Highway Act of August 27, 1958 (23 U.S.C. 317), supplemented by the Act of October 15, 1966 (49 U.S.C. 1651): This act authorizes the Federal Highway Administration to grant easements to States for highways that are part of the federal-aid system or that are constructed under the provision of chapter 2 of the Highway Act. The FS consents to the grant of these easements in a form agreed upon by the two agencies and upon the state highway agency's execution of stipulations. This is the only authority for granting rights-of-way for projects on the federal-aid system or projects constructed under the provisions of chapter 2 of the Highway Act (FSM 2731).

The Act of November 16, 1973 (30 U.S.C. 185): This act, amending Section 28 of the 1920 Mineral Leasing Act, authorizes the FS to issue authorizations for oil and gas pipelines and related facilities located wholly on NFS land. When the lands are under the jurisdiction of two or more federal agencies, authority for issuance is reserved to the USDI, BLM, subject to approval by the agencies involved.

Alaska National Interest Lands Conservation Act of 1980 (16 U.S.C 3210): provides numerous authorities related to access that are specific to national forests in Alaska (except for sec. 1323(a), which applies to all NFS lands; see the following paragraph b). The provisions of section 1323(a) (16 U.S.C. 3210) apply to all NFS lands. This section provides that, subject to terms and conditions established by the Secretary of Agriculture, the owners of non-federal land within the NFS shall be provided adequate access to their land. Regulations implementing section 1323(a) are set forth at Title 36, Code of Federal Regulations, Part 251, and Subpart D -Access to Non-federal Lands. See FSM 2701.3, paragraph 3, for the summary of the provisions of 36 CFR 251, Subpart D.

Small Tracts Act of January 12, 1983 (16U.S.C. 521c-521i): This act authorizes the sale, exchange, or interchange of certain parcels of minimal size.

Need to add organic act of 1956 authorizes acquisition of lands and interests in lands. This is the primary authority used by the FS to purchase lands.

Act of May 26, 2000 (16 U.S.C. 406l-6d): This act supplements the authority of the Secretary of Agriculture to regulate commercial filming and still photography on NFS lands. It also authorizes the Secretary to retain and spend land use fees collected for commercial filming and still photography without further appropriation, and provides for recovery of administrative and personnel costs in addition to the collection of the land use fee.

March 22, 2012, Executive Order 13604, Improving Performance of Federal Permitting and Review of Infrastructure Projects, states that “it is critical that executive departments and agencies take all steps within their authority, consistent with available resources, to execute Federal permitting and review processes with maximum efficiency and effectiveness…”

August 8, 2005, Energy Policy Act of 2005, Section 1211(c), Access Approvals by Federal Agencies (Public Law 109-58), states “Federal agencies responsible for approving access to transmission and distribution facilities located in the U.S. shall expedite any Federal agency approvals that are necessary to allow the owners or operators of such facilities to comply with reliability standards regarding vegetation management, electric service restoration, or resolution of situations that imminently endanger the reliability or safety of the facilities.”

May 18, 2001, Executive Order 13212, Actions to Expedite Energy-Related Projects, orders executive departments and agencies to take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.

Code of Federal Regulations (CFR)

The following regulations provide direction for special uses management on NFS lands:

- **36 CFR 251** – Land Uses
- **36 CFR 254 –** Landownership Adjustments

3.25.3 Assumptions

As population increases, expected trends include a greater use of NFS lands by the recreating public, particularly those areas close to population centers. There is also expected to be more development of private lands adjacent to forest and on private inholdings within the forest boundary. Private access needs will likely increase. This may also result in challenges from other land owners to existing and perceived access to NFS lands, as private landowners are becoming more reluctant to grant easements. Access in general across all NFS lands is becoming more difficult to obtain. This is expected to continue into the future.

3.25.4 Best available scientific information used

The Forest used the best available data and science relevant to inform the analysis for the draft plan components for lands and land uses. Data sources included information stored in the corporate data base and site-specific knowledge from forest personnel.

3.25.5 Affected environment

Lands

The total acres of NFS lands that are the administrative responsibility of the Forest are a result of the original Congressionally-designated lands and the conveyances (acquisitions, disposals, and exchanges) that have occurred to date. The HLC NF landownership pattern varies with location.The pattern can be characterized as:

- Large blocks of uninterrupted, contiguous NFS lands;
- NFS lands surrounding isolated tracts of private lands;
- NFS lands surrounded by isolated tracts of private lands;

Ownership

In 1986 when the current forest plans went into effect, the HLC NF included 2,825,580 acres of NFS lands. Since 1986, NFS ownership has increased by 20,906 acres on the Lewis and Clark NF portion and increased by 5,257 acres on the Helena NF portion of the forests.

There have been other land acquisitions across the Forest utilizing appropriated funds, typically through the Land and Water Conservation Fund Additionally, the Forest periodically exchanges lands for the mutual benefit of each party and the public. While there are still some areas of the HLC NF that have intermingled ownerships of land, there are no significant acquisitions or exchanges of lands in process, partly due to decreased lands funding.

Special uses

Some uses of NFS lands are covered by special use authorizations, including permits, leases, and easements that allow occupancy, use, rights, or privileges on the HLC NF.

The HLC NF currently administers 295 Lands Special Use Authorizations that are issued within the plan area (Table 252). These include current authorizations and authorizations that have expired. In the instances of authorizations that have expired, the use is still occurring and annual fees are being collected.

Table 252. Special Use Authorizations

Type of Use	Number of Authorizations
Agriculture	82
Community and Public Information	11
Feasibility, Research, Training, Cultural Resources and Historical	12
Industry	2
Energy and Gas Transmission	22
Transportation	115
Communication Uses	41
Water	7
Military Training and Facilities	3
Total	295

Lands special uses range from permits for individuals to use NFS land for their driveways, to more extensive uses such as powerlines, fiber optic cable, telephone lines, and oil and gas pipelines that cover many miles of NFS lands. Other land uses include communications towers, research studies, fences, signs, and service buildings.

The majority of the land use authorizations are for transportation-related uses and the majority of recreation uses are for recreation residences. There are a large number of unauthorized transportation uses in the plan area. With recent travel plan decisions, roads accessing private land that were open to the public in the past have been closed to public use. Use of these roads by private landowners requires a special use authorization. At present, the FS lacks the resources it needs to manage the special uses program (Office of Inspector General Audit findings, 2011). For this reason, the HLC NF special use program has not had the resources to process the large number of special use road authorizations which would allow legal use of these roads by private landowners.

In the current forest plans, utility rights of way and communication sites are not identified. The Regional Office has recommended that each forest plan should include three basic elements to identify suitable utility corridors and communication sites: 1) text or reference in the plan itself, 2) maps, and 3) tables.

Access

In this section, access refers to the easements held by the U.S. government and administered by the FS across non-NFS land for the management of NFS lands. This generally and preferably includes access by the public across these lands. There will likely be more challenges to historic access that currently exists and a greater need to perfect access to NFS lands. The FS will continue to pursue reciprocal right of way opportunities in an effort to continue securing access.

There is a need to identify those areas where there are access issues and to continue pursuing access in these areas.

3.25.6 Environmental consequences

Effects common to all alternatives

None of the alternatives propose to make any site-specific changes to the existing landownership on the HLC NF. No conveyances (acquisitions, disposals, or exchanges) are proposed. Any of these actions would only be considered at the project level. Until an external entity presents a proposal there would be no changes to the existing landownership pattern.

Since no changes in landownership are proposed, the number of acres of NFS lands remains the same for all four alternatives. None of the alternatives propose to make any site-specific changes to existing special use authorizations or rights-of-way on the HLC NF.

Due to differences in RWAs and lands suitable for timber production between alternatives, there could be an effect on the number of new access proposals that would be submitted resulting in a larger workload for land uses staff. These effects are described below in each alternative.

Cumulative Effects

At this time the HLC NF is not actively pursuing any adjustments in landownership. But, in recent years, external entities have made land acquisitions and have transferred ownership to the NFs; and there is some likelihood that these types of actions may continue. Any change (increase or decrease in total NFS lands) is dependent on what actions might be approved. Outright purchase and transfer would most likely result in an increase in the acres of NFS lands. Land exchanges, on the other hand, may result in a decrease in the acres of NFS lands. There are some small community based conveyances occurring on the forest. There may be an increase in the number of these conveyances.

The Forest can expect requests for special use authorizations to continue. As more private land is subdivided there is usually an associated increase in requests for road special use permits and utility easements. Requests for modification of existing authorized communication sites and designation of new communication sites can reasonably be expected as technological advances (e.g., cell phones) are made. On the HLC NF these sites typically occupy small acreages (1 to 2 acres).

Boundary survey and marking would increase with vegetation management and fire programs. Along with this, more encroachments are likely to be discovered.

Activities on adjacent lands under private ownership and from other land management agencies such as state, city, county and private may have an effect on land management in the planning area. An example would be the Black Butte mine project in the Sheep Creek area of the Little Belts, which may potentially impact adjacent land and management of NFS lands in the area.

Effects common to all action alternatives

Effects from forest plan components associated with:

Vegetation management

Vegetation management would increase the need for easements to be acquired and reciprocal right-of-way opportunities. There would be an increased need for boundary management which likely would daylight encroachments that were not previously known.

Wildlife management

NFS lands that provide secure habitat or contribute as linkage areas are less likely to be considered for disposal or exchange. The impact is the same for the four alternatives since the lands where these conditions exist does not vary between the alternatives.

Recreation management

NFS lands with developed recreation sites (e.g., campgrounds) are less likely to be considered for conveyance or exchange.

Fire and fuels management

Unplanned and prescribed fires would continue to affect the long-term ecological processes across recreation settings and may impact the location and availability of recreation opportunities on the Forest. Fire could create a temporary loss of vegetation, reduction in water quality due to sedimentation, and air pollution which could cause displacement of some forest visitors to other areas on the forest or to other forests in the region. There is a need to increase landownership consolidation of non-NFS and NFS lands for easier fire and fuels management.

Road access and infrastructure

For those areas with high development and use of FS roads by private landowners, the HLC NF would ask counties to enter into Forest Roads and Trails Act easements. Forest roads are maintained at a level suitable for FS administrative purposes not for access to private. They are not maintained for residential development, only for NF management.

Alternative A, no action

The existing plans include standards for elk security. These standards conflict with vegetation management along utility corridors.

This alternative proposes to seek land adjustments and acquire easements to support long term forest goals and objectives. The plan also provides for special uses that private land cannot support and uses that support forest goals and objectives.

Alternative B

Lands and land uses will not change under this alternative. This alternative could have an effect on new access proposals in RWAs. This alternative also includes plan components that would provide additional direction for approval of land uses in riparian areas.

Alternative C

This alternative could have an effect on new access proposals in RWAs. Alternative C also includes plan components that would provide additional direction for approval of land uses in riparian areas.

Alternative D

This alternative could potentially create a larger workload to special uses because it would not allow mechanized uses and would change to non-motorized use during the winter, which could increase the workload for authorizing access to private inholdings. This alternative also includes plan components that would provide additional direction for approval of land uses in riparian areas.

Alternative E

This alternative includes no RWAs and the highest amount of lands suitable for timber production. This could affect land values and would possibly increase the need for access to timber management areas. This alternative also includes plan components that would provide additional direction for approval of land uses in riparian areas.

Conclusions

Land adjustment activities would not vary in any of the alternatives, including alternative A. However, the action alternatives would include plan components that would provide additional direction for approval of land uses in riparian areas, and there could be differences in access needs by alternative.

By providing the plan components outlined in the action alternatives, the HLC NF meets the purpose and need of the revised forest plan because there are no significant impacts to land adjustments, access, ownership or special uses which provide for multiple uses.

3.26 Infrastructure

3.26.1 Introduction

Broadly, the infrastructure on the HLC NF includes roads, trails, bridges, facilities, and dams. The programmatic effects analysis focuses on the transportation system. The transportation system for the HLC NF is defined as the system of NFS roads, NFS trails, and airfields on NFS lands (36 CFR 212.1). Please see the recreation and access section for discussion on access and effects to NFS trails and motorized over-snow vehicle use, as well as airfields.

The HLC NF expects to maintain an appropriately sized and environmentally sustainable road system that is responsive to ecological, economic, and social concerns. The NF road system of the future would continue to provide access for recreation and resource management, as well as support watershed restoration and resource protection to sustain healthy ecosystems.

Effects to the NF road system are measured by the miles of open road within RWAs.

Analysis area

The geographic scope of the analysis includes NFS lands administered by the Forest. All lands within the Forest boundary form the geographic scope for cumulative effects. The temporal scope of the analysis is the life of the plan (15 years).

3.26.2 Regulatory Framework

Term Permit Act of March 4, 1915 (Pub. L. 63-293, Ch. 144, 38 Stat. 1101, as amended; 16 U.S.C. 497): This act provides direction to the NFS lands to authorize occupancy for a wide variety of uses through permits not exceeding 30 years.

Highway Safety Act of September 9, 1966 (Pub. L. 89-564, 80 Stat. 731, as amended): This act authorizes state and local governments and participating federal agencies to identify and survey accident locations; to design, construct, and maintain roads in accordance with safety standards; to apply sound traffic control principles and standards; and to promote pedestrian safety. The Highway Safety Improvement Program and the Safety Performance Management Measures Final Rules (effective April 14, 2016) addresses the requirements of the Moving Ahead for Progress in the 21st Century Act and the Fixing America’s Surface Transportation Act. The Highway Safety Improvement Program Final Rule updates the existing Highway Safety Improvement Program requirements under 23 CFR 924 to be consistent with Moving Ahead for Progress in the 21st Century Act and the Fixing America’s Surface Transportation Act, and to clarify existing program requirements. The Safety Performance Management Measures Final Rule adds part 490 to title 23 of the CFR to implement the performance management requirements under 23 U.S.C. 150, including the specific safety performance measure requirements for the purpose of carrying out the Highway Safety Improvement Program to assess serious injuries and fatalities on all public roads.

Federal Aid Highway Act of 1968, as amended (23 U.S.C. 109(a) and (h), 144, 151, 319, and 351): Establishes the National Bridge Inspection Standards (23 CFR Part 650, Subpart C) and the requirement that each state have a current inventory of bridges on all public roads, including NFS roads open to public travel (FSM 1535.11).

Surface Transportation Assistance Act of 1978 (Pub. L. 95-599, as amended). Supersedes the Forest Highway Act of 1958: Authorizes appropriations for forest highways and public lands highways. Establishes criteria for forest highways; defines forest roads, forest development roads, and forest development trails (referred to as “NFS roads” and “NFS trails” in FS regulations and directives); and limits the size of projects performed by FS employees on forest roads. Establishes the Federal Lands Highway Program.

Moving Ahead for Progress in the 21st-Century Act of July 6, 2012 (Pub. L. 112-141): Replaces the Federal Lands Highway Program with the Federal Lands Transportation Program and Federal Lands Access Program. This act authorizes funding for federal lands transportation facilities and federal lands access transportation facilities under a unified program with policy similar to federal-aid highways and other public transportation facilities. It requires federal land management agencies to identify a comprehensive inventory of public federal lands transportation facilities that, at a minimum, includes the transportation facilities that provide access to high-use federal recreation sites or federal economic generators.

National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP Technical Guide, April 2012: The first volume of guidance for the FS, U.S. Department of Agriculture, and National Best Management Practices Program. The National BMP Program was developed to improve agency performance and accountability in managing water quality consistent with the Federal Clean Water Act and state water quality programs. Current FS policy directs compliance with required Federal Clean Water Act permits and state regulations and requires the use of National BMP Program to control nonpoint source pollution to meet applicable water quality standards and other Federal Clean Water Act requirements. It includes road management activity National BMP Program for construction, operation, and maintenance for roads and motorized trails.

36 CFR 212—Travel Management This final rule requires designation of those roads, trails, and areas that are open to motor vehicle use. Designations are made by class of vehicle and, if appropriate, by time of year. This rule prohibits the use of motor vehicles off the designated system, as well as use of motor vehicles on routes and in areas that is not consistent with the designations. Subpart B provides for a system of NFS roads, NFS trails, and areas on NFS lands that are designated for motor vehicle use. After these roads, trails, and areas are designated, motor vehicle use, including the class of vehicle and time of year, not in accordance with these designations is prohibited by 36 CFR 261.13. Motor vehicle use off designated roads and trails and outside designated areas is prohibited by 36 CFR 261.13. Subpart C provides for a system of NFS roads, NFS trails, and areas on NFS lands that are designated for over-snow vehicle use. After these roads, trails, and areas are designated, over-snow vehicle use not in accordance with these designations is prohibited by 36 CFR 261.14. Over-snow vehicle use off designated roads and trails and outside designated areas is prohibited by 36 CFR 261.14.

The Road Management Rule 2001. This rule “removes the [prior rule’s] emphasis on transportation development and adds a requirement for science-based transportation analysis.” “The intended effect of this final rule is to help ensure that additions to the NFS network of roads are those deemed essential for resource management and use; that, construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and finally that unneeded roads are decommissioned and restoration of ecological processes are initiated” (Federal Register Vol. 66, No 9, pg. 3206).

Subpart A of the Rule pertains to Administration of the Forest Transportation System. In part, Subpart A requires each unit of the NFS to: 1) identify the minimum road system (MRS) needed for safe and efficient travel and for protection, management, and use of NFS lands (36 CFR (CFR) 212.5(b)(1)); and 2) identify roads that are no longer needed to meet forest resource management objectives (36 CFR 212.5 (b)(2)). In determining the MRS, the responsible official must incorporate a science-based roads analysis at the appropriate scale.

3.26.3 Assumptions

Due to the extensive evaluation of RWAs and the effort to identify areas with the least amount of infrastructure, facilities and bridges would be minimally impacted across all alternatives and therefore only motorized access will be compared between alternatives.

3.26.4 Best available scientific information used

The FS uses the best available science when implementing construction and maintenance activities. Please see the regulatory framework section for more information.

3.26.5 Affected Environment

Forest system roads

NFS roads are under the jurisdiction of the FS. They are wholly or partly within or adjacent to NFS lands. The FS determines the necessity of these roads for the protection, administration, and utilization of NFS lands and the use and development of its resources. Roads managed by public agencies (such as states, counties, and municipalities) that provide access to NFS lands are also informally considered part of the overall regional transportation system, but do not fall under the jurisdiction or direction of the NFS. These roads are not included in this evaluation.

In 2015 the Forest completed a travel analysis report. This broad-scale analysis encompassed all existing NFS roads on the Forest. The report provides an assessment of the road infrastructure and a set of findings and opportunities for change to the forest transportation system. This report provides information to forest managers regarding the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of NFS lands.

The travel analysis report is used by the Forest to prioritize maintenance needs and identify opportunities for decommissioning roads, or putting them in intermittent stored service as the Forest works to identify the minimum number of routes needed for an efficient transportation system as directed in 36 CFR 212 subpart A. The travel analysis report identified NFS roads as “not likely needed for future use”. These roads may be considered candidates for conversion to another use, storage for future use, or removal through decommissioning. Other roads that were rated as “high risk” were identified as candidates for storage for future use, reconstruction or relocation, or additional road maintenance. Roads considered as “low risk” are the first to be considered for reduced road maintenance (i.e., change to a lower maintenance level).

Neither the travel analysis report nor the draft plan makes travel management decisions. Site-specific, project level analysis is required to make travel management decisions, including road closure, storage, or decommissioning.

NFS roads are designated by design (vehicle classifications and use) and maintenance standards for each road. Roads are generally constructed and maintained wide enough (>12 feet) for typical cars and trucks. Since many of the roads were initially constructed for vegetation management objectives, the design vehicles were lowboys or logging trucks. Roads are constructed to grades usually less than 12 percent to allow grade-ability for most highway vehicles. The FS uses five maintenance levels to define the general design standards, use, and associated type of maintenance required. These five maintenance levels are:

- Maintenance level 1. These are roads that have been placed in storage between intermittent uses. The period of storage must exceed one year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur. Roads managed at this maintenance level are in basic custodial care.

- Maintenance level 2. These roads are open for use by high clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations. Warning signs and traffic control devices are generally not provided. Motorists should have no expectations of being alerted to potential hazards while driving these roads. Traffic is normally minor, usually consisting of one or more of a combination of administrative, permitted, dispersed recreation, or other specialized uses. Roads managed at this maintenance level are described as high clearance vehicle roads.
- Maintenance level 3. These roads are open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not priorities. Roads in this maintenance level are typically low speed with single lanes and turnouts and are included in the term "passenger car" roads. These roads are maintained for travel by a prudent driver in a standard passenger car.
- Maintenance level 4. These roads provide a moderate degree of user comfort and convenience at slow to moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. Maintenance level 4 roads are collectively maintained for travel by a prudent driver in a standard passenger car.
- Maintenance level 5. These roads provide a high level of user comfort and convenience at slow to moderate travel speeds. The roads are normally double lane, paved facilities. Some may be aggregate surfaced and dust abated. Maintenance level 5 roads are collectively maintained for travel by a prudent driver in a standard passenger car.

These roads fall under the requirements of the National Highway Safety Act and the Manual of Uniform Traffic Control Devices. Warning signs and traffic control devices are provided to alert motorists of situations that may violate expectations.

Forestwide, there are approximately 2,569 miles of road that are open for public use either seasonally or year round. Roughly 1,593 miles of these roads are open for high clearance vehicles and 976 miles are open for passenger cars. Additionally, there are 1,082 miles of NFS roads within the plan area that are currently in custodial care (closed to public motorized use).

Table 253 provides information related to the distribution of roads by maintenance level and GAs within the plan area. Some roads under the jurisdiction of the FS fall outside of the GA boundaries. These roads are owned and/or maintained by the FS on private lands, have easements in place with private land owners, or are situations where necessary easements are being pursued by the FS.

Table 253. Overview of NFS roads by maintenance level

Geographic Area	ML 1 (Miles)	ML 2 (Miles)	ML 3 (Miles)	ML 4 (Miles)	ML 5 (Miles)	Total (Miles)
Outside GA[1]	21	33	69	37	3	163
Big Belts	333	205	142	26	0	706
Castles	3	50	21	3	0	77
Crazies	7	26	11	0	0	44
Divide	216	201	97	38	1	553
Elkhorns	114	123	35	15	0	287
Highwoods	1	9	2	0	0	12
Little Belts	166	562	235	58	0	1021
Rocky Mountain Range	14	53	33	26	8	134
Snowies	14	48	16	1	6	85
Upper Blackfoot	193	283	86	9	1	572
Total Miles	1,082	1,593	747	213	19	3,651

1. Areas where roads under NF jurisdiction are not located on NFS land.

The total number of miles of NFS roads within the plan area has steadily been declining over the past ten years. Miles of road decommissioning has become an assigned accomplishment target. The miles of roads decommissioned are shown in Table 254. The roads that have been decommissioned were routes that were no longer needed, routes that were decommissioned to eliminate resource damage, or roads that were acquired through land exchange and are not needed.

Road maintenance practices and policies

The maintenance level of roads, as well as the amount of attention the roads receive annually, varies widely. Some of the roads are in poor locations, which increases maintenance needs and the risk that sediment from the road surface could enter the adjacent streams. The FS works to prioritize road maintenance in annual maintenance plans. These plans are based on projected budgets, the amount of traffic individual roads receive, and damage created by environmental factors such as flooding and erosion.

Routine road and bridge maintenance work (brushing, blading, ditch, culvert cleaning, deck cleaning, etc.) is periodically performed on approximately 2,500 miles of maintenance level 2, 3, 4, and 5 roads as funding allows and in most cases they are kept in a drivable condition for their designed use. The approximately 1,100 miles in maintenance level 1 (which includes roads treated for intermittent stored service), however, do not receive routine maintenance work.

Table 254 provides a summary of the accomplishments from 2007 and 2014. There has been a steady increase in the emphasis on decommissioning of both system and non-system roads over the past several years. The emphasis on decommissioning roads for specific resource concerns is expected to continue.

Table 254. 2007-2014 road maintenance accomplishments (miles)

Accomplishment Item		FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Road Maintenance	High Clearance Roads	319	333	407	461	340	20	0	4
	Passenger Car Roads	394	335	417	625	390	217	162	143
Road Improvements	High Clearance Roads	5	0	0	8	1	14	2	0
	Passenger Car Roads	16	22	6	21	2	8	0	13
Road Reconstruction	Passenger Car Roads	0	0	0	0	0	0	2	0
Road Decommissioning	All Roads	25	57	59	79	59	138	69	180

Administrative facilities

The management of buildings and other structures is held under FSM 7310. Forests are mandated to develop a facilities master plan as a guide to facilities planning. These documents are continuously updated.

Administrative facilities are typically buildings and their appurtenances necessary to support the employees, equipment, and activities necessary for the management of the NFs. These are commonly called fire, administrative, and other. Administrative facilities are separate from recreation facilities. Administrative facilities include fire stations, offices, warehouses, and shops as well as living quarters such as barrack and individual residences. Living quarters are partially supported by rental receipts, while administrative and other facilities are financially supported through annual budget appropriations.

There are two supervisor offices which serve the HLC NF plan area; one is located in Helena, MT and the other one is located in Great Falls, MT. Both of these administrated offices are leased facilities. There are eight ranger district offices dispersed throughout the forests as well as the Lewis and Clark Interpretive Center and the Augusta Information Station. The Helena Ranger District, which is co-located with the Helena NF Supervisor's Office and the Townsend Ranger District Office and Warehouse, the Judith Ranger Station, the Musselshell Ranger District, the Rocky Mountain Ranger District and Augusta Information Station are leased facilities. The Lincoln Ranger District, Belt Creek Ranger District, White Sulfur Spring Ranger District, and the Lewis and Clark Interpretive Center are NFS facilities.

There are approximately 245 FS-owned fire administrative and operations buildings. The rehabilitation or replacement of existing forest facilities that do not meet current operational standards and the disposal of those facilities that are considered surplus to the forest operational needs is a focus for the Forest program. There are actions underway to remove these facilities from the forest and from the inventory. There are approximately 20 structures that have been identified as excess across the HLC NF.

Road bridges

There are approximately 138 road bridges under the jurisdiction of the FS within the HLC NF plan area. The majority of these structures meet or exceed the minimum criteria for bridge condition. Approximately 11 are at an intolerable or minimum tolerable limit for condition.

FS policy requires two-year inspections on every bridge under FS jurisdiction. Bridges must be repaired and replaced with road maintenance funding, with a small number of structures being replaced through the capital investment program.

Many bridges within the planning area were constructed to support the timber program and are over 30 years old. Older bridges were often built with the abutments at the very edge of streams and often encroach on the stream, and are no longer in compliance with BMPs. Table 255 describes the number of bridges within the planning area, the GA in which they are located, and information concerning the condition of these structures.

Table 255. Road bridge location and condition in the HLC NF plan area

GA	Intolerable: requires high priority replacement	Meets minimum tolerable limit	Somewhat better than minimum adequacy	Equal to minimum criteria	Better than minimum criteria	Equal to desirable criteria	Superior to desirable criteria	Totals
Big Belts			1	4	1	7		13
Castles			2		1			3
Crazies				3	1			4
Divide		1	1	4	3	4		13
Elkhorns				1	1	3		5
Highwoods		1	1	1	1	2		6
Little Belts	1	6	13	16	5	5		46
Rocky Mountain		2	5	2	11	2		22
Snowies			1	2				3
Upper Blackfoot			2	4	9	6	2	23
Totals	1	10	26	37	33	29	2	138

Facilities, Dams

There are six dams in the HLC NF planning area that have been identified by the infrastructure database. These dams are inspected by the FS or by private contractor.Table 256 shows the list of dams that are located within the HLC NF planning area. The records for these dams are held at the supervisor's office and in the infrastructure database. These dams are maintained and operated by the FS, the City of Helena, or private entities. The Teague dam is privately owned and located in the Big Belt GA. This dam has not been inspected recently because it falls below the FS capacity requirements of retaining greater than 13 acre-feet of water.

Table 256. Dams by GA

GA	Dam Name	Operation Condition	Owner/Operator	Hazard Classification
Big Belts	Gipsy Lake Dam	Limited Operations	FS	Low
Big Belts	Teague	Fully Operational	Private	Low (<12 acre feet)
Divide	Chessman Dam	Fully Operational	City of Helena	Medium
Divide	Park Lake Dam	Fully Operational	FS	High
Rocky Mountain	Wood Lake Dam	Fully Operational	FS	Low
Upper Blackfoot	Mike Horse Dam	Fully Operational	FS	Low

The following information about these dams shows the relative condition of each of them. More specific information is located in the infrastructure database and in files at district offices:

- Gipsy Lake Dam is in poor condition with an under designed spillway and substantial vegetation growing over 100% of the structure. There is substantial leakage around the outlet works.
- Teague Dam is a private dam that holds back less than 13 acre feet.
- Park Lake dam is in very good condition, having been recently rebuilt. There is an early warning system in place for this structure.
- Chessman Dam, located within the Divide GA, is operated by the City of Helena.
- Park Lake Dam has an early warning system in place which is inspected and monitored by a private engineering firm located in Helena.
- Wood Lake Dam is in good condition with maintenance required on the gate controls and brushing of the embankments needed.
- Mike Horse Dam holds back mine tailings and will be removed as soon as the tailings are removed from behind the dam.

3.26.6 Environmental Consequences

Effects common to all alternatives

Road, bridge, and facility maintenance (both recurrent and deferred) would continue to occur, as funding allows. Physical conditions would continue to be addressed through maintenance activities and be based on public health and safety, resource protection, and mission priorities. Annual operating budgets and supplemental funding would likely fluctuate, resulting in varying maintenance accomplishments from year to year.

The drivability of maintenance level 1 roads can be expected to continue to diminish as roads revegetate.

Effects from forest plan components associated with:

Fire and fuels management

Fuels management activities (e.g., prescribed burning) and fire suppression actions are likely to continue under all alternatives. Administrative use of gated roads that normally prohibit motor vehicle use yearlong is likely when these management activities occur.

Fire suppression actions are also likely to continue and could result in the use of gated roads. In some cases, roads in storage (maintenance level 1) that are impassible to motor vehicle use (due to re-vegetation or other restrictive condition) may be opened to facilitate suppression actions. These roads would probably be used for the duration of suppression efforts and post-fire work then returned to their previous status. Bridge load ratings are required for all road bridges and due to the age of many of the bridges, may limit the capacity of the bridge, requiring overload permits for the equipment used for fire suppression activities.

Wildlife management

Habitat security requirements and other mitigation measures for grizzly bear can be expected to affect motorized access under all alternatives. Where roads and the access they provide are necessary, limitations on road construction and operating seasons can be expected to affect public access. Areas most affected would be bear management units in the Northern Continental Divide Ecosystem primary conservation area. The standards and guidelines associated with the Grizzly Bear Conservation Strategy would be incorporated in all alternatives.

Minerals management

The FS does not initiate exploration or development of mineral or energy resources. Proposals for exploration and development are regulated by existing mining law. Access and road development (long-term or temporary) are often associated with mineral exploration and development, but a site-specific analysis would be required prior to any approval for exploration or development activities.

If any mine reclamation activities occur they would likely, but not always, use existing roads. These may be roads that are not currently designated for motor vehicle use. They would likely be used for the duration of the reclamation work and then returned to their previous status. New roads, trails or other types of access may be approved for a proposed mining operation as long as the proposal is incident to mining and within the scope of the next logical phase of mining development and subject to a site specific analysis.

Aquatic ecosystems management

Watershed improvement activities are likely to continue under all alternatives. The consequences to motor vehicle access to implement watershed improvements are expected to be minimal. Activity that would occur on roads that are generally not designated for motor vehicle use are treatments to reduce sediment production and transport sediment to surface waters or to provide for aquatic organism passage. Actions taken might include culvert removal, out-sloping of road prisms, or the removal of unstable fills.

Watershed treatments will continue to be completed on roads that are designated for motor vehicle use and may result in traffic delays or temporary road closure of open roads while construction occurs.

Effects common to all action alternatives

Table 257 describes the effects common to all action alternatives, based on draft plan components.

Table 257. Summary of plan components and their effects to infrastructure

Plan component	Expected effects
FW-WTR-GDL-02	Installation of drainage features would increase the stability of the road and reduce its deterioration for long term storage.
FW-CWN-OBJ-01	Repairing stream crossings would protect the road and avoid future road failure during high water event.
FW-CWN-GDL-02	Due to limited funding allocations for road maintenance, prioritizing road maintenance and obliteration to travel routes that directly affect streams verses roads that are ecologically disconnected from streams, may result in roads with higher public use not receiving road maintenance, reducing their drivability.
FW-RMZ-GDL-04 & FW-RMZ-STD-01	Avoiding construction of roads in RMZs may reduce access or increase cost of construction.
FW-VEGT-GDL-01	User safety and facility protection need to be considered when limiting vegetation removal.
FW-WL-GDL-10	Due to high deferred maintenance costs and national direction to reduce excess infrastructure, removal of buildings housing bats may be necessary and mitigation measures may be required.
FW-RECWILD-SUIT-08-09, FW-WSA-GDL-05-06	New administration facilities may be required for management activities due to travel time.
FW-CR-DC-02	Maintaining cultural and historic characteristics of existing buildings may result in increased costs for building materials and the use of less maintenance free products.
FW-RT-OBJ-01-03	The number of miles decommissioned, maintained, reconstructed or improved varies on available funding and the number vegetation management projects contributing to road management activities.
FW-RT-STD-02	Requiring all new, reconstructed and replaced crossings to meet the 100-year flow event would increase the cost and limit the number completed each year but provide increased road protection during high water events.
FW-RT-GDL-01	No effect.
FW-RT-GDL-02 & 04	Installation of drainage features would increase the stability of the road and reduce its deterioration for long term storage.
FW-RT-GDL-05 & 07	Not locating roads on lands with high mass wasting potential or wetlands and unsuitable areas would increase the stability and longevity of the road but may result in increased construction costs to avoid those areas.
FW-RT-GDL-10	Requiring annual operating plans on all new, reconstructed and replaced crossings in fish bearing streams would increase the cost and limit the number completed each year but provide increased road protection during high water events.
FW-BRDGE-DC-01, 02	These DCs would ensure that bridges and culverts are managed to provide safe access while protecting natural and cultural resources, and provide for aquatic organism passage.
FW-BRDG-GDL-01	No effect.
DI-FAH-STD-01	Requiring all new crossings to meet the 100-year flow event would increase the cost and limit the number completed each year but provide increased road protection during high water events.

Effects of plan components associated with:

Aquatic ecosystems management

Under all action alternatives, FW-RMZ-STD-01, delineating the size of riparian areas, would now limit road construction actives according to Categories 1-4, on both sides of the Continental Divide, which may result in reduced access and/or increased construction costs.

There are numerous plan components in infrastructure (FW-RT-STD-01 through 04; FW-RT-GDL-01 through 12) that are designed to minimize sediment from roads to waterbodies. Generally, these plan components would not affect the public use of roads except for decommissioned roads which would be more difficult to travel on but would improve road conditions through proper BMPs and maintenance.

Alternative A, no action

The no-action alternative is represented by the existing 1986 Forest Plans, as amended (See Table 258). There are three RWAs in this alternative, where mechanized means of transport and limited motorized uses are allowed. About 4.0 miles of open roads that are currently within the RWAs, within the Big Belts and Divide GA, would continue to be used as open motorized routes.

Under the no-action alternative, the current forest plan would continue to apply national BMPs and west of the continental divide directions from INFISH would be carried forward. The existing plan was developed to provide guidance and objectives to build the infrastructure that was needed to support land management activities for the future and those objectives have been achieved and continued growth in infrastructure is no longer needed at the rate laid out in the 1986 plans.

Table 258. Summary of existing plan components and their effects to infrastructure

Plan component	Expected effects
Facilities, Objective Lewis & Clark NF	Increasing the existing road system by an average 17 miles/year for the next 50 years is not sustainable or needed.
Facilities, Objective Helena NF	Increasing the existing road system by an average 22 miles/year over the next decade is not sustainable or needed.
Facilities, Road Standard 3	Not locating roads, trails and other linear features on lands with high mass wasting potential would increase the stability and longevity of the roads but may result in increased construction costs to avoid those areas.
INFISH RF-2d	No effect.
INFISH RF-2f	Requires minimizing side casting into or adjacent to waterbodies when blading roads and plowing snow. This only applies to INFISH priority watersheds. No effect.
INFISH RF-4	Requires installation of a 100-year crossing structure where “a substantial risk to riparian conditions” may exist. This is less stringent than the revised plan component which requires all new, reconstructed and replaced crossings to meet the 100-year flow event.

Effects that vary by alternative

Alternative B is the proposed action. There are nine RWAs in this alternative. Motorized and mechanized means of transport in RWAs would not be allowed. About 11.8 miles of open roads that are currently within the RWA, the Snowies GA may need to be to be removed from the system after site-specific analysis. In addition, about 57 miles of closed roads (maintenance level 1) that are currently within the RWAs may need to be to be removed from the system after site-specific analysis.

Under alternative C, the RWAs are the same as alternative B, but existing motorized and mechanized means of transport would be allowed. About 11.8 miles of open roads that are currently within the RWA, within the Snowies GA, would continue to be used as open motorized routes.

Alternative D represents more undeveloped recreation areas, and includes the greatest amount of RWAs and least amount of lands suitable for timber production. Motorized and mechanized means of transport in RWAs would not be allowed. About 23 miles of open roads that are currently within the RWAs, within the Big Belts, Castles, Little Belts, Snowies and Divide GA, may need to be to be removed from the system after site-specific analysis. In addition, about 130 miles of closed roads (maintenance level 1) that are currently within the RWAs may need to be to be removed from the system after site-specific analysis.

Alternative E represents the most motorized use on NFS lands and would require no removal of open roads as a result of not identifying RWAs.

Effects from forest plan components associated with:

Vegetation management

Commercial timber harvest activities would generally result in road maintenance, reconstruction and continued application of BMPs on existing NFS roads. New road construction is likely to be limited and temporary road construction used as a more common method for short-term access needs.

Administrative use of gated roads that normally prohibit motor vehicle use yearlong would be likely when management activities such as pre-commercial thinning, invasive weed treatments, or other non-commercial silvicultural treatments are planned.

Bridge load ratings are required for all road bridges and due to the age of many of the bridges and may limit the capacity of the bridge, requiring overload permits for the equipment used for commercial timber harvest activities.

Alternative E would generally be expected to result in the least amount of vegetation management activities and result in a lower amount of road use compared (respectively) to alternatives A, B, C and D. Consequently, reduced traffic (i.e., number of vehicles on roads), both commercial and administrative, can be expected for alternative E. Associated with reduced commercial use is the reduction of road reconstruction to standard and BMPs work. Road and bridge maintenance activities done in conjunction with commercial use would also occur less often since this work is only required commensurate with use.

Cumulative effects

The Forest is likely to be influenced by a variety of factors. Given the mixed land ownership (state lands, corporate timberlands) in and around the Forest, and the continuing management actions taken on these lands, there may be options for new access opportunities through cooperative and cost-share agreements.

Commercial traffic (timber hauling) can be expected to fluctuate to some degree, relative to vegetation management activities. Market conditions and other external factors can often influence activity levels. These traffic conditions are usually limited to relatively small GAs and short periods of time. Hauling occurs more often during the summer months, but is not uncommon during the winter months as well.

Change in ownership of private lands can result in continued requests for road access across NFS lands. Depending on the circumstances, these may be requests for forest or private road special use authorization. Depending on the terms and conditions written into any new authorizations, opportunities for access to NFS lands may be created.

State and local government agencies with road management authority can be expected to continue to maintain their existing road network across the Forest. Some changes such as widening, resurfacing, and bridge replacements are probable but are dependent on budgets and funding allocations. The likelihood of jurisdiction of NFS roads being passed to other public road agencies is low.

Some adjacent lands are subject to their own management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 259, for those plans applicable to roads and bridges.

Table 259. Summary of cumulative effects to infrastructure from other resource management plans

Resource plan	Summary of effects
Forest Plans of Adjacent National Forests	The Flathead, Lolo, Beaverhead-Deerlodge, and Custer-Gallatin NFs are adjacent to the HLC-NF, and share boundaries on specific GAs (Rocky Mountain Range, Upper Blackfoot, Divide, Elkhorns, and Crazies). The Flathead and Custer-Gallatin are currently in forest plan revision under the 2012 planning rule. The Beaverhead-Deerlodge is guided by a recent forest plan (2009) developed under the 1982 rule. The Lolo is guided by a 1986 forest plan and is expected to undergo revision relatively soon. Generally speaking, management of infrastructure is consistent across NFs due to consistency in law, regulation, and policy. The management of the specific areas that are adjacent would be complementary across boundaries.
BLM Resource Management Plans	The Butte, Missoula, and Lewistown field offices manage lands that are intermixed with the HLC-NF. The Missoula and Lewistown areas are currently in revision. The Butte area is guided by a recent plan (2009). At a broad scale, the themes of the plans are similar to the HLC NF; infrastructure would be generally be managed in a similar manner and with similar results.
County growth plans	Many of the county growth plans associated with the HLC NF plan area emphasize an interest in recreational uses and access, water quality and wildfire protection which are consistent with the infrastructure plan components.

Conclusions

Under the no-action alternative, the current forest plan would continue to apply national BMPs. West of the continental divide, directions from INFISH would be carried forward. In all action alternatives, plan components developed to support and improve watershed and aquatic management areas, including creation of RMZs, which would increase the GA where road construction limitations are applied. This change would likely result in a decrease in possible motorized access in those areas and an increase in construction costs to avoid RMZs.

RWAs would have a direct effect on motorized use across the GAs and would vary across all action alternatives as well as the no-action alternative. Alternative D proposes the most RWAs and contains the most open road within those areas followed by alternatives B, C, A and E where there are no RWAs and therefore no effect to open roads. In all alternatives, the total number of miles of open road that would be effected by RWAs would be minor compared to the total number of miles of open roads across the Forest.

Road, bridge and facility maintenance (both recurrent and deferred) would continue to occur, as funding allows. Physical conditions would continue to be addressed through maintenance activities and be based on public health and safety, resource protection, and mission priorities. Road and bridge maintenance would continue under all alternatives but maintenance activities would tend to be greater in the alternatives that allow for more commercial timber harvest activities, alternatives D, C, B A and E respectively.

Plan components in the draft plan that would require all new, reconstructed and replaced crossings to meet the 100-year flow event would increase the cost and limit the number completed each year but would provide increased road protection during high water events.

Under all alternatives, administration facilities would continue to be repaired or replaced to meet current operational standards. They would be disposed of if they are considered surplus to the forest operational needs. Action plan components that maintain cultural and historic characteristics of existing buildings may result in increased costs for building materials and the use of less maintenance free products.

Under all alternatives, the FS would continue to maintain dams in working condition and will continue to work with other agencies regarding their operations. The FS would continue to inspect these structures in compliance with the designated frequency.

3.27 Social and Economics

3.27.1 Introduction

The mission of the FS is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations. The HLC NF lands both influence, and are influenced by, local and national publics. Local communities, particularly those adjacent to NFS lands, benefit from a multitude of goods and services provided by the Forest and the FS. These societal benefits are often referred to as ecosystem services, which are defined "as goods and services provided wholly or in part by ecosystems and that are of value to people" (Olander et al. 2015). The Forest's ecosystem services, alongside infrastructure and operations, are the main ways that public lands contribute to social and economic sustainability. Many local communities were formed based on availability of roads and ecosystem goods and services such as timber, minerals, grazing lands, and other natural resources. Historically, individuals in these communities have benefited from a host of services such as recreation, scenery, employment and opportunities to connect with nature. The general public across the U.S. also benefit from the HLC NF. The key benefits the Forest and the FS provide include: recreation, income, jobs, scenery, clean water, cultural, historic and tribal resources, designated areas (e.g. wilderness), fire suppression, fish and wildlife, grazing, infrastructure, timber, other forest products and wood for fuel, energy and minerals, public information, interpretation and education and carbon storage and sequestration.

The 2012 Planning Rule states that plans are to guide management so that forests and grasslands contribute to social and economic sustainability, providing communities with ecosystem services and multiple uses that deliver a range of social, economic, and ecological benefits in the present and into the future. Specifically, plan components must include standards or guidelines to guide the plan area's contribution to social and economic sustainability, taking into account ecosystem services as well as multiple uses that contribute to local, regional, and national economies and communities in a sustainable manner. Furthermore, reasonably foreseeable risks to societal benefits shall be considered when developing the forest plan.

This section, therefore, (1) describes the social and economic conditions of the affected environment using key indicators of social and economic sustainability; (2) describes how key benefits of the Forest currently contribute to social and economic sustainability of beneficiaries, both locally and at a broader scale (3) evaluates the impacts of the proposed forest plan and alternatives on the benefits the Forest provides to local beneficiaries and the general public.

The Assessment identified an analysis area for the social analysis of 13 primary area counties and seven secondary areas counties. The factors for determining the social analysis area include recreational visitation, travel corridors, and social and cultural identity. The counties where the HLC NFs are located and that meet most of these factors are considered "primary analysis area counties", or primary areas. The counties that do not meet most of these factors and do not contain HLC NFs land are considered "secondary analysis area counties", or secondary areas.

The 13 primary counties are grouped into four areas:

- West: Broadwater, Jefferson, Lewis and Clark, Powell Counties
- North: Glacier, Pondera, Teton Counties
- Central: Cascade, Chouteau Counties
- East: Meagher, Judith Basin, Wheatland, Fergus Counties

Secondary area counties include:

- Missoula County

- Deerlodge County
- Gallatin and Park Counties
- Golden Valley and Sweet Grass Counties
- Yellowstone County

It is important to note that the social area of influence is distinct from the economic area of influence. Each GA is defined by a separate methodology. In the case of the economic area of influence for the HLC NF, there are 16 counties.

Ordered by population from highest to lowest, these 16 counties include: Gallatin, Cascade, Lewis and Clark, Park, Glacier, Jefferson, Fergus, Deer Lodge, Powell, Pondera, Teton, Chouteau, Broadwater, Wheatland, Judith Basin, and Meagher County. A visual display of these adjacent and overlapping areas is provided below in Figure 18. Details on the selection process for counties is found in appendix B.

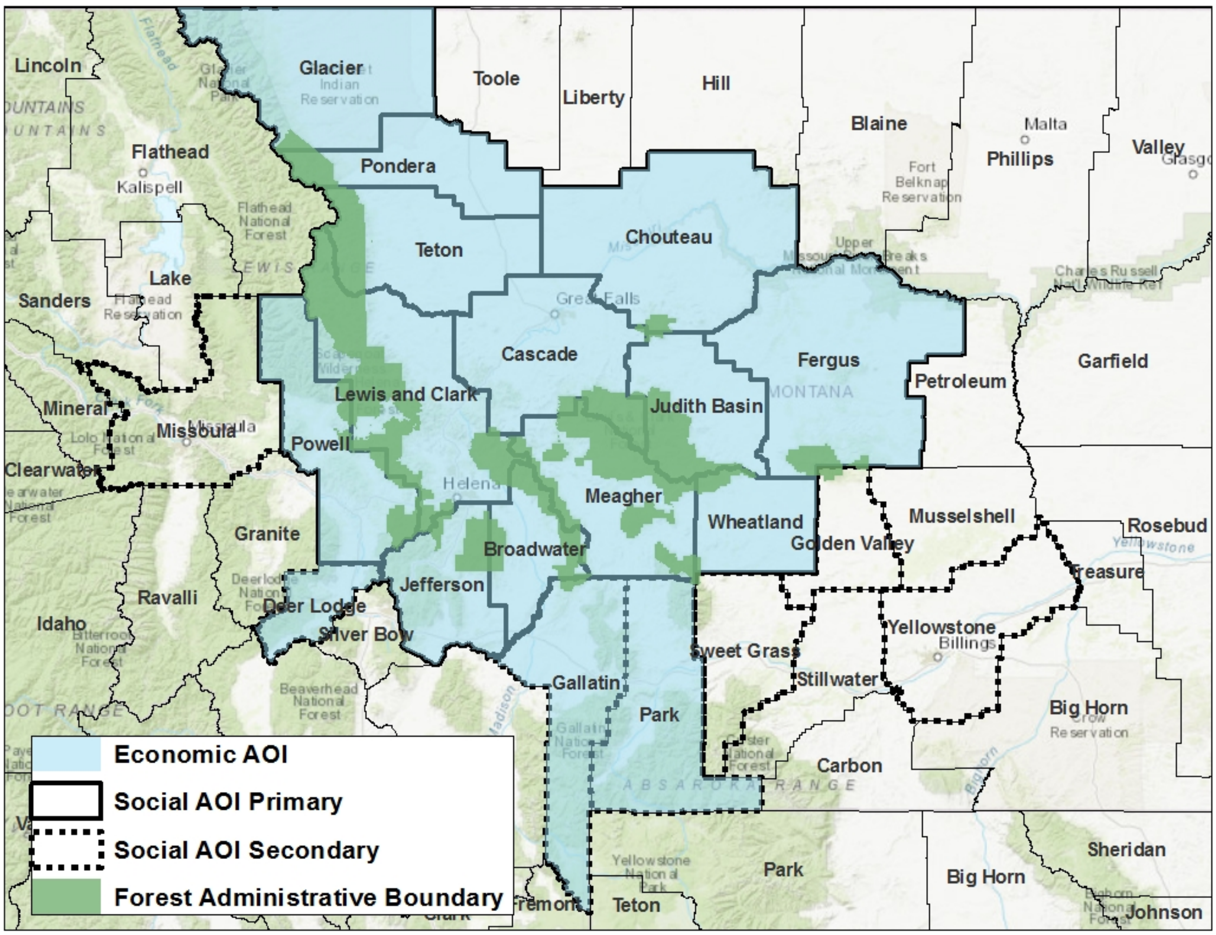


Figure 18. Map of the Economic and Social areas of influence for the HLC NF

Key indicators

Economic conditions

The economic conditions of the area of influence are assessed using the following indicators: employment (jobs and unemployment levels), income (labor and non-labor), Federal Land payments, and economic diversification. Existing conditions are accessed through the Economic Profile System – Human

Dimensions Toolkit (EPS-HDT) (http://headwaterseconomics.org/tools/eps-hdt), and report data are sourced from the U.S. Department of Commerce, and other Federal sources.

Social conditions

The social conditions of the area of influence are assessed using the following indicators: demographic characteristics and trends (population size, change and composition), land ownership and development patterns, percent of land within the WUI, and county health levels. County health rankings data are sourced from the Population Health Institute at University of Wisconsin. For an in-depth description of health metrics, please see the Assessment. Population, land ownership and WUI data are provided by the Economic Profile System – Human Dimensions Toolkit.

Societal benefits

The indicators of contributions to social and economic sustainability are the key societal benefits the Forest provides to beneficiaries. These societal benefits contribute to the social and economic sustainability of the area of influence (i.e. affected communities and beneficiaries) by enhancing the quality of life of the public. Quality of life is defined as the general level of wellbeing of individuals and society. The concept of quality of life encompasses all aspects of life including employment and health. For the purposes of this analysis, income, jobs, health, safety and well-being are often discussed separately to emphasize the specific ways the Forest enhances quality of life.

The Forest benefits include ecosystem services, multiple uses, infrastructure and contributions from management operations such as educational programs and fire suppression. The key benefits were identified through interdisciplinary discussions with Forest staff and comments from the public.

The key benefits to society provided by the forest include:

- Carbon storage and sequestration
- Clean water
- Cultural, historic and tribal resources (including spiritual experiences and non-use values)
- Designated areas (including solitude, inspiration, non-use values and research)
- Direct income and jobs
- Energy and minerals
- Fire suppression (and mitigation)
- Fish and wildlife (including non-use values)
- Grazing (including non-use values)
- Ecosystem integrity (including erosion control, flood protection, and non-use values)
- Infrastructure
- Other forest products and wood for fuel
- Other income and jobs
- Public information, interpretation and education
- Recreation (including solitude, spiritual experiences and inspiration)
- Scenery (including aesthetics and non-use values)
- Timber

3.27.2 Regulatory framework

The following is a select set of statutory authorities that govern the evaluation of social and economic resources in the plan area. There are multiple other laws, regulations, and policies - including those at the beginning of chapter three - that also guide the management of this resource.

Office of Management and Budget Circular A-116 (issued August 16, 1978): Requires executive branch agencies to conduct long range planning and impact analysis associated with major initiatives.

Executive Order No. 12898 on Environmental Justice (issued February 11, 1994): Mandates federal agencies to make achieving environmental justice part of their mission. This includes identification and response to disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

National Forest Revenue Act (amended 1908): Requires 25 percent of revenues generated by NFS lands to be paid to the States for use by the counties in which the lands are situated for the benefit of public schools and roads.

3.27.3 Assumptions

This analysis assumes that social conditions in the plan area will continue to follow observed trends. Population trends are expected to follow a similar trajectory as observed between 2000 and 2010.

3.27.4 Best available scientific information used

Data describing the social environment are taken from the Assessment. Data for the Assessment were "gathered in large part from perusal of Chambers of Commerce webpages, county planning documents, economic development groups and the like" (USDA 2015b). Demographic data are sourced from government entities through the Economic Profile System – Human Dimensions Toolkit. This data platform harmonizes data from the Bureau of Economic Analysis, the Bureau of Labor Statistics, and the US Census Bureau. The Planning Rule directs analysis to be conducted based on pre-existing information and does not encourage the collection of new, primary data to assess social conditions. Given these data constraints, the data used in the analysis of the social environment are the best available.

Data available for analysis of economic impacts are provided through the latest version of IMPLAN software, owned and sold by MIG, Incorporated. Data accessed through IMPLAN software originates from county business patterns of the U.S. Census bureau, and other Federal sources.

3.27.5 Affected environment

Social Conditions

West county group

Population dynamics

The West area is comprised of Broadwater, Jefferson, Lewis and Clark and Powell Counties. This area experienced significant population growth between 2000 and 2012, a 13 percent increase. Broadwater County experienced the most significant growth, a 27 percent increase. Powell County was the exception, losing almost 2 percent of its population during the same 2000 to 2012 period. The significant rise in population indicates increased demand for the benefits the Forest provide as well as increased stresses on vulnerable resources. Domestic migration was the main driver of population change between 2000 and 2012, with significantly more Americans moving into the West area counties than exiting. The population in the West area is slighter older than that of Montana as a whole, with median ages in the four counties ranging from 41 to 47 (compared to 39 for Montana). The population in the West area is also aging. Between 2000 and 2012, all four West area counties experienced a rise in median age, between 7 and 16 percent. This suggests that more residents may be entering retirement in the coming decades. In 2012, those aged 50 to 60 comprised the largest proportion of the West area population.

Health outcomes in the West area, as measured by the County Health Rankings composite indicator, vary by county. Broadwater, Jefferson and Lewis and Clark Counties ranked in the top half of all counties in

Montana for overall health outcomes. Powell County ranked in the bottom half, indicating that overall health outcomes in Powell County are below the Montana county average.

Land ownership, development patterns, and wildland-urban interface

Almost half of all lands in the West area, 42.5 percent, are NFS lands. Thus, these four counties are heavily impacted by FS land management decisions, particularly in terms of areas available for development. Land use is also relevant as development of private lands can influence adjacent, NFS lands. Impacts to wildlife habitat and increased recreational use are primary considerations. Residential acreage in the West area increased by 58 percent between 2000 and 2010, a substantial change. Land area (mi^2) in the wildland-urban interface (defined by Headwaters Economics as private forestlands that are within 500 meters of public forestlands), comprises 404 mi^2 of the West area. Only 5 percent of this area contains homes. This suggests that while residential acreage is increasing, residential development is occurring primarily outside of the WUI.

North county group

Population dynamics

The North area is comprised of Glacier, Pondera and Teton Counties. This area experienced a slight loss in population between 2000 and 2012, a 2 percent decrease. Teton County experienced the most significant loss, a 6 percent decrease. Glacier County had a slight uptick in population, with an increase of 1 percent. Domestic outmigration was the main driver of population change between 2000 and 2012, with significantly more Americans moving out of the North area counties than moving in. This could indicate a lack of economic opportunity in the area which is driving residents to seek employment elsewhere. The populations in Pondera and Teton Counties, similar to West area counties, are relatively older than the state average, with median ages of 43 and 46, respectively. Conversely, the Glacier County population is relatively younger, with a median age of 31 in 2012.

Health outcomes in the North area, as measured by the County Health Rankings composite indicator, vary by county. All three counties is the area ranked in the bottom half of all Montana counties, indicating that overall health and access to health services are below most other counties in the state.

Land ownership, development patterns, and wildland-urban interface

Only 8 percent of all lands in the North area are owned by the FS. There is significant variation in NFS land ownership by county. Teton County has the greatest percentage of total area under FS management, at 16 percent. Glacier County has the least, with only 2 percent. The National Park Service has a considerably larger stake in Glacier County, managing 19 percent of the area in Glacier County. Tribal lands comprise the most significant portion of Glacier County land, at 71 percent. 35 percent of all lands in the North are under tribal ownership, considerably more than in Montana overall. Considering the extent of tribal land ownership, NFS land management decisions are likely particularly relevant to tribal governments in the North area.

Residential acreage in the North area increased by 19 percent between 2000 and 2010. Teton County experienced the greatest change, with an increase of 24 percent. Land area (mi^2) in the wildland-urban interface comprises 21 mi^2 of the North area. Only 3 percent of this area contains homes. The North area has considerably fewer homes in the WUI, compared to Montana overall.

Central county group

Population dynamics

The Central area is comprised of Cascade and Chouteau Counties. While Cascade County experienced a slight increase in population between 2000 and 2012 (1 percent), Choteau County saw a 3 percent decrease. Both counties experienced significant outmigration. However, the higher number of births in Cascade County accounted for the slight net population increase. Similar to the North area counties, the observed outmigration could indicate a lack of economic opportunity in the area. Given the higher birth rate, it is not surprising that the median age in Cascade County is lower than that of Choteau County (38.7 vs. 41.5). Both counties experienced an aging of their populations between 2000 and 2012. Median ages increased by approximately 5 percent.

Health outcomes in the Central area, as measured by the County Health Rankings composite indicator, for both Cascade and Chouteau Counties, ranked in the bottom half of all Montana counties. Cascade County ranked 27th and Choteau County ranked 20th, out of 46 ranked Montana counties.

Land ownership, development patterns, and wildland-urban interface

81 percent of total acres in the Central area are privately owned. The FS manages a total of just 5 percent of lands in Cascade and Chouteau Counties. State trust lands comprise 9 percent of the Central area. Considering the extent of private and state land ownership, FS land management decisions are likely particularly relevant to state and private forestry managers.

The Central area experienced a significant uptick in residential acres between 2000 and 2010, an increase of 52 percent. Cascade County had considerably more development in the ten year period than Chouteau County. Residential acreage increased by 22.5 mi^2 in Cascade County and only 0.4 mi^2 in Chouteau County. Land area (mi^2) in the wildland-urban interface, comprises 78 mi^2 of the Central area. The vast majority, 71mi^2, of the WUI in the Central area is located in Cascade County. 12 percent of the WUI in Cascade County contains homes. The percent of homes in the WUI in Cascade County is higher than the state average of 9 percent.

East county group

Population dynamics

The East area is comprised of Meagher, Judith Basin, Wheatland and Fergus Counties. This area experienced significant population loss between 2000 and 2012, a 4 percent decrease. The largest population losses, on a percentage basis, occurred in Judith Basin County, where population declined by 12 percent between 2000 and 2012. Similar to counties in the North and Central areas, counties in the East lost population due mainly to net outmigration, save Meager County, which had a very slight increase in net migration over the same period.

The population in the East area is considerably older than that of Montana, with median ages in the four counties ranging from 47 to 51 (compared to 39 for Montana). The population in the East area is also aging more rapidly than the state as a whole. Between 2000 and 2012, all four East area counties experienced a rise in median age, between 10 and 22 percent.

Health outcomes in the East area, as measured by the County Health Rankings composite indicator, vary considerably by county. Fergus County (ranked 5th) and Judith Basin County (ranked 13th), have some of the best health outcomes in the state. Conversely, Meagher County (ranked 38th) and Wheatland County (ranked 28th) had outcomes far below the state average.

Land ownership, development patterns, and wildland-urban interface

Similar to the Central area, the bulk of lands in the East are privately owned (71 percent). While the FS manages just 16 percent of East area lands overall, there is considerable variation across counties. The FS manages 33 percent of Meagher County lands and just 6 percent of Fergus County lands. The BLM manages 11 percent of Fergus County lands, suggesting that FS land management decisions are highly relevant to the managers of that agency. In Judith Basin County, state trust lands account for 8 percent of total lands, suggesting a need for the FS to work closely with state trust land managers when implementing decisions that may affect East area lands.

The East area is sparsely populated. While residential acres increased by 75 percent between 2000 and 2010, the vast majority of lands are still undeveloped. Less than half of one percent of private lands are developed residential acres in the East area. Fergus County had the most developed acres, with 9.3 mi^2 in 2010. Wheatland County has the least, with only 1.9 mi^2. Land area (mi^2) in the wildland-urban interface, comprises 168mi^2 of the East area. Less than one percent of the WUI area contains homes.

Summary

Table 260 summarizes the key social conditions across the HLC NF counties.

Table 260. Summary of key social conditions by county areas

	West	North	Central	East
Population trend	Increasing	Declining	Stable	Declining
Percent of WUI lands with homes	5	3	12	<1
Health outcome	Above average	Below average	Below average	Varies by county

Economic conditions

The area of influence described in the section is different from the social analysis area. The economic area of influence is comprised of 16 counties, an area identified with the most recently available data through methods detailed in the USDA FS Protocols for Delineation of Economic Impact Analysis Areas (METI, 2010).

The Assessment provided details on the economic characteristics and trends including: sector and industry presence (jobs), employment (unemployment rate), income (labor and non-labor), and economic diversification (Shannon-Weaver index). The data in the Assessment were reviewed to determine which economic conditions may be relevant for analyzing the effects of the proposed action and alternatives on economic sustainability. With this lens in mind, the “affected environment” section provides a more focused summation of the economic conditions in the analysis area. Relevant economic conditions are summarized by characteristic.

Total population, employment, and personal income trends since 1970 fluctuate widely across the area of influence counties. Population change since 1970 ranges from 219 percent to negative 42 percent, a measurement for Gallatin and Deer Lodge counties, respectively. Employment change since 1970 ranges from 510 percent to negative 26 percent, a measurement again for Gallatin, and Deer Lodge counties, respectively. Lastly, personal income change since 1970 ranges from 664 percent to negative 11.4 percent, a measurement for Gallatin and Chouteau counties, respectively.

Unemployment and industry presence fluctuate across counties. Unemployment rate ranges from 8.6 percent to 2.8 percent, a measurement for Glacier and Gallatin counties, respectively. Timber industry presence in private employment ranges from 25 percent to 0 percent, a measurement for Powell, and many other counties, respectively. Mining industry presence in private employment ranges from 10 percent to 0 percent, a measurement for Jefferson and many other counties, respectively. Agriculture industry presence in private employment ranges from 32 percent to 1.6 percent, a measurement for Judith Basin, and Lewis and Clark and Gallatin counties, respectively. Lastly, travel and tourism industry presence in private employment ranges from 33 percent to 14.3 percent, a measurement for Meagher, and Wheatland counties, respectively.

For most primary counties, timber industries do not represent significant employment. The exceptions are Powell and Broadwater County, which collectively have more timber jobs than the rest of the area of influence. Table 261 provides the most current data on timber industry employment in the multi-county area, as observed by the U.S. Census Bureau County Business Patterns. An estimated 804 private industry timber jobs exist in this multi-county area.

Table 261. Timber industry subsector private employment in primary counties, 2015

County	Growing and harvesting	Sawmills and paper mills	Wood Products manufacturing	Total timber	Total private employment
Powell	113	165	2	280	1119
Broadwater	0	165	0	165	854
Gallatin	21	29	63	113	43091
Park	6	91	2	99	4961
Lewis and Clark	9	26	17	52	25198
Jefferson	1	46	2	49	1769
Cascade	1	14	16	31	30802
Teton	0	7	0	7	1179
Meagher	3	0	0	3	289
Chouteau	2	0	0	2	728
Deer Lodge	2	0	0	2	2758
Glacier	1	0	0	1	2164
Pondera	0	0	0	0	1334
Wheatland	0	0	0	0	364
Judith Basin	0	0	0	0	189

Benefits to society contributed by the HLC NF, including benefits directly contributing to jobs and income for communities are described in detail in the following section.

Societal benefits

The Forest provides a suite of key benefits to local communities, national and even international publics. While some benefits may be relevant to all beneficiaries (local and global), other benefits are more localized, such as jobs maintaining roads on NFS lands. Below is a discussion of the societal benefits the Forest provides and how they contribute to social and/or economic sustainability. Specifically, benefits are described in relation to how they contribute to income and jobs, protecting health and safety or/and contributing to well-being more generally. Relevant social conditions and public comments, where data are available, are examined to determine the magnitude of the contribution provided by the given benefit. Risks and stressors that may affect the ability of the Forest and the larger landscape to continue to contribute to social or economic sustainability are also considered. To gather public input, the interdisciplinary team, in partnership with the Center for Natural Resources & Environmental Policy at the University of Montana conducted several rounds of workshops in ten key local communities. These communities, aggregated by area, are:

- West: Augusta, MT; Helena, MT; Lincoln, MT; Townsend, MT
- North: Browning, MT
- Central: Choteau, MT; Great Falls, MT;
- East: Harlowton, MT; Stanford, MT White Sulphur Springs, MT

During the workshops, public input was captured by session facilitators and summarized in workshop reports. The comments captured in the reports (CNREP 2015; CNREP 2015a; CNREP 2016; CNREP 2016a; CNREP 2016b) do not provide a statistically significant sample of public opinion. They do provide insight, however, into the key forest benefits workshop attendees' care about most. Figure 19 summarizes the comment topics by social area. In the description of Forest benefits below, public input is sourced from the aforementioned workshop summary reports. In addition to the seventeen key benefits previously identified, workshop participants also raised concerns about managing for conflicts between users groups and the importance of collaboration in management. Stakeholders expressed a keen interest in collaboration and partnerships. Several participants expressed that the Forest should make every effort to include private land owners, tribal governments and local governments in the decision-making processes.

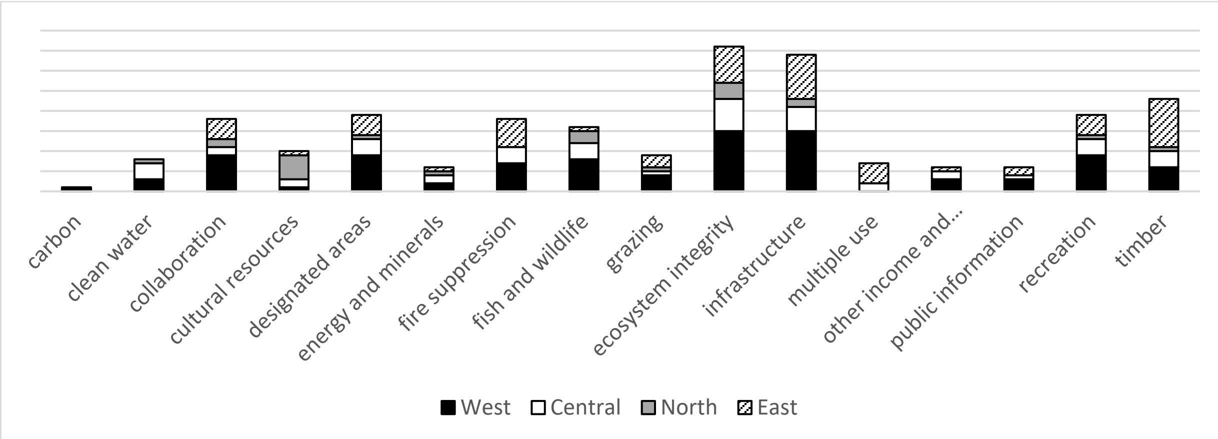


Figure 19. Public workshop comments by social area[1]

1. Data source: CNREP 2015; CNREP 2015a; CNREP 2016; CNREP 2016a; CNREP 2016b

The following subsections describe the key societal benefits of each of the resource area. Refer to the sections for each resource for more complete information.

Carbon storage and sequestration

Workshop participants from West area communities noted the importance of carbon sequestration as a key benefit that protects public health by mitigating the amount of carbon dioxide released into the atmosphere. Both national and international citizens and businesses have a keen interest in reducing the amount of carbon dioxide released into the atmosphere (C2ES 2017). The Paris Climate Change Accord compelled nations around the globe to reduce carbon dioxide emissions and increase carbon storage and sequestration, with a particular focus on reducing emissions from deforestation (Krupp 2015). There is strong support, both at home and abroad, for implementing policies that reduce harmful carbon dioxide emissions (World Bank 2009).

Communities surrounding the Forest are growing and residential acres are increasing, particularly in the West and Central areas, where residential acres increased over 50 percent between 2000 and 2010. One of the primary detractors of sequestration is the conversion of land to other uses – in addition to the urban sprawl, many areas surrounding the Forest have long been converted to agriculture rather than native plant communities. These changes in land use limit the ability of surrounding landscapes to store as much carbon as they have in the past. Thus, the role public lands play in carbon storage and sequestration will become increasingly more important as residential land use trends continue.

Clean water

Many communities depend on ground and surface water from the Forest for both drinking water and agricultural irrigation. These include larger cities such as Helena and Great Falls, and smaller towns including Neihart and White Sulphur Springs. At least 100,000 residents, or one in ten Montanans, rely on water sourced from the Forest for their drinking water.

Workshop participants in the West, Central, and North areas all mentioned clean water as a key benefit that supports income and jobs through agriculture and protects community health by providing safe drinking water. Watershed restoration was a top priority for some local stakeholders. As populations in Helena and Great Falls continue to grow, demand for clean water will follow suit.

Cultural, historic, and tribal resources

Hundreds of cultural, historic and tribal resources exist on the Forest. Stakeholders mentioned cultural, historic and tribal resources as key benefits that enhance quality of life and support income and jobs through tourism. Stakeholders expressed an interest in increasing efforts to restore historical and cultural resources. They also expressed a desire for increased interpretation and stewardship programs. Preservation of cultural resources and values was mentioned as a key benefit by workshop participants in communities across all areas of the Forest. The Badger Two Medicine area was of particular concern to workshop participants in North area communities, which are also environmental justice communities.

Designated areas

The Forest has a plethora of designated areas. Some are designated by Congress while others are designated at the administrative level. Designated areas on the Forest include: IRAs, national recreation trails, a national scenic trail, a national historic trails, recreation areas, RNAs, a cultural district, experimental forests, wilderness areas, WSAs, WSRs, and a wildlife management unit. While each type of designation is unique and has a different management goal or philosophy, the overarching themes for designated areas are to protect ecological integrity and biodiversity, provide the public with opportunities to connect with, be inspired by, and learn from nature and history, and provide scientists with opportunities to study natural processes and impacts of management actions.

Designated areas may enhance the quality of life of both visitors and non-visitors. Visitors to designated areas have opportunities to engage in a multitude of experiences which enrich their quality of life. These include, but are not limited to: carrying out cultural traditions, challenging recreational pursuits, research, exercise, alleviating stress through connecting with nature, learning about history and culture, and becoming inspired by iconic scenery. Extensive literatures from the fields of public health, environmental sociology and environmental psychology document the health benefits (physical, mental and emotional) of connecting with nature and exposure to pristine landscapes (APHA 2013; Zelenski and Nisbet 2014).

Those who never visit a designated area may also obtain benefits from the area. For example, Cordell and others (2005) find that most Americans are inspired by just knowing a wilderness or primitive area exists, even if they never visit. Cole (2005) highlights the symbolic value of wilderness areas, which serve as demonstrations of human restraint and humility. Designated areas also enhance quality of life through science. Designated areas, and particularly RNAs, provide opportunities for scientific discoveries that advance knowledge for the benefit of society.

Level of access and permitted uses vary by designated areas, and are determined by the laws, regulations, goals and management principles of the given area. Designated areas, their associated level of access, and the array of opportunities offered to the public, are described in detail in the congressionally designated areas and the administratively designated areas sections.

Stakeholders mentioned designated areas as key benefits that enhance quality of life by supporting income and jobs through tourism and supporting community health by providing opportunities to connect with nature and be inspired by wild landscapes (which enhances both physical and emotional health). Stakeholders expressed interest in identifying areas on the Forest that contain underrepresented ecosystems and in prioritizing these areas for consideration of wilderness designation. There was also concern for the health of wilderness landscapes and a desire for integrated restoration in wilderness areas. Stakeholders also expressed an interest in WSR inventory and protection. There were also a series of comments relating to preferences for additional wilderness designation. In communities across all areas of the Forest, some stakeholders expressed a desire for more lands on the Forest to be designated as wilderness while others opposed the designation of additional land as wilderness. Public comments pertaining to particular wilderness inventory areas were reviewed and discussed in more detail in the designated areas sections. Some workshop participants also expressed interest in creating new designated recreation areas. A group of medical professionals in Montana submitted comments expressing their interest in promoting access to nature and pristine landscapes, in the context of enhancing the quality of life of the public.

In the past decade, visits to designated areas around the country have increased, particularly day visits (Bowker et al. 2006; NVUM 2016). This increase in day use of designated areas is expected to continue as urban populations close to designated areas continue to grow (Rasch and Hahn 2018). Designated areas on the Forest that are in close proximity to the growing urbans areas of Helena and Great Falls will likely experience a significant increase in visits in the coming decades. A key issue raised by the public was permitted uses of designated areas. Preferences for motorized and mechanized (incl. mountain biking) uses in designated areas vary greatly by stakeholder group.

Direct income and jobs

The HLC NF multi-county area of influence has a range of per capita income, average earnings per job, and components of personal income. In 2016 all counties in the area measured lower per capita income and earnings per job than the U.S. average of $49,246 and $58,372, respectively. The lowest was Chouteau County at $31,202 and 22,815 respectively. In most counties, non-labor personal income was a higher proportion than the U.S. average of 36.8 percent. The counties with the highest non-labor income ratio include Meagher and Chouteau County at 57.8 percent. Income-maintenance payments (welfare payments), as a component of non-labor income, can have important implications for social and economic sustainability and environmental justice. Amongst counties in the analysis area, Glacier and Deer Lodge County have the highest proportion of transfer payments, both at approximately 30 percent of their economies.

Employment is also an important indicator of the economic health of an area. Employment (measured as recorded full and part-time jobs) in the multi-county area increased 20 percent from 2000 to 2016, over 1 percent per year, pacing faster than population growth. In 2016, the area recorded 233,070 jobs, an increase of 45,961 jobs, or 2872.6 new jobs per year.

Services-related employment (which includes a wide range of jobs, from restaurant workers and software developers to doctors) makes up the largest share of this economic area. Nearly 75 percent of all new jobs in the area are in services, rather than agricultural, manufacturing or natural resources. Approximately 16 percent of the economy is in non-service industries, 17 percent is in government, and the remaining is in services. Within non-service industries, the largest employment comes from farm, construction, and manufacturing, leaving less than 2 percent of the private economy working directly with natural resources.

In 2016, unemployment nation-wide had improved, and most counties in the analysis area were below the U.S. average at 5.7 percent. Unemployment was, however, particularly high in Glacier County at 8.6 percent, which is 3.7 percent higher than the U.S. average.

As observed in 2016, the multi-county area generally fell behind U.S. averages, in terms of personal income, but not necessarily for levels of employment. Increased, or sustained economic well-being could be achieved by activities that lead to increasing per capita income in the area, or increasing proportions of labor income to non-labor income, particularly in more rural counties, such as Glacier, Chouteau and Deer Lodge County. Employment opportunities are especially needed and important in counties with higher unemployment rates, such as in Glacier County.

The primary risks and stressors to contributed employment and income in the 16 county area around the HLC NF, external of direct FS operations, includes the further loss of forest products industry capacity and infrastructure as well as pattern changes in annual travel and tourism, especially as it relates to non-local visitors seeking recreation opportunities.

Ecosystem integrity

Forest ecosystem integrity varies considerably across the landscape. Ecosystem integrity, and particularly stable soils, can protect the public from harm by reducing the risk of flooding and landslides. Ecosystem integrity also supports habitat for pollinators and rare and endangered species. Just knowing that these species exist is an important value to the public, and referred to in the non-market valuation of natural resources literature as a non-use value (Harpman et al 1994). Therefore, ecosystem integrity can enhance the quality of life of both users and non-user alike that value the existence of ecosystem integrity.

Participants from communities across all areas noted ecosystem integrity as a key benefit that enhances quality of life. Some participants stressed the need to have flexibility in forest management plans to ensure critical projects can be implemented. Protection of native plants, weed management, using fire as a habitat restoration tool, and considering impacts of climate change were all mentioned as important issues the Forest should consider when planning projects that will restore and/or maintain ecosystem integrity.

Energy and minerals

The Forest contains many areas previously and currently developed for mineral and energy resources. There are also many areas with potential for future energy and mineral development, including renewable energy such as geothermal resources and wind.

There are many hazardous mine openings and features which pose risks to public safety. The Forest mitigates these hazards, as resources allow, and 15 to 25 hazards are mitigated annually. There are three federal Superfund sites on the Forest that pose risks to public health. These sites are administrated by the Environmental Protection Agency. The Upper Tenmile Creek Mining Area is a Superfund site located in the Rimini district near Helena. Lewis and Clark County has relatively high health outcomes, suggesting that the Superfund site is not currently significantly impacting public health. Lewis and Clark County residents are also at risk from the State of Montana Comprehensive Environmental Cleanup and Responsibility Act superfund site, the Upper Blackfoot Mining Complex site, located near Lincoln.

The Barker-Hughesville Mining District Site is located east of Monarch. Residents in Judith Basin County have relatively high health outcomes, suggesting that the Superfund site is not currently significantly impacting their health. Residents is Cascade County have some of the lowest health outcomes in the state, suggesting they may be more vulnerable to potential health impacts from the Barker-Hughesville Mining District Site. Cascade County residents are also at risk from the Carpenter-Snow Creek Mining District site, located near Neihart.

Measured locatable and leasable mining production on the HLC NF, remains limited to small amounts of sand and gravel material. As a result, mineral activity on the Forest is not currently contributing a known number of jobs, or labor income.

Workshop participants in communities across all areas noted energy and mineral development as a key benefit that provides income and jobs. Some participants were concerned with the impacts of energy development on the ability of the Forest to provide clean water and habitat for fish species. Participants from North area communities were interested in abandoned mine reclamation projects.

Fire suppression (and mitigation)

The Forest manages both fire suppression and mitigation programs. Fire mitigation and suppression efforts contribute to the safety and well-being of the public by reducing the risk of larger, catastrophic wildfire in the future and protecting communities at risk. Wildland fires impact the public through risk to life and property. Even when fires do not directly impact communities, residents may still experience emotional distress from the stress associated with their perceived risk to life and property (González-Cabán et al. 2007). The health of the public is also affected when wildfire smoke reaches unhealthy levels.

Larger wildfire activity and fire mitigation efforts spur economic activity temporarily as agency resources and private service contracts are expended. Some portion of large fire incident and mitigation program spending occurs locally and can boost both employment and income temporarily for community and regional businesses. Additionally, some permanent resources and annual spending is allocated to wildfire management. These resources contribute to jobs and income as a component of the total contribution from all budgeted operations and planned agency expenditures. Currently FS expenditures from the HLC NF contribute to an estimated 742 jobs, and $27 million in labor income, annually.

It is important to note that simultaneous to wildfire suppression efforts, wildfire events can cause great economic costs. Large fire activity can deter travel and tourism and change travel patterns during summer and fall. This potential business impact is important to note because it can occur in peak tourism season and can offset economic benefits associated with wildfire suppression efforts. Additionally, smoke and particulate matter generated by wildfires can directly affect public health and disease management, costing individuals and health care systems.

Participants from communities in the West, East and Central areas all mentioned fire suppression and fire mitigation measures (e.g. fuels management through pre-commercial thinning) as key benefits that enhance community well-being and keep people and property safe from the impacts of wildfire. During listening sessions, county government officials expressed concern that funding is being directed toward suppression, rather than mitigation. There was an expressed preference to steer funding toward harvesting beetle kill timber and other fire mitigation efforts. Some were particularly concerned with fuels management in the wildland-urban interface WUI and expressed interest in increased, active management in the interface to reduce the risk of wildfire damage to their communities. Irrigation districts (particularly on the Rocky Mountain Front) have expressed great concern with wildfires in the wilderness, citing (perceptions of) negative effects to the water they use.

Active management in the WUI is of particular interest to communities in the West area as more homes in the West area are located in the interface, compared to the state overall. Fire social science research also finds that the public is generally supportive of active fire mitigation management, including prescribed burning (McCaffrey and Olsen 2012).

Researchers have found that future climates are likely to be warm and dry, resulting in the potential for more wildfire and insect disturbances. More residential development is expected in the WUI, particularly in the West area, which may place an increasing number of homes at risk from wildfire.

Fish and wildlife

The Forest provides habitat for a range of fish and wildlife including trout, bats, falcons, bighorn sheep, beavers, moose, black bears and elk. There were approximately 33,000 elk on hunting districts that overlap with the Forest and 295,011 hunter days in 2016. The Forest also provides habitat for the following at-risk species: Canada lynx, wolverine, grizzly bear, flammulated owl, and Lewis's woodpecker. Consumption of, and activities associated with, fish and wildlife enhance the quality of life of the public. Fish and wildlife are consumed as food and have numerous recreational and cultural uses such as hunting for sport, trapping, viewing by recreationalists, and cultural importance to Native American populations. Fish and wildlife contribute to people's sense of place. People also benefit from just knowing fish and wildlife exist (i.e. they have non-use value).

Close to 80,000 angler days were reported for high use waters on the Forest in 2014 (USDA 2015b).

Participants from communities across all areas noted providing habitat for fish and wildlife as a key benefit that enhances their quality of life and provides income and jobs from tourism and recreation.

Stakeholders expressed interest in protecting wildlife corridors and increased coordination with state agencies. Some participants were concerned with connectivity and advocated for increases in fish and wildlife corridors that connect ecosystems. Others were interested in reintroduction of bison and some were concerned about conflicts between bison and cattle.

Grazing

Opportunities for grazing enhance the quality of life of permittees by providing them with the opportunity to sustain their rural lifestyles and livelihoods. Opportunities for grazing also enhance to the quality of the life of local publics through contributions to sense of place and rural heritage. Grazing opportunities also enhance the quality of the life of visitors to the Forest and surrounding areas by providing opportunities to view scenic, ionic Western landscapes.

Grazing allotments provide for economic opportunities across a large number of Forest communities. Currently it estimated that grazing programs contribute to 252 jobs, and $8.2 million in labor income, around the Forest, annually.

Workshop attendees in all areas mentioned grazing as a key benefit that provides income and jobs. Weed management and the impacts of weeds on livestock grazing was a concern for some stakeholders. Stakeholders advocated for an increased effort by the Forest to manage noxious weeds more aggressively. Agricultural interests and county government officials expressed a desire to maintain existing grazing allotments and restore grasslands through BMPs such as improvements to fencing. Some also expressed concern for overgrazing and the impacts of overgrazing on water quality. Others had concerns about conflicts between grazing and recreational uses as well as grazing impacts in wilderness areas. Current demand for forage from livestock operators with private land adjacent to the Forest is greater than the Forest can provide.

Infrastructure

The Forest provides an extensive system of roads, trails and airstrips for the use and enjoyment of the public. This transportation system provides the public with access to public land and enhances the quality of life of those who use the system. Transportation infrastructure also enhances public health and safety by providing access for emergency rescue teams and firefighters.

Workshop participants from all area communities noted infrastructure as a key benefit that enhances quality of life and health by providing opportunities to access nature (which enhances both physical and emotional health). Roads, trails, trailheads and airstrips were all mentioned as important benefits. Many noted that road decommissioning would limit access for recreation and firewood collection. There was particular concern that access would be limited for the elderly, who mainly access the Forest via motorized means. Many communities around the Forest have relatively older populations, compared to Montana and the nation overall. Thus, maintaining access for the elderly is of particular concern.

Other forest products and wood for fuel

Forest products enhance the quality of life of those who harvest and consume them. Some special forest and botanical products hold particular value for tribes. Forest products may also enhance the health of those who consume them for medicinal purposes.

The HLC NF timber program, which administers the sale of wood material, contributes to an estimated 119 jobs, and $5.4 million in labor income, annually. Currently, a large proportion of the total sold and harvested wood volume from the Forest is utilized for fuel, and other non-sawlog forest products.

Although collection of forest products for personal use does technically require a permit, demand for most forest products is not well-known.

Other income and jobs

Agency operations, in addition to the other multiple-use resources, provide income and jobs to local economies surrounding the Forest. Another economic relation between Federal land and counties are Federal revenue sharing and land payments, including Secure Rural Schools and payments in lieu of taxes. State and local governments cannot tax federally owned lands the way they can tax privately owned lands. As a result, a number of Federal programs exist to compensate county governments for the presence of Federal lands. These programs can represent a significant portion of local government revenue in rural counties with large Federal landholdings, such as the counties in the analysis area.

Before 1976, all Federal payments were linked directly to receipts generated on public lands. Congress funded payments in lieu of taxes, with appropriations beginning in 1977, in recognition of the volatility and inadequacy of Federal revenue-sharing programs. Payments in lieu of taxes are intended to stabilize and increase Federal land payments to county governments. More recently, the Secure Rural Schools and Community Self-Determination Act of 2000 decoupled FS payments from commercial receipts. Secure Rural Schools received broad support because it addressed several major concerns around receipt-based programs—volatility, the payment level, and the incentives provided to counties by linking Federal land payments directly to extractive uses of public lands.

Payments in lieu of taxes and Secure Rural Schools each received a significant increase in Federal appropriations through the Emergency Economic Stabilization Act of 2008. Despite increased appropriations at times, Secure Rural Schools funding status remains in question. A number of bills presented in the 115th (2017-2018) Congress address Secure Rural Schools funding, but have not yet been passed by congress or into law.

The two most significant land payments to counties in the analysis area are payments in lieu of taxes and FS receipts. Since 2008, FS receipts have declined steadily for counties around the HLC NF, where payments in lieu of taxes have increased or stayed flat. Payments in lieu of taxes formulas are specifically based on population and acres of Federal land. Under this payment structure, Gallatin, Lewis and Clark, and Park County receive considerably higher payments in lieu of taxes ($2-3 million annually) than the other counties in the analysis area. Conversely, Meagher and Powell Counties rely heavily on FS receipts, which make up a large percentage of their total Federal land payment.

HLC NF related payments to states and counties currently contribute to an estimated 151 jobs, and $6.8 million in labor income, annually.

Workshop participants from the West, Central, and East area communities noted other income and jobs as key benefits the Forest provides. Some participants noted jobs and income generated from recreation as particularly important. Others noted jobs and income from range and mineral development as key benefits. County government officials expressed the need for the continuation of Secure Rural Schools and payments in lieu of taxes as county budgets rely on these funds to provide services.

The greatest risk to Federal land payments is congressional or executive branch policy changes, which at any time could dissolve or partially remove these revenue streams, which are particular important in the western United States. A secondary risk to counties exists, if agencies were to reduce or seize management activities. FS receipts are directly tied to the level of timber sold and harvest from within a given county. For counties with a higher proportion of FS receipts, a greater fiduciary risk exists with relation to continued forest management activity.

Public information, interpretation and education

The Forest provides the public with opportunities to connect with nature, and learn about the history and cultural significance of the area through public information, interpretation and education services. These programs enrich the quality of life of participants. Some examples include: the Lewis and Clark National Historic Trail Interpretive Center programs, educational lectures with elementary school students, citizen science programs, day camps, star gazing nights and volunteer programs.

The Forest also provides essential safety information to communities affected by Forest conditions such as wildfires. Forest communication efforts can be effective tools for building trust with local stakeholders. Trust between agencies and communities is an essential component for achieving forest management and restoration goals (McCaffrey and Olsen 2012).

Workshop participants from the West, Central, and East area communities noted public information, interpretation, and education as key benefits that enhance quality of life, and particularly the health and safety (e.g. hazardous smoke updates and bear safety information) of the public. Many stressed the importance of communicating Forest management actions to the public and educating the public on why certain projects are being implemented.

Recreation

A multitude of recreation settings, opportunities, access and special uses exist on the Forest. Recreation activities enhance the well-being and health of those who engage in them. There is extensive literature on the physical, emotional and mental health advantages of outdoor recreation (APHA 2013; Zelenski and Nisbet 2014). The Forest provides many different types of recreation experiences which provide opportunities to connect with nature, find spiritual inspiration, engage in physically challenging pursuits, and experience solitude in natural settings.

Recreation on the HLC NF, as is the case on many NFs, is an important component of the contribution to Forest community economic sustainability. Currently the HLC NF contributes to an estimated 238 jobs, and $6.7 million in labor income, annually.

Participants from communities across all areas noted recreation as a key benefit which enhances well-being and community health, as well as providing jobs and income. There is concern that roads are being decommissioned and will prevent access to recreation opportunities. Many participants noted a preference for increased recreation access. Others expressed concern over user conflicts and advocated for more areas designated for particular users. Some noted a need to manage for conflicts between recreationalists and cattle grazing.

Scenery

The Forest contains many scenic landscapes, beautiful vegetation, and unique geologic features that enhance the well-being and health of the public. Viewing scenery is associated with health benefits such as reduced stress levels and a sense of joy. Scenery also contributes to the sense of place people attach to a given landscape.

Scenery including forested landscapes can influence population and economic growth by encouraging migration as well as travel and tourism. Travel and tourism related industries alone, employ an estimated 22 percent of all private jobs in the economic area of influence surrounding the HLC NF. The relative degree to which scenery contributes to population growth and travel and tourism spending remains unknown, but nonetheless it remains a notable factor for community economic health.

Participants from communities across all areas noted scenery as a key benefit that contributes to their sense of place and well-being.

Timber

The Forest contains valuable timber resources, including products that are in demand by the American public Commercial timber harvest may enhance the quality of life and safety of the public by improving watershed condition, improving wildlife habitat, and/or reducing wildfire risk through reduced fuel loads.

The HLC NF timber management program, which administers the sale of timber and other wood material, currently contributes to an estimated 119 jobs, and $5.4 million in labor income, annually.

Participants from communities across all areas noted timber as a key benefit that provides jobs and income. Local stakeholder expressed concern that timber harvest decisions take too long. Others were concerned about effects of timber harvest to water quality and wildlife habitat. County officials expressed concern that declining timber harvest negatively impacted local economies. Some stakeholders expressed a desire for increased timber production and harvest on the Forest. Others opposed timber production on the Forest. Many noted that timber harvest should be used as a tool for wildlife habitat restoration and to improve forest health.

Market conditions present risks regarding the economic feasibility of managing forests and providing timber for forest products.

Environmental justice

In the Assessment, county-level populations were analyzed, according to the Council on Environmental Quality (1997) criteria, to determine whether or not they met the definition of an environmental justice county. These determinations are summarized below. For more detail on the criteria, please see the Methodology section.

None of the West or East area counties met the criteria for environmental justice counties under either the “minority population” test or the “low-income population” test. In the North area, both Glacier and Pondera Counties met the definition of environmental justice counties under both the “minority population” and the “low-income population” tests. In the Central area, Choteau County met the definition of an environmental justice county under the “minority population” and “low-income population” tests.

In sum, the following three counties were identified as environmental justice counties in the Assessment: Glacier County (North area), Pondera County (North area) and Choteau County (Central area). In all three environmental justice counties identified, the minority and low-income populations are Native American. For a detailed breakdown of minority and low-income populations by county, please see the Assessment. In the subsequent analysis of alternatives, effects to minority and low-income populations in Glacier, Pondera, and Choteau Counties were considered to determine whether the proposed action or alternatives would disproportionately affect populations in these environmental justice counties.

3.27.6 Environmental consequences

Effects common to all alternatives

The previous sections assessed the social and economic conditions of the affected environment and the societal benefits the Forest provides. The affected environment section provides a baseline understanding of how the Forest currently contributes to social and economic sustainability, for local beneficiaries and the general public, where applicable. The key dimensions of social and economic sustainability assessed are how the Forest (and Forest management) contribute to: income and jobs, quality of life and well-being, and the health and safety of the public. The following section considers the potential impacts of alternative management scenarios on these contributions. This section provides a brief summary of the impacts to the benefits the Forest provides, and places those benefits in the context of contributions to social and economic sustainability. For more details and the complete analysis of effects to specific Forest resources, please see the relevant resource sections.

Climate and Carbon Storage and Sequestration

Wildfires may become more severe as a result of expected hotter and drier climates in the future. The scale of wildfires, coupled with limited resources, may result in a decline in the ability of the Forest to actively mitigate wildfire risk in affected communities. All alternatives are focused on promoting forest health and would not negatively impact the Forest's ability to store and sequester carbon in the future.

Cultural, historic and tribal resources

All alternatives would provide protections for cultural, historic and tribal resources. Contributions from cultural resources to the well-being of the public in expected to continue under all alternatives.

Designated areas

All alternatives would provide for the protection of designated areas, according to the relevant laws and regulations. Designated areas contribute to the health and well-being of the public under all alternatives. The projected increase in visits to designated areas may compromise those areas' abilities to meet management goals such as maintaining opportunities for solitude, in the case of wilderness, or maintaining sufficient elk populations for hunting, in the case of the Elkhorns Wildlife Management Unit. Climate change may also impact the ecological integrity of ecosystems within designated areas. Increases in invasive species and decreases in native species populations may occur, affecting the pristine nature of some designated areas, and thus impacting the contributions of designated areas to the quality of life of the public.

Ecosystem integrity

All alternatives would provide plan components intended to preserve and restore ecosystem integrity. Ecosystem integrity would continue to contribute to the health, safety and well-being of the public under all alternatives.

Energy and Minerals

All alternatives would provide opportunities for energy and mineral development. Impacts to the health and safety of the public from energy and mineral plan direction are not expected, given the legal requirements for mitigation of environmental impacts and reclamation. In communities where income and jobs are dependent on the energy and minerals industries, mining and energy development opportunities provided by the Forest would indirectly contribute to social sustainability through contributions to jobs and income, which in turn contribute to the well-being of local residents. Fluctuations in the global prices for minerals may impact demand for mineral development.

Fire suppression (and mitigation)

All alternatives would promote fire mitigation programs. Fire suppression tactics are employed when deemed appropriated to protect values at risk. These programs contribute to the well-being and safety of the public by protecting life and property at risk, particularly for those wildland-urban interface communities in the West area. No substantial impacts to public health from smoke from prescribed burning are expected under any of the alternatives as all prescribed burning activities must comply with the Clean Air Act.

Fish and wildlife

All alternatives would provide fish and wildlife habitat for an array of species. Opportunities to consume, and otherwise engage in fish and wildlife related activities, including fishing and hunting, would be provided and are not expected to vary significantly across alternatives at the forestwide scale. These opportunities contribute to the well-being of hunters, anglers and wildlife-viewers. Plan components designed to enhance fish and wildfire habitat also contribute to the well-being of those who are inspired by just knowing certain species (e.g. grizzly bear, bull trout) exist.

Grazing

Opportunities for grazing are provided for, and would not vary by alternative. In communities where income and jobs are dependent on the livestock and ranching industries, grazing opportunities provided by the Forest would indirectly contribute to social sustainability through contributions to jobs and income, which in turn contribute to the well-being of local residents.

Infrastructure

The current system of roads, trails and airstrips would provide access to the public and contribute to the well-being of those who use the system by providing opportunities to connect with nature. While miles of open road vary slightly by alternative, the variation is minimal and accounts for less than one percent of total open roads. Given the relatively small number of miles of proposed road closures (ranging from 11.8 to 23 miles out of a total of 2,569 miles), no significant impacts to well-being of road users are expected, across all alternatives.

Other forest products and wood for fuel

Forest products would be available to the public under all alternatives and would contribute to the well-being of those who harvest and/or consume them.

Public information, interpretation and education

Opportunities to learn about and connect with nature would be provided and would contribute to the well-being, health and safety of the public.

Recreation

A plethora of opportunities for recreation across all recreation settings would be provided. These opportunities would contribute to the well-being, health and safety of those who recreate on the Forest.

Scenery

Scenery would contribute to the well-being and health of the public, under all alternatives.

Timber

Sustainable levels of timber would be provided under all alternatives. In communities where income and jobs are dependent on the timber industry, timber provided by the Forest would indirectly contribute to social sustainability through contributions to jobs and income, which in turn contribute to the well-being of local residents.

Effects that vary by alternative

The only variation in employment and labor income, across alternatives stems from known differences in wood quantities sold, and hence more or fewer jobs contributed from timber and other forest products. Alternative E would allow for the highest level of wood volume and hence would contribute more jobs and labor income than the other alternatives.

Jobs and income

All alternatives would provide similar economic contributions in relation to employment and labor income. Results of the economic contribution analysis appear in the two tables below. In Table 262 employment refers to levels of employed individuals on an annual basis. In Table 262, labor income refers specifically to earned wage or proprietor income and does not include Social Security, Medicaid, dividends, or capital gains, i.e., government programs or investments.

Income and employment levels contributed by the Forest and FS operations do not fluctuate widely between alternatives. However, as shown in Table 262 and Table 263, income and employment are different across alternatives due to changing assumptions regarding forest management activities under the timber program. Between alternatives A and E, job contributions range between 1502 and 2150 jobs, and labor income between $54.7 and $82.5 million.

All alternatives would produce more jobs and income over current levels, with alternative E producing the most. Variation in employment, across alternatives stems from known differences in wood quantities sold, and hence more or fewer jobs from timber resources. It is anticipated that recreation related visitation to the Forest will increase over time, regardless of the alternatives and so the economic impact model does not differentiate visitation levels, or the recreation impacts between alternatives. However, the Forest anticipates increased local and non-local visitation through enhanced recreation and wilderness areas. Nonmonetary benefits to various recreation user groups ranges between alternatives as well. For more information on recreation benefits see the recreation section.

The greatest contribution to employment and income from the HLC NF comes through FS expenditures, which includes general operations and contracted services. Ordered from higher to lower; range, recreation, Federal land payments, and timber management programs also contribute to jobs and income.

For more information regarding the following two tables, see the project record document entitled "Details of the IMPLAN economic impact analysis for the Helena Lewis and Clark Plan DEIS."

Table 262. Employment in the analysis area by resource and alternative (direct employment contribution, estimated number of jobs)

Resource	Current	A	B	C	D	E
Recreation	238	238	238	238	238	238
Grazing	252	252	252	252	252	252
Timber	119	454	444	444	445	767
Minerals	0	0	0	0	0	0
Payments to States/Counties	151	151	151	151	151	151
FS Expenditures	742	742	742	742	742	742
Total Management	1,502	1,837	1,828	1,828	1,829	2,150
Percent Change from Current	--	22.3%	21.7%	21.7%	21.8%	43.2%

Table 263. Labor income in the analysis area by resource and alternative (average annual labor income, in thousands of 2015 U.S. dollars)

Resource	Current	A	B	C	D	E
Recreation	$6,676	$6,676	$6,676	$6,676	$6,676	$6,676
Grazing	$8,207	$8,207	$8,207	$8,207	$8,207	$8,207
Timber	$5,442	$19,782	$19,382	$19,382	$19,425	$33,332
Minerals	$0	$0	$0	$0	$0	$0
Payments to States/Counties	$6,809	$6,809	$6,809	$6,809	$6,809	$6,809
FS Expenditures	$27,568	$27,568	$27,568	$27,568	$27,568	$27,568

Resource	Current	A	B	C	D	E
Total Management	$54,702	$69,041	$68,641	$68,641	$68,684	$82,592
Percent Change from Current	---	26.2%	25.5%	25.5%	25.6%	51.0%

Designated areas

All action alternatives provide additional recognition for national recreation trails. This additional emphasis may lead to greater public awareness of the trails and an increase in new users. All action alternatives provide specific plan components for IRAs that enhance and/or protect those areas for present and future generations. The greater emphasis on managing designated areas for their intended purposes may result in greater contributions to the quality of life, health and well-being of the public, compared to alternative A.

Alternative D would provide the largest contribution from designated areas to the well-being of the public, as the majority of Americans value and benefit from (either directly or indirectly) the preservation of wilderness landscapes. An additional RNA would be a candidate for designation under alternative D, which may provide more opportunities for scientific research of grassland ecosystems.

Alternative E is expected provide the smallest contributions to the well-being and health of those who use and/or value designated areas for their natural and/or wild characteristics.

Ecosystem integrity

All action alternatives include plan components are designed to maintain and enhance the health of ecosystems. Under all action alternatives, explicit desired conditions for terrestrial vegetation are developed to be consistent with the NRV, with consideration for climate change vulnerabilities. Alternative A would not necessarily preclude similar goals or management opportunities, but does not contain similar direction.

Alternative E is expected to result in the fewest acres treated to restore ecosystem integrity and therefore, a landscape less resilient to insect and disease outbreak. Therefore, contributions to the well-being, health and safety of the public from ecosystem health may be lowest under alternative E, compared to all other action alternatives.

Energy and Minerals

Access to locatable, leasable and salable minerals, as well as opportunities for mineral entry, mineral prospecting, exploration and development would vary by alternative. Contributions to the well-being of those who enjoy and/or base their livelihoods on mineral-related activities, are expected to be highest under alternative E, followed by A, C, and then B. Contributions are expected to be lowest under alternative D.

Fire suppression (and mitigation)

All action alternatives include plan components that incorporate the best available science for fire suppression and mitigation management. These components are expected to provide a larger contribution to the well-being and safety of the public, compared to expected contributions under alternative A.

Fish and wildlife

All action alternatives include plan components designed to enhance fish and wildlife habitat and connectivity, above and beyond the conditions expected under alternative A. There are also specific standards and guidelines designed to protect old growth areas, provide sufficient snags and coarse woody debris, and shield riparian areas from potential impacts of timber harvest activities. Plan components are also designed to minimize the potential for impacts to wildlife resulting from resource management activities or uses, and to reduce wildlife-human conflict. Therefore, contributions to the quality of life of the public from fish and wildlife activities are expected to be greater under all action alternatives, compared to alternative A.

Alternative D has the most land identified as RWAs. As a result, alternative D has the lowest likelihood of negative impacts to fish and wildlife habitat from motorized and mechanized use, compared to all other alternatives. Alternative D also provides the most opportunities for wildlife connectivity among island mountain ranges.

Alternative E has no RWAs and the highest expected level of motorized use, which, in turn, may result in greater impacts to fish and wildlife habitat, compared to all other alternatives. Contributions to well-being from fish and wildlife related activities are expected to be lower under alternative E, compared to B, C, and D.

Grazing

Under alternatives B and D, portions of allotments would be recommended for wilderness designation and motorized and mechanized uses will not be permitted. The well-being of the permit holders of these allotments may be impacted by this designation as they would be required to apply for permits to access portions of their allotments using motorized vehicles, to the greatest extent with alternative D. Under alternative C, portions of 24 allotments would be recommended for wilderness designation and motorized and mechanized uses will be permitted. The well-being of the permit holders of these allotments will not be impacted by this designation. Alternatives A and E would not impact how permittees currently access their allotments relative to RWAs.

Infrastructure

Road maintenance is often required as part of timber harvest projects. Under alternative E, fewer acres are expected to be harvested, compared to all other alternatives. Therefore, contributions to the well-being and safety of those who use forest roads are expected to be smaller under alternative E, compared to alternatives B, C, and D.

Other forest products and wood for fuel

All action alternatives include plan components designed to maintain and enhance the health of ecosystems, including conditions which enhance the production of non-timber forest products. Therefore, contributions to the quality of life of those who harvest and/or consume other forest products are expected to be greater under all action alternatives, compared to alternative A.

Public information, interpretation and education

All action alternatives include plan components designed to increase opportunities for the public to learn about and connect with nature. These include components that place a greater emphasis on partnerships and volunteer opportunities, as well as goals for joint stewardship. Education programs are also expected to increase public awareness of best practices for wildfire mitigation and reduce human-wildlife conflict. Public outreach and education programs have been shown to build trust between agencies and the public (McCaffrey and Olsen 2012), improve the quality and efficacy of wildfire mitigation and suppression planning and management efforts (Steelman and McCaffrey 2013), and increase public safety. Therefore, contributions to the well-being, health and safety of the public are expected to be greater under all action alternatives, compared to alternative A.

Recreation

All action alternatives include plan components designed to enhance recreation opportunities and access, and provide safer experiences to recreationalists. Therefore, contributions to the well-being, safety and health of recreationalists are expected to be greater under all action alternatives, compared to alternative A. All action alternative include additional direction on constructing new recreation sites within riparian areas and developing future water supplies. Alternative A does not address these issues. These plan components may curtail development of new sites in riparian areas, and may have a marginal impact on the well-being of recreationalists who desire new developed sites in riparian areas.

The contributions to the well-being and health of recreationalists varies, depending on which type of recreation they prefer. Those who prefer primitive experiences would benefit the most from alternative D. Those who prefer motorized or mechanized experiences would benefit the most from alternative E. There are still ample opportunities for mechanized and motorized recreation settings and access across all alternatives.

According to the most recent survey data available (NVUM 2017), eleven percent of Forest visits involved motorized uses (excluding driving for pleasure) and five percent of visits involved mechanized uses. The number of mechanized and motorized users are expected to increase with the uptick in West area populations. The limitations on mechanized uses in alternative D, amounting to a 30 percent reduction in trails open to mountain bikes, may impact contributions to the well-being and health of the growing population of mountain bikers and mechanized users in West area communities.

The minor limitations on motorized uses under alternatives B, C and D, are not expected to substantially impact contributions to the well-being and health of motorized recreationalists. Only a seven percent reduction in acres open to motorized over-snow use and a seven percent reduction in motorized trails are expected under alternative D, which is the most restrictive in terms of motorized use.

Under alternatives A, C, and E, expected increases in motorized and mechanized use may impact opportunities for solitude and quiet recreation settings. These impacts may reduce contributions to the well-being and health of those who prefer primitive recreation settings.

Under alternative E, fewer acres would be treated to promote ecosystem integrity and resilience. A less resilient forest could lead to lower quality recreation experiences. Impacts could include less aesthetically pleasing scenery, fewer fish and wildlife encounters, and more area closures due to wildfire.

Scenery

All action alternatives include plan components designed to enhance scenery and scenery management and planning. Plan components in all action alternatives are designed to maintain and promote old growth. Contributions to the well-being of those who value the scenery on the Forest will be greater under all action alternatives, compared to alternative A.

Timber

Under alterative E, the highest amount of timber volume would be removed, compared to all other alternatives. Larger contributions to income and jobs in the forest products industry are expected. This alternative may negatively impact the quality of life of those who are opposed to timber harvest due to preservationist values. This alternative provides the largest contribution to those who benefit from income and jobs in the forest products industry.

Cumulative effects

The same analysis area used to analyze the above effects to contributions to social sustainability is used to analyze cumulative effects. Present and foreseeable future conditions or activities that could affect the Forest’s contributions to social and economic sustainability are described below. Cumulative effects are described in the context of social conditions and societal benefits, where data are available. For a detailed analysis of cumulative effects for a given benefit, please see the relevant resource section.

Population change

The population in the communities in the West surrounding the Forest is increasing. This uptick in population has resulted in increased demand for housing, and the subsequent conversion of forested lands to residential acres, limiting the ability of lands near the Forest to store and sequester carbon. These trends in population and residential acres may result in a decline in the ability of the lager landscape to store and sequester carbon. The carbon released through natural disturbance on the Forest and residential development in neighboring landscapes combined is minuscule, compared to national carbon dioxide emissions, and should not significantly impact global public health in the long term.

Projected increases in local populations in the West area are expected to lead to increases in recreational uses on the Forest. Impacts from increased recreational uses may affect the Forest's ability to provide clean water to the public in the future. Population increases may also impact the Forest's ability to maintain wilderness character in RWAs.

Given the trends in population in communities surrounding the Forest, it is expected that use will likely increase in areas on the West side of the Forest, near the growing population center of Helena. Populations are either declining or increasing only marginally in communities in the North, Central, and East areas. Estimated visitation to the Forest is approximately 700,000 visits annually. 70 percent of visits to the Forest are from visitors within 100 miles of the Forest. Approximately ten percent of visits include a motorized or mechanized activity (NVUM 2017). Given these levels of visitation, population trends and levels of motorized and mechanized use, significant increases in motorized and mechanized uses are not expected, with the exception of areas easily accessible from Helena.

Environmental Protection Agency management

The three federal superfund sites in the plan area are management by the Environmental Protection Agency. These sites have the potential to impact the health of residents in the analysis area and the Environmental Protection Agency may have limited capacity to fully address these clean-up efforts.

Environmental justice, environmental consequences

As discussed in the affected environment section, environmental justice populations exist within the planning area. Populations most at risk of experiencing disproportionately high and adverse human health or environmental effects include low-income households and Native Americans living on reservation lands. These populations are not mutually exclusive and are present in three counties: Glacier County, Pondera County and Choteau County.

Under all the alternatives, the Forest management activities would contribute to social and economic sustainability by providing key benefits to environmental justice communities. These benefits, which include the protection of cultural resources and sacred sites, provision of clean drinking water, and fire suppression activities, contribute to the quality of life, well-being and health and safety of environmental justice communities. The Forest would continue to provide access to traditional lands and areas of cultural significance.

Approximately 20 percent of jobs in Glacier and Pondera counties are in the travel and tourism sector. All action alternatives support tourism and travel employment by providing opportunities to access and recreate on Forest lands. Ecosystem protections ensure that visitors have opportunities to experience high quality, pristine landscapes. Less than one percent of employment in Glacier and Pondera counties is in the timber industry. Specific timber industry data were not available for Choteau County. However, less than four percent of employment in Choteau County is in the fishing, farming and forestry sector. The amount of lands suitable for timber production varies by alternative. Given the relatively small proportion of employment in the timber industry, the amount of lands suitable for timber production should not impact employment opportunities in environmental justice counties. There are no populations in the plan area that would experience significant, adverse human health impacts or environmental impacts due to management actions proposed under any of the alternatives.

Conclusions

The anticipated effects of the proposed action and alternatives would meet the purpose and need because, under all alternatives, a full suite of key forest benefits would be provided and are expected to contribute to social and economic sustainability. Under all alternatives, the well-being, health and safety of affected publics would not be significantly, negatively impacted. Conversely, under all alternatives, there would be significant contributions to the well-being, health and safety of the pubic. The relative size and type of contributions vary by alternative.

3.28 Livestock Grazing

3.28.1 Introduction

This section addresses livestock grazing as well as the health of associated rangelands. The scale of the analysis is the entire HLC NF plan area, focusing on the range allotments located therein.

Public comment on livestock grazing in the HLC NF plan area generated several issues during scoping. Comments centered on providing for grazing opportunities on suitable rangelands, balancing forage use by domestic livestock with ecosystem functions, regulating grazing activities by implementing more stringent standards and guidelines, or reducing or eliminating livestock grazing to allow for vegetation and riparian recovery.

Domestic livestock grazing has been, and continues to be, an important multiple use of NFS lands within the plan area. Livestock grazing has been a use of public lands since the inception of the FS and has become an import part of the culture of the rural western U.S. The objectives for FS management of rangelands include managing rangeland vegetation to provide ecosystem diversity and environmental quality while maintaining relationships with allotment permittees; meeting the public's needs for rangeland uses; providing for livestock forage; maintaining wildlife food and habitat; and providing opportunities for economic diversity. Rangeland management is an essential part of the FS multiple-use strategy. This strategy ensures that rangelands provide essential ecosystem service such as wildlife habitat and related recreation opportunities, watershed functions, and livestock forage.

Although rangelands provide a variety of ecosystem services, such as wildlife habitat, recreation, watershed functions, carbon sequestration, and biodiversity conservation, these lands have primarily been managed for forage production and livestock grazing. Forage is a provisioning service. Provisioning services include all tangible products from ecosystems that humans make use of for nutrition, materials, and energy. Forage is managed by the FS to be sustainable, ensuring that it will be available for future generations while still providing the other rangeland's ecosystem services required by their multiple use strategy. To accomplish this, the FS divides rangelands into allotments and monitors each one. Additionally, the FS manages forage in transitory ranges. Transitory range is defined as forested lands that are suitable for grazing for a limited time following a timber harvest, fire, or other landscape events (Spreitzer, 1985).

Grazing permits for each allotment are issued to eligible commercial livestock owners. To determine the carrying capacity (livestock numbers) on an allotment, which is often called the stocking rate, rangeland managers use AUMs. An AUM is defined as the amount of dry forage required by one mature cow of approximately 1,000 pounds or its equivalent, to graze for one month. The forage allowance per day has been determined to be 26 pounds. In determining the AUMs per allotment, permitted outfitters, guides, and other recreational visitors using livestock are not included.

Livestock grazing management is established through forest plans, FS grazing guidelines, and individual allotment management plans. These plans are developed to be comprehensive using sound science and incorporating public involvement. Plans are revised and updated to ensure that livestock grazing management decisions are based on existing and future ecological, social, cultural, and economic conditions.

The successful management of livestock grazing use on the HLC NF relies upon the maintenance of healthy, functioning rangelands. Please refer to the discussions for nonforested vegetation communities in the terrestrial vegetation section and the RMZ section. These sections focus on the health of those plant communities utilized for grazing purposes, and how revised forest plan components would affect livestock grazing in the plan area.

Effects indicators

The indicators and measures used to analyze effects or changes to livestock grazing opportunities on the HLC NF are:

- Expected rangeland condition and trend, measured as rangeland acres meeting, not meeting, or moving towards desired rangeland condition as a result of management actions.
- Acres of suitable rangeland, analyzed as changes in suitable acreage available for livestock grazing as well as changes in forage producing capability.
- Number of permitted livestock head months or AUMs, measured in changes of permitted livestock numbers over time based on the implementation of plan components, such as more intensive management of RMZs and aquatic threatened and endangered species habitat.

3.28.2 Regulatory framework

Federal Law

The Public Rangelands Improvement Act of 1978 recognizes the need to correct unsatisfactory conditions on public rangelands by increasing funding for maintenance and management of these lands.

The Rescission Act of 1995 directs the FS to complete site-specific NEPA analyses and decisions for grazing allotments on a regularly scheduled basis based on the permit requirements.

Regulation, policies, and guidance

The following regulations and policies have been developed to support implementation of the acts and executive orders previously presented:

USDA Environmental Compliance, Policy on Range, Departmental Regulation, Number 9500-5, April 21, 1988; This regulation sets forth Departmental Policy relating to range services and coordination of range activities among agencies of the USDA and other executive agencies, organizations, and individuals.

National Grasslands Management - A Primer (1997): a document identifying and interpreting the laws and regulations applicable to the administration of the national grasslands.

Other agreements and plans

The following agreements and plans also support the FS’s rangeland management program:

Memoranda of understanding for forage reserves. Forage reserves are allotments under a term grazing permit but may be used by other permittees that have been temporarily displaced due to wild or prescribed fire, drought, or other situations that have made forage unavailable.

Non-use for resource protection agreements. These agreements may be established to provide long-term nonuse to allow rangelands to recover, provide forage on a temporary basis to allow resource recovery on other grazing units, provide temporary resolution of conflicts created by predation on livestock, or provide supplemental forage in times of drought to assist area livestock operators and lessen the resource impacts of grazing.

3.28.3 Assumptions

With all quantitative and qualitative analysis, the following assumptions are used to determine the degree of impacts on livestock grazing. These assumptions are based on previous assessments, professional judgment, and FS Range Management Directives.

- Livestock that use rangelands can remove plant material, trample soils, and alter water flow patterns. However, with proper management these impacts are not substantial when compared with the natural resilience of ecosystems (Holling, 1973).
- Livestock grazing would be managed to meet specific standards and guidelines for rangeland health, including riparian standards and guidelines. In addition, range improvements would be used to meet standards and guidelines for rangeland health and achieve rangeland management goals.
- The grazing system in each allotment would remain the same, and permitted AUMs for each allotment is not expected to increase or decrease unless changed through a site-specific analysis or allotment management plan update.
- Impacts on livestock grazing would be the result of activities that affect forage levels or the limiting of access to designated allotments such that livestock could no longer use rangelands.
- Mitigations for impacts to, or from, livestock would be addressed in a site-specific analysis.
- Grazing use would be managed similarly in all alternatives.
- Grazing allotments would remain open as long as there continues to be demand, existing permits remain in good standing, and resource conditions are meeting or moving towards desired conditions.

3.28.4 Best available scientific information used

The science of assessing rangelands is evolving as certain concepts and ecological processes are becoming better understood (Pellant et al 2005). General concepts for maintaining or moving towards desired rangeland condition will focus on aspects of ground cover, species composition and the presence or absence of invasive species as indicators.

Information sources include current scientific literature, FS reports and databases, and other documentation. Data used to analyze the existing condition for livestock grazing and the rangeland resource came from the following sources:

- FS Natural Resource Manager database (includes grazing allotment, permitted use, range capability, range improvement, and range vegetation plot data).
- Completed range analyses (includes range vegetation inventory and assessment data).

Rangeland capability and suitability

Capability is defined in the FS Manual as, “the potential of an area of land to produce resources supply goods and services and allow resource uses under an assumed set of management practices and given level of management intensity.” Capability is an inventory and remains constant throughout the planning process. The NFMA of 1976 requires the identification of the suitability of lands for resource management including grazing. Suitability is defined as, “the appropriateness of applying certain resource management practices to a particular area of land as determined by an analysis of the economic and environmental consequences and alternative uses forgone. A unit of land may be suitable for a variety of individual or combined management practices” (FSM 1905). Once capability is determined, an assessment of suitability is conducted to address whether livestock grazing is, or is not compatible with management direction for other uses and values in that area. The assessment also decides which, if any, other uses would be foregone with livestock grazing.

Rangeland condition and trend

Rangeland health has been defined as the degree to which the integrity of the soil, vegetation, water, and air, as well as the ecological processes of the rangeland ecosystem are balanced and sustained (Pellant et al 2005). In the publication "*Indicators of Rangeland Health and Functionality in the Intermountain West*" (O'Brien et al. 2003), the authors found that four indicators were useful for describing the range condition and functionality of rangelands at many scales. The indicators include presence or absence of noxious weeds, percent ground cover, plant species composition, and percent shrub cover. Although a consistent analysis across the plan area for these rangeland health indicators is not available, these concepts are considered qualitatively along with data that has been collected, or that will be collected for future allotment management plan revisions.

Through fire and other agents there has always been a mix of ecological status classes over the landscape. Different plant and animal species are favored by vegetation in each of the classes. To maintain forest and rangeland ecosystem health, a mix of ecological status classes are desired for dominant habitat types. These resource values include: plant and animal species and structural diversity, wildlife forage and cover, soil stability and productivity, fish habitat, and palatable livestock forage. Some areas classified in "low" ecological status are composed primarily of introduced species such as Kentucky bluegrass and common timothy.

Riparian areas and annual use indicators

To sustain riparian vegetation, which protects water quality, herbaceous utilization, stubble heights that vary by vegetation type, and limiting utilization of riparian shrubs are indicators to monitor (Mosley et al. 1999). Recommendations by Clary and Webster (1990) called for residual stubble or regrowth of at least 4 to 6 inches in height to provide plant vigor maintenance, bank protection and sediment entrapment. Utilization of streamside herbaceous forage should be an additional indicator, and vary by the season of use. Improper livestock grazing can have numerous direct and indirect effects on soil infiltration by trampling, compaction and loss of vegetation cover on both upland and riparian sites. Impacts are often greater in riparian zones because livestock seek shade, water, and succulent vegetation in which these areas provide. Overuse by livestock in riparian zones can reduce bank stability through vegetation removal and bank trampling, increase soil compaction and sedimentation, cause stream widening or down cutting, and can change vegetation composition (Platt, 1991).

According to Clary and Webster (1990) the level of forage use occurring on a site, including riparian areas, is the most important consideration to manage livestock appropriately on western rangelands. Rangelands comprised of upland plant communities and the riparian areas are complex systems with many factors contributing to their development and resiliency. Physical factors such as stream type, geology, climate, and elevation greatly influence the recovery of riparian areas. Specific management action must be made to fit local conditions (Clary & Webster, 1990), which also includes selecting annual use indicators that match the resource goals of a riparian site. Riparian grazing plans should be site-specific and based upon the best research and evidence available to maintain and enhance vegetation and protect streambanks (Mosley et al. 1999).

While no one method works everywhere, stubble height has been extensively studied and is widely put in practice as a trigger for cattle movement or end of season monitoring indicator.

Two typically used grazing monitoring indicators are within grazing season trigger points and the end of season guidelines. Within season annual indicators are normally used to trigger or indicate when it is time to remove livestock from a given area so that end of season guidelines, usually in the form of an allowable use level, can be met. End of season annual indicators are used to determine if management for that particular unit and season has been satisfactory. End of season annual indicators may also indicate that management is not meeting or moving towards desired conditions and thus changes to management should be considered prior to the next operating season.

End of season stubble height of greenline vegetation has been shown to be a good indicator of two primary factors: 1) the effect of grazing on the physiological health of herbaceous, hydrophytic plants, and 2) the ability of the vegetation to provide streambank protection and bank building function. Stubble height criteria should be used where streambank stability is dependent upon herbaceous plants. Alternatively, woody plant utilization or streambank alteration could be used as a management guide in situations where streambank stability is controlled by substrate or the stream is deeply incised (Clary & Kinney, 2002).

3.28.5 Affected environment

Permitted livestock grazing use

Grazing is widespread across the HLC NF and occurs in each GA, as shown in Table 264 and Table 265. Active grazing allotments occupy approximately 50 percent of the NFS lands on the Lewis and Clark NF, and 65 percent on the Helena NF. Grazing allotments are more prevalent in some GAs than others.

Table 264. HLC NF grazing allotment summary

Grazing Permittees (Number of Permit Entities)	234
Active Allotments (Number)	240
Active Allotment Total Acres	1,419,085
Active Allotment NFS Acres	1,379,819
Active Allotment Waived (Private) Acres	39,266
Vacant Allotments (Number)	12
Closed Allotments	23

Table 265. Grazing allotment Acres by GA

GA	Grazing Allotment Acres	% of the GA
Big Belts	233,854	52
Castles	56,315	71
Crazies	59,539	85
Divide	134,425	58
Elkhorns	90,506	52
Highwoods	40,680	92
Little Belts	502,867	56
Rocky Mountain Range	175,547	22
Snowies	57,227	47
Upper Blackfoot	77,991	22

According to records for 2011-2013, across the active allotments permittees are authorized to graze a variety of livestock as shown in Table 266. A head month is defined as one month's use and occupancy of the range by one animal (weaned or adult cow with or without calf, bull, steer, heifer, horse, burro, or mule, or 5 sheep or goats), and is used primarily for FS grazing fee calculations. In contrast to head months, AUMs are used for grazing capacity or stocking rate calculations since it typically includes a livestock kind and class conversion factor based on forage requirements for the particular animal unit (e.g., mature cow, cow-calf pair, yearling, or breeding bull).

Table 266. Livestock grazing use in head months on the HLC NF, based on 2011-2013 records

Livestock	Head	Average Head Month
Cattle	24,190	86,015
Horses	79	122
Sheep	5,000	8,648

Commercial livestock grazing on NFS lands is considered a privilege, and authorized through the issuance of a term (i.e., 10-year) grazing permit. Term permits include terms and conditions for grazing use and describe the responsibilities of the permit holder. These terms and conditions are also incorporated into an allotment management plan. The allotment management plan establishes site-specific goals and objectives and provides management strategies to maintain or move towards desired condition. Grazing management strategies may include allowable use levels, seasons of use, pasture rotations, and a schedule for implementing range-improvement projects such as fences and water developments. This plan also includes requirements for monitoring and inspections, payment of grazing fees, ownership of livestock and base property, livestock management, range improvement maintenance and construction, and other terms as appropriate. Once approved, the allotment management plan becomes a part of the permit.

The grazing management program helps to ensure a reliable and consistent level of native rangeland forage for permitted commercial livestock production. This resource helps local ranches maintain an economical operation that, in turn, maintain open space adjacent to the forest, which is integral to meeting desired resource conditions and maintaining the economic and social sustainability of local communities.

Rangeland capability and suitability

Rangeland specialists' estimate that timber canopy closure and conifer encroachment have reduced forage availability by at least 10 percent over the past 60 years on some grazing allotments in the planning area. Analysis of grazing allotments within the Divide and Little Belt Mountain GAs indicates grass/forb understory is decreasing in past timber harvest units due to increasing canopy closure by conifers. In some areas this forage loss is due to the restocking of these harvest units back to lodgepole pine, while in others range managers suggest that this trend in canopy closure and the resulting loss of forage may be due to fire exclusion. In either case, as tree densities and canopy cover increase these rangelands will continue to transition from being suitable to not being suitable for livestock use due to a loss of forage production and/or access to forage.

The HLC NF will use the allotment management planning process to determine additional lands that are not suitable and determine the site-specific permit actions necessary to meet forest plan desired conditions, objectives, and standards. Allotment management plans will also be used to evaluate the twelve allotments across the Forest that are vacant based on economic or other resource values. The decision whether or not to permanently close, establish a forage reserve on, or reallocate these vacant allotments will be made during the allotment management planning process, and therefore determine the site-specific suitability of rangelands for livestock grazing at that time.

Rangeland condition and trend

Intensive collection of vegetation plot data was collected prior to 2005 for several range analyses across the Forest. This data was collected on roughly 42 percent of the HLC NF, primarily on the east side of the plan area. Analysis of this data, which is believed to typify range conditions across the plan area, determined that approximately 87 percent of sampled areas retain high native species integrity (i.e., potential natural community or high ecological status). Grasslands that have lower amounts of natural community attributes and/or the substantial presence of invasive species (approximately 5 percent of samples) suggest that these plant communities have a low similarity to potential natural community ecological condition. A large portion of the assessment area is susceptible to invasive weeds, and a high risk of continued weed expansion exists.

To provide a general depiction of current rangeland condition across the plan area, allotment specific data collected through agency approved methodologies will help determine movement towards or departure from desired rangeland conditions. Historical data and photographs and new monitoring techniques should all be considered in order to develop apparent trends and effects of management changes. According to O'Brien and others, (2003), monitoring should document the following attributes in order to determine if range condition is moving towards desired condition at the allotment or pasture level:

- Noxious weeds are absent, or are a very minor component of the existing plant community.
- Ground cover provides proper watershed and soil protection for the rangeland site, and bare ground percentages are within the NRV, or spectrum of ecosystem states and processes that evolved over a long period of time from natural disturbance regimes.
- The composition of desirable shrubs, grasses, and forbs is within the NRV for the rangeland site.
- Shrub cover is within the NRV for the rangeland site.

These general concepts were used on the HLC NF to develop an estimate of ecological status of rangeland acres based off of existing information and monitoring data. Estimated acres of ecological status are shown in Table 267.

Rangeland comprises a variety of vegetation types, including many timbered plant communities, grasslands, shrublands, and riparian areas. Range condition is an assessment of the current health of the plant communities and soils, often expressed as the degree of similarity or dissimilarity of current plant composition and abundance compared to potential or natural/historic conditions. On the Lewis and Clark NF, a Range Vegetation Classification (USDA 1996) was completed from 1991-1995 to describe vegetative characteristics and their distribution to stratify herbaceous vegetation into community types and determine ecological status. An ecological status rating was assigned for each vegetative community. Ecological status is a rating of the overall condition of the vegetation, whether human forces or natural induces the condition. Ecological status was rated in four categories based on similarity of the existing species composition to that of the potential natural community. The potential natural community is the plant species composition that would naturally occur if minimally disturbed. Potential natural community is equal to 76 to 100 percent similarity, high is equal to 51 to 75 percent similarity, mid is equal to 26 to 50 percent similarity, and low is equal to zero to 25 percent similarity. Ecological status may be the result of natural succession, fire, timber harvest, introduced species, grazing, or other disturbances. For example, a community type with a tree overstory is predominantly influenced by the natural succession of trees and fire, and grazing of the understory may have some effect on the overall similarity to the potential natural community. On the other hand, grazing may have a dominant influence on the overall similarity of a grassland community type.

Table 267. Inventoried rangeland acres by ecological status

Forest	Potential natural community ecological status	High ecological status	Mid ecological status	Low ecological status
HLC NF	1,221,877	373,002	136,837	100,267
Beaverhead-Deerlodge	15,480	4,725	1,734	1,270

Table 269 represents a snapshot in time of rangeland current conditions. To effectively implement ecosystem management, a reference or benchmark to represent the conditions that fully describe functional ecosystems need to be developed (Cissel, Swanson, McKee, & Burditt, 1994); Laughlin et al., 2004). Livestock grazing is a major land use component and is one tool which can mimic natural disturbances such as grazing by large herbivores and alter changes in ecological status. Weed invasion and conifer encroachment can also rapidly change rangelands within the plan area. These conditions could be evaluated against this reference to determine movement towards or departure from desired condition, and from that information, vegetation treatments may be designed or management adjustments that would return declining ecosystems to a more natural or native condition (Hessburg, Smith, & Salter, 1999; Swetnam, Allen, & Betancourt, 1999).

Watershed condition and riparian areas

The aquatics ecosystems section analyzes current and expected conditions of watersheds, stream habitat, fisheries and soils, as well as existing riparian conditions. The 2012 WCC Framework rated the overall watershed condition across the Forest. 103 watershed were classified as functioning properly, 159 as functioning at risk, and 34 as impaired. One of the most significant drivers of the ratings in the plan area was livestock grazing. These ratings will be re-assessed in the future to assess change. Other monitoring data, including PIBO data and forest stream studies have shown livestock impacts to streams and riparian areas are occurring on many stream reaches in the planning area, which is resulting in habitats and water quality that presently do not meet desired conditions. See the aquatic ecosystems section for more details.

Livestock management and annual forage use indicators

In order to address livestock use concerns and provide triggers in which to manage livestock the 1986 Plans incorporated grazing standards that contained annual use indicators. Annual forage use levels by vegetation type and grazing system were prescribed in the Helena NF Plan and total physical bank damage on key areas were set at 30 percent in the Lewis and Clark NF Plan. The 1986 Forest Plans encouraged the incorporation of new research results and management techniques in allotment management plans to help improve riparian areas.

Revised allotment management plans in the mid-1990s up until the present time have incorporated multiple annual use indicators such as bank alteration and forage use levels to guide livestock management. Over the years, financial and personnel limitations, as well as other resource priorities, have limited the amount of range allotment NEPA project decisions as well as created inconsistencies in monitoring frequency and intensity on the HLC NF allotments. These issues have ultimately led to a wide variety of riparian conditions and inconsistencies in permittee accountability in accordance with allowable use levels.

Invasive and non-native species

The HLC NF faces two large challenges related to non-native rangeland species: noxious weeds that decreasing forage availability and native species diversity; and non-native invasive forage species such as Kentucky bluegrass, smooth brome, and timothy. All three of these forage species were intentionally introduced for hay or forage production but have escaped cultivation and have out-competed native plant communities across the HLC NF. Invasive forage species can significantly affect the structure and diversity of plant communities, as well as the seasonal palatability on some grazing allotments.

3.28.6 Environmental consequences

Effects common to all alternatives

For the foreseeable future, management under any of the alternatives would continue to provide forage production and productive livestock grazing. Acres available for livestock grazing and permitted head months would be the same under all alternatives. None of the alternatives change existing allotment management nor do they provide any specific direction regarding current livestock management. No allotments or portions of allotments are proposed to be formally closed to grazing due to other resource needs. Under all alternatives, changes to livestock management and allowable forage use levels at the site-specific scale would be made during allotment management plan revision.

Permitted livestock use

Plan components for the protection of the aquatic resources, particularly riparian areas, have had some of the greatest impact on the forests' grazing program. Emphasis on improving riparian conditions is expected to continue under all alternatives. Revisions of allotment management plans would continue to implement BMPs and identify allowable use levels that are expected to move riparian areas towards desired conditions. Management adjustments may result in a loss of permitted head months for some permittees. Current vacant grazing allotments would most likely be used as forage reserves for allotments affected by fire, depredation, threatened and endangered species, or riparian management issues. Therefore, it is unlikely that permitted head months would be increased through the opening of new allotments under any alternative.

Rangeland suitability

Conifer canopy closure, conifer/shrub encroachment into grasslands, and the spread of invasive weeds all have the ability to reduce available forage for livestock. The degree to which future management actions address each of these ecological processes would influence the potential loss or increase in available forage. Fire and physical manipulation of the tree overstory may help to maintain or increase forage productivity for browsing and grazing ungulates. Development of rotation grazing systems versus season long grazing can have very positive effects on establishment of desired native vegetation. Treatment of invasive weeds can allow desired natural plant communities to flourish. Resource specialists predict that permitted livestock numbers may decline in some areas due to more stringent management constraints for riparian areas as well as the loss of forage from invasive weed spread, and encroachment of conifers into some grassland communities. However, vegetation modeling (as discussed in the terrestrial vegetation section) indicates that the extent of nonforested plant communities overall would likely remain fairly constant under all alternatives, and further that forest densities may decrease. This may result in increased forage in some forested areas.

No alternative proposes to change allotment boundaries, or formally close open or vacant allotments. Therefore, existing suitable acres would not change between any of the alternatives. A suitability analysis is done during allotment management plan revision and site-specific suitability determinations would be made at that time.

Climate change

Over the life of the plan certain environmental influences may negatively impact rangeland health and forage production. If climatic temperatures continue to increase, there may be changes in vegetation where there is a shifting from more mesic (moist) plant associations to more xeric (dry) communities that are better adapted to the drier sites. As a result, it is expected that bare ground would increase within these plant communities as rangeland sites become drier during extended periods of drought (Pellant, Abbey, & Karl, 2004). Elevation will play a large role in plant species composition in conjunction with predicted climate change. High elevation, alpine or other fringe type environments may see plant species composition change first (Murphy and Weiss 1992). Invasive weeds would likely continue to spread and increase in abundance and density. Timber canopy may continue to close in areas where wildfires or other disturbances do not occur, and some grasslands/shrublands may see additional conifer encroachment and conversion to a conifer-dominated community. Conversely, there is potential that wildfire may play a larger role in shaping vegetation in some areas, perhaps promoting non-forested vegetation communities, particularly given warmer climate regimes. Transitory range acreage may fluctuate as forested stands become more open due to harvest, insects, disease, and/or fire. Over time and through succession, forest canopies would likely close in once again.

Climate change affects vegetation, which in turn could affect livestock grazing. Potential effects include, but are not limited to, changes in type, amount, and distribution of precipitation, which directly affects type, abundance and distribution of vegetation. Lower-elevation grasslands and shrubland habitat are expected to become drier and habitat zones shift upward in elevation (Finch, 2012). The result of these potential changes could be an increase in suitable cattle forage, thereby causing increased suitable forage for cattle grazing at higher elevations within an allotment. On the other hand, lower elevation rangeland and upland plant communities would be expected to senesce earlier in the season, resulting in reduced palatability earlier in the grazing season. Reduced palatability in the uplands, combined with warmer temperatures would affect livestock distribution by concentrating livestock in riparian and wetland areas. Riparian use levels would be met earlier in the season, thus forcing livestock to be removed from an allotment or pasture earlier than the permitted off date.

Increases in atmospheric carbon levels and higher temperatures would likely make invasive species, especially annual grasses, more competitive and adaptable, which may allow some species to expand to higher elevations as well as become more difficult to control due to reduced chemical efficacy (Ziska, Faulkner, & Lydon, 2004). Not only will some species become more invasive, but the array of species would continue to change (Scott, Mahalovich, Rinehart, & Krueger, 2013).

It is possible for climate change to impact resource use within a short timeframe, which could change the suitability and utilization of forage. For example, there have been periods of increased summer temperature and decreased summer precipitation over a 15- to 20-year planning period which would indicate that the potential for changes in the suitability and utilization of forage within a grazing allotment may change within a planning period. This could cause beneficial or negative impacts to the permitted use of a grazing allotment for suitability and utilization. Annual fluctuations of temperatures and precipitation would affect forage palatability under all alternatives.

Though the impacts to livestock grazing from climate change remain to be fully understood or experienced by permittees of the HLC NF, the FS has administrative tools to adapt to unexpected conditions as well as short and long-term changes in resource conditions. Examples of administrative changes include stocking adjustments and adjusting management practices. The impact of climate change to livestock grazing could include limited use of allotments due to less available forage and/or rapid seasonal changes in palatability.

Effects of plan components associated with:

Wildlife management

Grazing livestock share habitat resources with big game species. Big game grazing and browsing is compatible with livestock grazing and browsing. There is a large dietary overlap (40 to 80 percent) between elk and cattle and a similar though smaller dietary overlap with deer (Hansen & Reid, 1975; Wallmo, Gill, Carpenter, & Reichert, 1973). Elk grazing patterns have been shown to be strongly influenced by livestock grazing, as they seek areas of forage regrowth following grazing by livestock (Crane, Mosley, Brewer, Torstenson, & Tess, 2001).

Current forest plans and allotment management plans for most HLC NF allotments identify and manage for wildlife forage needs, such as crucial winter range and limiting interactions between livestock and bighorn sheep to avoid disease transmission, and would continue to do so under all alternatives. Allotment management plans have adjusted grazing management accordingly where allotment boundaries overlap with known big game winter range by having rest pastures in the rotation or attempting to increase livestock distribution, thus decreasing livestock use in areas of concern. In certain site-specific cases, such as localized population fluctuations or a distribution shift due to habitat loss on historic winter range, future limitations could be placed on forage use by permitted livestock through the allotment management plan revision process to assure adequate forage for the wild ungulate populations. Most allotments would have the flexibility to adjust livestock distribution if needed for adequate winter range forage. Upland use levels are rarely exceeded, let alone approached on most HLC NF allotments, as riparian areas primarily drive management actions. Plan components associated with big game habitat management should not limit livestock forage opportunity and not affect permitted use, suitability, and utilization within the grazing allotments to a great degree in any of the alternatives.

Grizzly Bear Conservation Strategy

All alternatives would include the adoption of the grizzly bear conservation strategy. Potential for grizzly bear-livestock conflicts exist where grizzly bear habitat and livestock operations overlap on both NFS lands as well as outside the Forest boundary. Historically, grizzly bear and livestock conflicts have been rare under current management. The 1986 Lewis and Clark NF Plan did address livestock/grizzly bear interactions with two standards that are similar to the strategy: Management Standard D4 – livestock grazing restrictions (5) “Administer provisions of the ESA in occupied threatened and endangered species habitat will use the Interagency Wildlife Guidelines to avoid or mitigate conflicts between livestock grazing and threatened and endangered species” and (6) “Grazing which affects grizzly bears and/or their habitat will be made compatible with grizzly needs or such uses will be disallowed or eliminated.” Adoption of the grizzly bear conservation strategy would apply to allotments within the Conservation Area on both the Lincoln and Rocky Mountain Ranger Districts.

The HLC NF would continue to allow livestock grazing in the twenty five active and two inactive allotments, but no increase in cattle or sheep allotments, or permitted head months within the grizzly bear primary conservation area would occur. Within the primary conservation area, twenty four allotments are permitted for 9,241 AUMs of cattle grazing, with one allotment on the Lincoln Ranger District permitted for sheep grazing at 133 AUMs.

Potential for grizzly bear-livestock conflicts is expected to be mitigated to the best possible extent while continuing to authorize permitted livestock grazing under the action alternatives. Mitigations include implementation of standards and regulations found within the strategy, and BMPs such as capping permitted livestock numbers on allotments, removing carcasses from high concentration areas, and prohibiting boneyards on NFS lands. Implementing a range rider program and having the ability to track collared bears could be other options to be proactive at keeping separation between grizzlies and livestock. Vacant allotments could be added or used in conjunction with existing active allotments without increasing permitted numbers even though the area available to graze is greater. This would give the permittee more places to move livestock to avoid bear-livestock encounters. These strategies benefit existing permittees, even though they may not maintain AUM production.

The grizzly bear conservation strategy is primarily administrative in scope, but is a mechanism to highlight BMPs that could decrease livestock-predator interactions. Conflicts between grizzly bears and livestock on NFS lands within the plan area have been sporadic. However, no matter what the strategy or alternative selected, having a sustainable population of grizzlies in the same mountain ranges as permitted livestock will probably result in depredation of livestock at some point. This may increase operating costs and psychological stress for permittees, as some level of livestock death loss will be inevitable under all alternatives.

Recreation management

Recreation use of NFS lands in the plan area is expected to increase. Recreation management can alter livestock grazing in several ways. Achieving reasonably uniform livestock distribution across an allotment is one objective of livestock management because it allows the optimal use of available forage. Areas with concentrated human activity are generally avoided by livestock. Concentrated or frequent recreation use along roads and near popular areas can cause livestock to avoid grazing or passing through an area, and work directly against a permittee's attempts to distribute livestock evenly. People using camping or picnic sites on the forest sometimes become concerned with livestock in and around their recreation sites. Cattle are occasionally shot by mistake during hunting seasons, or struck and injured or killed by vehicles, resulting in a direct economic loss.

Archery hunting has become very popular since the 1986 Plans were signed. Archery hunting season generally coincides with the last month of the grazing season (September/first half of October). Hunting pressure has and will continue to affect livestock dispersion in both upland and riparian areas under all alternatives. Livestock on public lands may be seen as a competing use to the provision of quality archery hunting opportunities on NFS lands with some member of the general public. Livestock are generally off the Forest when the general rifle season opens in late October.

Fences are a common solution to control livestock, but require installation and maintenance and can be costly. Fencing of roadways may result in a safer travel way for motorists and livestock, but also result in a loss of forage available to permitted livestock. Right-of-way fence can either disrupt planned grazing management or it can increase the management flexibility by creating additional pastures. Higher levels of summer recreation could create increased levels of potential conflicts with livestock grazing, and oftentimes may complicate livestock management and make it more expensive (e.g., more gates may be left open and livestock inadvertently or purposely moved). Winter recreation and motorized over-snow vehicle use would not impact livestock grazing because the permitted grazing season would not occur during the winter months.

Increased recreational uses of NFS lands within the plan area would most likely make grazing on the Forest more expensive for permittees under any alternative. Livestock allotments are most often located within the roaded landscapes on the HLC NF. Increased traffic on roads and trails in these areas would make it more difficult to keep livestock in scheduled pastures as gates may get left open and cause livestock to stray. With expected increases in visitation to easily accessible NFS lands vehicle collisions with livestock on system roadways and vandalism to range improvement infrastructure are likely to increase. These effects from recreational use would be the same under all alternatives.

Cultural resources management

Livestock can contribute to the deterioration of cultural and historical resources through physical contact (e.g., hoof action, rubbing on structures) or by contributing organic matter to a site. They can remove or alter vegetation that protects sites from erosion and make these resource more visible for unauthorized collection. In cases where the level of impact is unacceptable, the impacts can be mitigated with fencing or with changes in management (intensity or timing). Under all alternatives, plan components are in place to ensure the protection of cultural and historic sites and resources. If livestock are excluded from a site or forage use levels are reduced, total AUMs on an allotment may be reduced, which limits a site's suitability and utilization. The potential for these effects is the same for all alternatives.

Fire and fuels management

Fire and fuel management can have different short-term and long-term effects on livestock grazing. Effects depend upon burning conditions and burn type, and the results and timing of a wildfire are much less predictable than from a controlled burn/prescribed fire.

Prescribed burning often results in an increase in forage production and availability, and a shrub community more compatible with a variety of wildlife species. A reduction in shrub and conifer density could potentially accelerate the recycling of nutrients and make water more accessible across the landscape, such as in springs, seeps, and intermittent streams. Both wildland and prescribed fire can increase suitable rangeland on an allotment which in turn can simplify livestock management, improve livestock or wildlife distribution, and increase available AUMs. Under-burns in conifers or other types of burns can increase forage production and accessibility. Areas that are typically grazed may have use deferred for up to two growing seasons following a prescribed burn to allow for vegetative recovery. This "resting" requires that the permittee be flexible in management and involved in considerable advance planning and coordination. If a prescribed fire does not take place on schedule, arrangements need to be made again in successive attempts, which can accrue additional costs to the permittees and/or FS.

A wildfire can have similar effects as prescribed fire, but is likely to have unplanned adverse effects as well. Wildfire may result in the entirety of an allotment being burned, resulting in forage unavailability, with permittees being forced to move livestock to other lands in their operation (e.g., private, state). On rare occasions, large, quick-moving wildfires may also overrun livestock that cannot escape, which results in direct financial loss for a permittee. Wildfire may remove trees and open forest understories to a flush of grass and forb production for many years. Similar to prescribed fire, this can have the effect of recycling nutrients and improving the quality and quantity of forage for livestock and wildlife. However, since timing, location, and burn conditions are not controllable, wildfires are less likely to provide the same amount of positive effects as prescribed burns.

To evaluate the potential impact of fire on livestock grazing, the projected acres of prescribed fire and wildfire are used to determine areas most likely to create more suitable forage. As shown in the terrestrial vegetation section, the projected acres of wildfire range from about 100,000 to 175,000 acres per decade over the next 50 years, and are similar for all alternatives. Projected prescribed burning acres on forested lands are similar for alternatives A, B, C, and D, and typically less in alternative E depending on the decade. The location of prescribed fire treatments is not known, and the model did not include nonforested plant communities.

Fire would need to be within an existing allotment to affect the amount of acres that could be considered suitable for livestock grazing. The differences in the expected acreages of wildfire and prescribed fire are negligible at the forestwide scale, and therefore the potential effects would be similar across all alternatives. All alternatives have plan components that are generally permissive to the use of prescribed fire on the landscape.

Threatened, endangered, and species of conservation concern

Protection of threatened or endangered species habitat may have the largest influence on livestock grazing on Federal lands. Some permittees could be economically affected if conditions on their federal allotment require more intensive management actions or a reduction in stocking in order to manage for improved riparian and at- risk aquatic species habitat. In many cases regarding aquatic and riparian habitat improvement needs, changes in livestock management may require constructing new range improvements, adjusting forage use levels, and/or increasing herding efforts in addition to routine management practices. All these actions cumulatively increase the overall permit administration cost for a grazing permittee. Intensive management can generally be successful in moving resource conditions towards desired condition, but instances may arise where reduced stocking levels are also needed. At this time, predicting any future reductions are outside the scope of this analysis but would be addressed with an analysis if species are listed.

Terrestrial vegetation management

Opportunities for vegetation management that include reducing Douglas-fir encroachment and restoring aspen stands would have beneficial effects on livestock grazing. The predominant understory vegetation in Douglas-fir encroachment areas would respond favorable to conifer removal and provide forage for livestock and big game. A flush of forbs and grasses occurs especially after a prescribed burn and to a lesser extent after other conifer removal methods. The increase in production in these cases can last for many years or even decades. Aspen restoration would also increase forage, but treatments must account for the potential for heavy browsing. Cattle may be fenced from treatment areas, or pastures placed in non-use until sprouts escape the browse zone from livestock and wildlife. Once aspen stands have recovered, understory vegetation would be favorable for providing forage for livestock and wildlife.

All alternatives have similar potential to promote aspen and reduce conifer encroachment, although the action alternatives have more explicit desired conditions related to aspen and nonforested plant communities. Vegetation modeling shows similar expected trends for most attributes of terrestrial vegetation across the alternatives.

Designated wilderness

In designated wilderness, livestock grazing "and activities and the necessary facilities to support a livestock grazing program, would be permitted to continue in NF wilderness areas, when such grazing was established prior to classification of an area as wilderness" in accordance with Congressional Grazing Guidelines" (FSM 2323.2, WO Amendment 2300-90-2). There is to be "no curtailment of grazing permits or privileges in an area simply because it is designated wilderness." Wilderness designation should not prevent the maintenance of existing fence or other livestock improvements, not the construction and maintenance of new fences or improvements which are consistent with allotment management plans and/or which are necessary for the protection of the range." However, travel variances would need to be issued to permittees for motorized access in order to administer their allotments, and would also be subject to line officer approval. In some instances added time to receive the variance and do the job could be expected. Variances could also be denied if conflicts with other Forest users were identified, which would require permittees to conduct administration via non-motorized means.

Wilderness is designated by congress. The three designated wilderness areas on the HLC NF are the Gates of the Mountains, the Bob-Marshall, and the Scapegoat Wildernesses. These designations would be the same for all alternatives.

Recreation access

Travel planning has been completed on the HLC NF, but travel plans are designed to adapt to changing conditions and adjust as needed in order to manage motorized use in accordance with other resource needs. The impact to livestock grazing from recreation and travel management is mainly limited by the grazing permit holder's ability to use motor vehicles to access the allotment. Motorized vehicle access to areas allocated for non-motorized settings can be authorized by line officers. These decisions are discretionary and are made on a case-by-case review of the proposal and circumstances. The intent of the non-motorized areas is not to prevent allotment management as some of the motorized vehicle access needs include transportation of fence and/or water development materials, noxious weed control, and salt distribution. During particular times of the year, or as some routes grow in with vegetation from the lack of use or maintenance; vehicle access may be more restrictive than what is currently available under all alternatives.

Invasive Species

Noxious and invasive weeds have the potential to significantly decrease livestock forage when left unchecked. The impact of noxious and invasive species management on livestock grazing is evaluated based on a qualitative assessment. Impacts are similar between all alternatives, including the no-action alternative. Noxious weed management would continue under direction of both the Helena NF Weed EIS (2006) and the Lewis and Clark NF Weed EIS (1995), until revised. Infestation levels of invasive plants would likely remain steady to slightly increasing over time. Some species may contract in density as new treatment and biological options become available, while other weeds will expand in range and density.

All action alternatives would formalize the need to adopt and authorize the best available tools for weed management, but the same tools can also be pursued under current management. Action alternatives may be more favorable in the long term for overall management direction for invasive species, but in regards to effects on livestock forage, no significant difference would be present between the alternatives.

Under all alternatives, management of invasive species is not expected to affect current permitted livestock numbers, range suitability, and forage use on grazing. Current and foreseeable treatment options for noxious and invasive species are adequate to maintain livestock forage production on grazing allotments. However, weed treatments would need to continue to evolve in order to manage new weed species, expanding infestations, and possible herbicide resistance under all alternatives.

Minor inconveniences for grazing permit administration may occur under all alternatives for weed prevention and treatments. Access to areas may be temporarily closed or delayed for weed management activities. Also mitigations, such as washing vehicles or equipment entering NFS lands, or restricting off-road travel may be used as part of the grazing permit and allotment plan. These actions may temporarily limit access but would have positive effects for rangeland vegetation and livestock forage under all alternatives.

Effects common to all action alternatives

The plan components developed for the revised forest plan are the same for all action alternatives, and are designed to protect upland and riparian resources, manage noxious weeds, and maintain adequate levels of forage (Table 268). Furthermore, there are resource mitigations and BMPs that are part of allotment plans designed to protect forest resources from potential disturbances by livestock grazing. These elements are site-specific for each allotment and not part of this analysis. No action alternatives prescribe grazing standards for allotments with outdated allotment management plans, but defer to developing these annual use indicators at the allotment management plan revision level in order to implement the best site-specific standards to move riparian areas towards desired conditions.

Table 268. Summary of plan components for livestock grazing–alternatives B, C, D, and E

Plan Component(s)	Summary of expected effects
FW-RMZ-DC, STD and GDL	RMZ standards and guidelines would impact livestock grazing, including direction regarding RMZs and certain activities within these zones. Collectively these components may limit grazing in some riparian areas.
FW-SOILS-STD and GDL	Soil standards and guidelines would place limitations on detrimental soil conditions. These measures may place limitations on grazing, but conversely would result in protecting soil productivity and therefore would help provide for better range conditions in the long term.
FW-GRAZ-DCs	Desired conditions for livestock grazing emphasize sustainable grazing, stable soils, diverse vegetation and native plan communities, as well as riparian and wetland health. Movement toward these conditions would be achieved through implementation of the standards and guidelines for grazing and the other resource areas. Necessary changes to meet DCs would be implemented at the allotment management plan/project level.
FW-GRAZ-STDs and GDLs	Generally would affect how allotment planning is implemented. Collectively with the additional RMZ plan components mentioned above, the allotment management planning process will be guided by this guidance so that future grazing will move resource conditions within allotments toward desired conditions.

Alternative A, no action

The existing 1986 forest plans, with permit and/or contract-specific terms and conditions, provide the current direction being used by the HLC NF to address livestock grazing. Forage use levels prescribed for specific grazing systems (Helena NF Plan 1986) would guide management for allotments without current allotment management plans on all other Helena NF allotments. Lewis and Clark NF allotments would follow guidance under the Lewis and Clark NF Plan (1986) which implements a 30 percent bank alteration standard on all fish-bearing streams. On Helena NF allotments west of the Continental Divide, INFISH (1996) grazing standards which prescribe annual use indicators focused on maintaining or improving riparian conditions would continue to guide livestock management on NFS lands.

Alternative A may be the least restrictive for livestock grazing use, especially east of the Continental Divide, based on plan components associated with riparian areas.

Under the 1986 Helena and the Lewis and Clark NF Plans, management direction focused on authorizing livestock grazing on forest allotments while trying to improve rangeland and riparian condition through increasing livestock distribution. The Lewis and Clark NF plan outlined developing allotment management plans that incorporated BMPs such as off-site water developments, grazing systems, and accounted for new research and management techniques to improve riparian areas. Site-specific standards, such as total physical bank damage on key areas in excess of 30 percent, and excessive grass/forb use were identified as factors which indicated damaging livestock use to fisheries habitat. The Lewis and Clark plan identified an average annual use level at 71,000 AUMs, with the potential to increase up to 90,000 AUMs as transitory range became available post-timber harvest. Use levels have remained around the lower level of AUMs and have not increased substantially due to low timber harvest acreage and riparian and aquatic concerns. Allotment range improvements have helped maintain AUMs and aide in distribution in some areas under the current plan. AUMs would be expected to remain stable to slightly decreasing as more allotment management plans are updated and improved management systems are put in place in order to move riparian areas toward desired conditions.

Although allowable use levels were stated in existing 1986 plans, position vacancies and funding deficiencies for rangeland administration have not allowed for 100 percent compliance checks on all primary allotments every year. Therefore, it is difficult to determine as to whether or not annual use indicators need adjustment, which in some cases may be warranted, or if inadequate monitoring has resulted in desired conditions not being met. Under this alternative, livestock use and disturbance levels in the 1986 plans would continue to be implemented until site-specific use indicators determined during an allotment management plan revision, which would most likely be more stringent than current management for many allotments.

In summary, under the no-action alternative grazing management as outlined in the affected environment section would continue, with revisions of allotment management plans and associated protections for other resources following guidance from the 1986 plans. Grazing management would continue to provide the livestock head months authorized in term FS grazing permits. The 1986 plans allowed for increasing the amount of AUMs across the Forests, mainly from the transitory range being created from timber harvest, although riparian and aquatic concerns would most likely keep permitted head months stable. The quantity and size of grazing allotments could change from the current condition. Additional grazing allotments could be added if they were to meet the goals and guidelines of the existing management areas.

Effects that vary by alternative

In the short term, all alternatives are designed to maintain forage production and livestock grazing. All alternatives have similar vegetation treatment levels, which could be favorable for grazing permittees as herbaceous forage should temporarily increase after treatments. Alternative D would not reduce livestock grazing, but would have the most area in RWAs, where access for permittees could be more limited or require authorization in regards to the use of motor vehicles for permit administration.

Rangeland condition and trend

Rangeland condition and trend is measured through implementation and effectiveness monitoring of allotment management plans by methods outlined in FSH 2209.21. Monitoring determines if rangeland acres are meeting, departing from, or moving towards desired rangeland conditions in livestock grazing allotments.

Infestations of noxious weeds can substantially impact livestock grazing if they are extensive enough to reduce the amount of available forage. Any ground-disturbing activity has the potential to expose a site to noxious and invasive plants, particularly when motor vehicles are involved. Conversely, established motorized access can make noxious and invasive plant treatment much easier and cost effective. Even though grazing can be used as a noxious weed and invasive species control mechanism, risk of spreading undesired species to other areas within the forest remains an issue without the use of mitigations, such as quarantine or cleaning livestock before and after they have been in an area known to be infested with undesired species. The alternatives vary slightly in their potential for ground disturbing activities such as timber harvest and prescribed fire, with alternative E predicted to have the least amount. Similarly, the potential for motorized access also varies to a very limited extent, based primarily on whether existing motorized uses are allowed in RWAs and the number of new RWAs. However, for both ground-disturbing activities and motorized access, the differences between the alternatives are slight in respect to the potential to impact rangeland condition and trend. These differences are negligible at the programmatic scale.

Action alternatives are expected to move upland and riparian rangeland towards desired conditions. Effects pertaining to riparian areas are described below.

Effects of plan components associated with:

Recommended wilderness

If RWAs contain active grazing allotments, future grazing management could be impacted. RWA allocation would primarily be administrative in scope for administration of livestock grazing allotments. Some on-the-ground management practices, especially concerning motorized travel, may be subject to increased review for authorization. Table 269 summarizes the acres of allotments within RWA by alternative. Alternatives A and C allow for existing motorized uses in RWAs, while alternatives B and D would prohibit those uses. Therefore, a variance may need to be granted for motorized allotment administration in RWAs under alternatives B and D. Alternative E has no RWAs.

Alternative D has the most RWAs and has the most potential to change motorized uses for grazing permit administration. Therefore alternative D could affect the most grazing permittees in terms of allotment access, operability, and management. Alternative D would not lead to a decrease in permitted AUMs, but could create an increased operating expense for some affected permittees in terms of added time to manage their allotment(s). However, most of the proposed RWAs are semi-remote/primitive and would not result in significant travel or access changes as a result of a RWA allocation. Alternative D would potentially have the largest effect on livestock grazing, but would mainly be administrative in nature. Alternatives B and C could also be potentially administratively restrictive for some permittees, but less than alternative E. Alternatives A and E are the least restrictive to allotment administration.

Table 269. Allotment acreages within RWAs by alternative

Alternative	A	B	C	D	E
Number of allotments with a portion in RWA	3	24	24	47	0
Acres (%) of allotments within RWA	4, 510 (1%)	63,631 (10%)	63,631 (10%)	205,406 (20%)	0
Acres of suitable range within RWA	851	15,200	15,200	58,543	0

RWAs do not affect significant amounts of suitable rangeland acres in any alternative; however permittees that have allotments within portions of RWAs, could potentially have increased administrative terms and conditions that make it more difficult to operate as compared to alternatives with less RWA allocation.

Vegetation management

Vegetation management, such as timber harvest and prescribed fire, can provide transitory range that would be available for livestock and wildlife grazing. Transitional range forage capacity decreases over time as the forest overstory grows back and shades out the herbaceous understory. As timber is harvested, areas may open up to livestock that were not previously available thus increasing capable grazing acres. These newly accessible areas would be used as transitory range as long as the acreage occurs within an existing allotment. Timber harvest could also open up range that is inaccessible to livestock because of natural barriers. This could cause livestock control and management problems if the previously unharvested timber stands were used as natural barriers between allotments or other critical area. If this were to occur, additional range improvements would need to be installed to control livestock. In addition, if livestock use is inhibiting regeneration of trees (through trampling or grazing), livestock may need to be temporarily excluded from these areas, which would offset potential gains in transitory range for a time.

The acres suitable for timber production are the most likely to be harvested, although harvest may occur in other areas as well. Acres suitable for timber production are used to compare the relative probability of creating transitory range across alternatives. Alternative E would have the most acres suitable for timber production. However, the actual projected acres of harvest are less in alternative E than in the other alternatives, due to an emphasis on harvesting stands that yield more timber volume. Therefore, despite having more lands suitable for timber production, the impact of actual acres harvested to create transitory range may actually be greater with alternatives A, B, C, and D. Transitory rangeland is considered as capable range, but would not be considered as suitable, since conifer regeneration would slowly come back into the harvest units over the next approximately 15 years. Transitory rangeland would therefore only provide increased forage for approximately a 10-20 year timeframe. However transitory range would help grazing allotments by providing increased forage and additional foraging areas which would have been inaccessible or void of herbaceous forage prior to timber harvest. Refer to the timber section for more information on projected timber harvest by alternative.

All alternatives would still provide positive effects for rangeland capability by providing transitory range. Transitory range on some allotments could help improve riparian conditions by providing permitted livestock other areas in which to forage. Some allotments do not contain land suitable for timber production and therefore would not benefit from creation of transitory range.

Aquatic and riparian resource management

The aquatics section discusses the effects of plan components on aquatic resources, particularly riparian areas. Management and protection of riparian and wetland resources are emphasized under all alternatives. The watershed, fisheries and soils plan components, under both the no-action alternative (alterative A) and the action alternatives (alternatives B-E) have had and would continue to present some of the greatest challenges to livestock grazing. The objectives and standards for protecting riparian and wetland resources have some of the greatest influences relative to the forest grazing program achieving desired conditions. Changes have been made in grazing management and practices to protect riparian and wetland resources, which are reflected in current resource conditions. Over the last 20 years much has been accomplished through altering grazing practices to protect aquatic resources. This has occurred through allotment management plan revisions throughout the Forest as well as implementation of INFISH standards on a small number of allotments west of the Continental Divide. However, work still needs to be done on many HLC NF allotments in order to move toward desired riparian conditions while maintaining an economically viable level of permitted AUMs.

All action alternatives would adopt revised watershed components along with new RMZs plan components, which may be more limiting than current management, especially the implementation of RMZ components east of the Continental Divide. East of the Continental Divide (the majority of the HLC NF), RMZs would result in more acres being subject to riparian area plan components as compared to the no-action alternative. West of the Continental Divide, the area influenced by riparian plan components is the same across all alternatives because RMZs would be defined the same way as riparian habitat conservation zones are in the no-action alternative.

Several components, including FW-RMZ-DC-01, 02, FW-RMZ-GDL-12, FW-GRAZ-STD-02, and FW-GRAZ-GDL-01, 07, 08, and 09, could increase the amount of management needed within allotments to meet desired conditions. Based on these components, all future allotment management plan revisions would implement some level of riparian allowable use levels and other BMPs if riparian areas are not meeting desired conditions and to mitigate livestock impacts if they are present.

Some permittees would be able to manage to meet grazing standards with the action alternatives and as a result be able to graze their permitted season and numbers. Impacts to permittees might include increased time, labor, and capital investments in order to consistently meet grazing use levels. Other permittees may not be able to meet standards and may have to reduce livestock use to comply with use levels and new management strategies. The effects of implementing grazing standards on Forest allotments for the purpose of improving aquatic habitat is hard to quantify. Many variables impact the effectiveness of action by the permittee and the agency to comply with standards. Site-specific riparian allowable use levels have been effective to move riparian condition in an upward trend. However, a strong commitment is needed by both the grazing permittee and agency to implement, monitor, and provide accountability for allowable use levels to be successful. Overall, effects of aquatic and riparian protections as they relate to livestock grazing would be similar under all action alternatives.

Effects to riparian habitat under the revised forest plan would likely not vary for livestock grazing under any action alternative. Over time, conditions in RMZs as well as aquatic habitat within grazing allotments are expected to improve over current conditions. Refer to the sections on watershed, aquatic habitat, and RMZs for more details.

Cumulative Effects

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. The GAs are island mountain ranges and are typically surrounded by private lands.

Timber harvest, grazing, or conversion of rangeland or forests on adjacent lands would affect vegetation conditions at the landscape level, changing composition and structures, and could potentially affect the lands' capability to be grazed. Most public rangelands, both Montana state and BLM lands, should remain undeveloped and suitable for livestock grazing in the foreseeable future. Private lands surrounding the plan area could potentially be affected by conversion to agricultural lands or residential development. Development of these private lands would affect wildlife connectivity and overall landscape function with NFS lands within the plan area. Future development of private lands adjacent to the Forest boundary could also affect the spread of invasive weeds, increase fire protection responsibilities and costs, as well as increasing the complexity of grazing livestock on the Forest in some areas.

The need for a formal agreement has been identified between the BLM and Forest for co-managed allotments within the plan area in order to clarify allotment administration responsibilities and formalize monitoring roles and methodology. An agreement that defines these items will likely be adopted by the BLM field offices in Lewistown, Butte, and Missoula and the HLC NF within the Plan's lifetime. A formalized approached for allotment administration between the two agencies is expected to have advantages for management consistency, and increased efficiency and effectiveness for both BLM and FS Range Management Programs. This should lead to annual increases in monitoring on more acres of Federal grazing allotments in the Plan area, which ultimately will help determine if movement towards desired conditions in both the Forest Plan and Resource Management Plans is occurring.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 270, for those plans applicable to the livestock grazing resource.

Table 270. Summary of cumulative effects to livestock grazing from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. Generally speaking, management of vegetation is consistent across all NFs due to law, regulation, and policy. The cumulative effect would be that the management of vegetation and grazing would be complementary. This includes specific adjacent landscapes that cross Forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans components related to resilient terrestrial vegetation and livestock grazing, and are complementary to the plan components for the HLC NF. Some HLC grazing allotments contain BLM lands and would also need to follow resource management plan direction for those parcels.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the terrestrial vegetation characteristics in this area are therefore likely similar to the wilderness areas in the adjacent Rocky Mountain Range GA and would complement these conditions.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily non-forested, and calls for managing for fire-resilient vegetation as well as restoration of native vegetation including mountain mahogany specifically. This plan would be generally complementary to the HLC NF most especially in promoting the health of native vegetation.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Terrestrial vegetation is a component of these parks, although not always the primary feature. Specific vegetation conditions would not necessarily contribute to the desired conditions as described for the HLC NF.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. These plans also outline the sideboards on how domestic grazing leases on wildlife management areas will be managed. This plan would complement grazing management on HLC lands.

Livestock grazing use

Livestock grazing, especially for cattle, is likely to be still desired by the local livestock industry within the plan area for the foreseeable future. Cattle, sheep, and horses that graze the NFs during the summer months are provided forage from private lands during late fall, winter, and early spring. Forage from private lands during this period is in the form of native grass pasture, irrigated pasture, irrigated and dry land hay, and fall crop residue. The availability of private lands in the surrounding area that can provide summer forage is somewhat limited. This demand for grazed forage, especially during the months June through October, is greater than NFS lands can supply. Productive lands associated with the lands surrounding the plan area are generally used for crops, including spring/winter wheat and along with other cereal grains. Demand for grazing on NFS lands should continue to be very high for livestock operators whose private lands are adjacent to NF.

Large expanses of grasslands associated with non-arable lands near the plan area are generally obligated to cattle grazing. Some of these grasslands may produce forage at less than their full potential due to the abundance of exotic annual grasses and invasive weed species. Livestock production from State of Montana trust lands is expected to stay relatively stable in the plan area for the foreseeable future. Grazing on private lands depends on the market, drought conditions, and needs of livestock owners. Grazing on these non-federal lands is expected to remain in high demand. Possible future reductions on Federal lands in the plan area due to reduced forage capacity (increases in invasive weeds and tree canopy closure) and tighter administrative constrains for protection and enhancement of TES habitat and other resource concerns will put added grazing pressure and demand on private and MTDNRC land leases.

Livestock grazing is influenced by effects that impact the allocation of forage resources between livestock and wildlife; predation and disease transmission; management adjustments to protect cultural and historical resources; fisheries; threatened and endangered species; water quality; considerations necessary due to wildfire and prescribed fire management, and recreation. All of these factors add to the complexity and expense for the ranching operations that are permitted to graze livestock on the Forest (Rimbey & Torell, 2011). Livestock management is generally considered more difficult on NFS lands than on private lands. In addition, the business of livestock management is subject to factors most often not under the control of livestock operators, such as tourism; land values and potential subdivision of ranches; labor prices and availability; domestic and foreign demand for livestock products; markets and meat prices; FS budgets and farm programs; fuel prices; predator control; social values; and federal policy.

Increasing human population

It is expected that recreational uses on NFS lands will continue to increase, and as more people nationwide continue to look for places to recreate. As more people venture onto public lands, differing societal desires and ideas of what public lands should provide will continue to influence public land management policy. Increased attention and public recreation on grazing allotments in the future may make operating on NFS lands more expensive for permittees.

Conclusions

The following key points summarize the conclusions for livestock grazing use, effects, and opportunities on the HLC NF.

Expected Rangeland Condition and Trend

Rangeland condition and trend is expected to be maintained and improved under all alternatives, as each alternative has plan components or standards and guidelines to improve grazing management. This improvement should move riparian areas and upland plant communities towards desired conditions. Livestock management may become more intensive in a quicker timeframe under the action alternatives with the incorporation of new plan components, and therefore improve riparian areas more quickly than the no-action alternative.

Acres of suitable rangeland and number of permitted livestock head months or AUMs

No alternative proposes to decrease suitable rangeland acreage or decrease head months/AUMs by formally closing allotments or portions of allotments for other resource allocations. Suitable acres and forage within the grazing allotments would continue to be available for livestock grazing.

- Invasive weeds will continue to be one of the biggest threats to desired rangeland condition under all alternatives. All alternatives have tools under the existing Weed EIS documents to effectively manage noxious weeds in a manner which should preserve forage production and permitted grazing use within allotments. Action alternatives include plan components that are more proactive in adapting to new findings and technology in weed science and management, and should have a greater impact in slowing the spread of invasive species, which benefits herbaceous vegetation and ultimately livestock grazing in the future.

- Under all alternatives the permitted use of the existing grazing allotments would continue. Based on current rangeland and riparian conditions and the need to revise allotment management plans for many allotments, changes in the amount of permitted AUMs are difficult to predict. Project-level analysis will determine future stocking rates and other management adjustments to meet desired conditions under all alternatives. Permitted head months over the long-term could possibly decrease under all alternatives due to more intensive management of RMZs and aquatic TES habitat.
- Motorized access on allotments could become more restricted under alternatives that contain RWAs. Some allotments may be more difficult to administer if a travel variance to use motor vehicles is not authorized. However, most of the RWAs are already semi-primitive and/or roadless under current management and contain very small amounts of suitable rangeland and range infrastructure. Therefore, allocation of RWAs should be insignificant for livestock grazing within the plan area.
- All alternatives have the opportunity to implement vegetation treatments, such as timber harvest, prescribed fire, and to allow wildfire to provide resource benefits where feasible. Vegetation should move towards a desired mix of conditions from these treatments and thus provide a secondary benefit of improving forage conditions and transitory range in the future.

3.29 Timber and Other Forest Products

3.29.1 Introduction

The HLC NF contains valuable timber resources, including products in demand by the American public such as lumber, house logs, pulpwood, and fuelwood. Timber harvest may be used to supply timber products as well as move vegetation towards desired conditions and meet other resource objectives such as improving watershed condition, improving wildlife habitat, and reducing wildfire risk. Timber harvest also provides jobs and income in logging and manufacturing of wood products.

Other special forest products include plant and fungi materials that are gathered from NFS lands. The most common of these products provided by the HLC NF is Christmas trees. Other products that are commonly utilized include posts and poles and, periodically in recent fire areas, mushrooms.

Timber and other forest products are analyzed at the scale of all NFS lands across the plan area. Timber demand is evaluated across the counties associated with the HLC NF.

Key indicators that will be used to measure effects of alternatives are:

- Timber suitability (acres)
    - Lands suitable for timber production
    - Lands unsuitable for timber production where harvest may occur for purposes other than timber production
- Timber supply [million board feet (mmbf) and million cubic feet]
    - PTSQ
    - PWSQ
    - sustained yield limit
- Timber demand (qualitative)
- Acres harvested by decade (acres)
- Other forest products (qualitative)

Timber harvest and timber production were raised as issues during public scoping, including desires to increase the amount of harvest, lands suitable for timber production, and/or the volume outputs over time; as well as concerns for the impacts of harvest on other resources and a desire to limit this use.

Definitions and metrics compared for alternatives

The metrics for estimated timber volume outputs have changed from the 1982 planning rule (which guide the current plans and no-action alternative); and those defined in the 2012 Planning Rule (which would guide the action alternatives). The metrics defined for the current forest plans in 1986 are disclosed to describe alternative A. However, to provide a direct comparison, alternative A was also included in the modeling to calculate the metrics as defined in the 2012 Planning Rule. The timber volume metrics from both planning rules and/or associated directives are defined as follows:

- *Long term sustained yield capacity* (applies to alternative A) is the highest uniform wood yield from lands being managed for timber production that may be sustained under a specified management intensity consistent with multiple-use objectives (47 FR, 219.3 1982).
- *Allowable sale quantity* (applies to alternative A) is the quantity of timber that may be sold from the area of suitable land covered by the forest plan for a time period specified by the plan. This quantity is usually expressed on an annual basis as the ``average annual allowable sale quantity." (47 FR, 219.3 1982).
- *Sustained yield limit* (applies to alternatives B, C, D, E) is the amount of timber, meeting applicable utilization standards, which can be removed from a forest annually in perpetuity on a sustained-yield basis. It is the volume that could be produced in perpetuity on lands that *may be suitable* for timber production. Calculation of the limit includes volume from lands that may be deemed not suitable for timber production after further analysis during the planning process. The calculation of the SYL is not limited by land management plan desired condition, other plan components, or the planning unit’s fiscal capability and organizational capacity. The sustained yield limit is not a target but is a limitation on harvest, except when the plan allows for a departure (USDA, 2015).
- *PWSQ* (alternatives B, C, D, E) is the estimated quantity of timber and all other wood products that is expected to be sold from the plan area for the plan period. The PWSQ consists of the PTSQ (below) as well as other woody material such as fuelwood, firewood, or biomass. It includes volume from timber harvest for any purpose based on expected harvests that would be consistent with the plan components. It is also based on the planning unit’s fiscal capability and organizational capacity. It is not a target nor a limitation on harvest. (USDA, 2015).
- *PTSQ* (alternatives B, C, D, E) is the estimated quantity of timber meeting applicable utilization standards that is expected to be sold during the plan period. As a subset of the PWSQ, it includes volume from timber harvest for any purpose from all lands in the plan area based on expected harvests that would be consistent with the plan components. The PTSQ is also based on the planning unit’s fiscal capability and organizational capacity. It is not a target nor a limitation on harvest. (USDA, 2015).

It is not appropriate to compare the measures estimated using the 1982 planning rule directly against the measures calculated based on the 2012 Planning Rule and associated directives.

Timber suitability for alternative A was also updated to account for additional regulation and policy that have changed the management situation since 1986, such as the designation of IRAs. This was important to ensure that the depiction of alternative A accurately reflects what the management situation would be if this alternative were selected. As with timber volume outputs, this also allows for a direct comparison to the suitability determinations made for the action alternatives.

3.29.2 Regulatory framework

36 CFR 223. 1 allows that trees, portions of trees, and other forest products on NFS lands may be sold for the purpose of achieving the policies set forth in the Multiple Use Sustained Yield Act as amended and the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended.

36 CFR 223.239 and 240 provide regulations for free-use without a permit for members of Tribes with treaty or other reserved rights related to special forest products.

36 CFR 261 .6 lists activities regarding timber and other products that are prohibited.

3.29.3 Assumptions

Much of the timber analysis is based on harvest schedule modeling conducted with the Spectrum model; many assumptions are associated with modeling, as detailed in appendix B.

Harvest prescriptions are generalized for this broad scale analysis. During implementation of the forest plan under any alternative, site-specific prescriptions and silvicultural practices would be tailored to the forest stand to be treated. Further, site-specific mitigations and BMPs, such as those that apply in RMZs, would apply as described in the plan. These site-specific factors would not materially change the broad scale volume estimates made for planning purposes.

For the action alternatives, it is assumed that all management strategies described in appendix C of the revised forest plan would generally be followed.

3.29.4 Best available scientific information used

The affected environment was described using FS cut and sold reports from the Timber Sale Accountability database and treatment records in the FACTS database. Information on the location and condition other forest products that could be gathered is limited.

FIA data and a variety of GIS data were used to determine the lands that may be suitable for timber production (see appendix B). Yield tables were developed using the Forest Vegetation Simulator. This information along with Spectrum modeling was used to estimate acres treated by treatment type and volume outputs, as described in appendix B. The actual timber harvest level that would occur during implementation of the plan is dependent on many variables, including the demand for products.

There is no incomplete or unavailable information for the timber analysis. This analysis was completed at the strategic level, using forest level data sources. Site-specific data at the project scale is expected to result in some changes to timber suitability and volume outputs. The data used is the latest available information. The effects of recent disturbances, including the fires of 2017, are not portrayed by this data. However, the analysis of alternatives includes the potential for future fire and therefore the relative comparisons at the programmatic scale remain valid.

3.29.5 Affected environment

Use and development of natural resources on the HLC NF and surrounding lands played an essential role in the economy and growth of the area since the early settlement by European-origin Americans. Mining for gold and other minerals boomed in the late 1800's, and tree cutting that occurred for fuelwood, mine timbers, and railways was extensive in accessible drainages. Harvest became associated with a demand for pulpwood during World War II and to support numerous small mills (USDA, 1986a, 1986b). The original mission of the FS focused on protecting water and timber (Kline & Mazzotta, 2012), and harvest continues to be an important use. Timber harvested on the HLC NF provides a variety of wood products, such as sawlogs, veneer logs, and house logs, as well as logs used for pulpwood, posts and poles, firewood, furniture, and energy.

Timber suitability

Lands suitable for timber production were used to derive the allowable sale quantity in the current 1986 forest plans. These plans determined 282,307 acres to be suitable for timber production on the Lewis and Clark NF and 251,600 acres to be suitable on the Helena NF (USDA, 1986a, 1986b). Timber suitability was determined through the use of resource data and computer models and followed the handbook and planning regulations that were in place at the time. Refer to appendix A for maps of lands suitable for timber production. The acres suitable for timber production in the existing condition are equivalent to that of alternative A.

There have been changes to timber suitability as the forest plans have been implemented. These changes include de-facto reductions in lands suitable for timber production caused by the designation of IRAs. There have also been changes in available vegetation data and land ownership status. To accurately portray the existing condition (and alternative A), timber suitability was recalculated to reflect these changes. Based on these updates, roughly 430,489 acres are suitable for timber production in the existing management paradigm, which is 103,405 fewer acres are suitable for timber production than in the original 1986 forest plans and represents about 15% of the total HLC NF.

Currently, harvest may occur on an additional 40% of NFS lands on the HLC NF that are not suitable for timber production but where harvest may occur for purposes other than timber production. The existing acres unsuitable for timber production where harvest may occur for other purposes is equivalent to that of alternative A. The lands where harvest may occur are shown including and excluding IRAs. While harvest could occur in IRAs, it would be constrained by the 2001 Roadless Area Conservation Rule.

Timber supply

Forest growth rates influence potential timber production over time. Site productivity is generally considered to be fixed based upon site attributes such as topography, soil type, and climate. On the HLC NF, site productivity in terms of tree growth is estimated to be between 20 and 84 cubic feet per acre per year on suitable lands with average rotation ages ranging from 95 to 150, depending on the species and site (USDA, 1986a, 1986b).

Figure 20 displays the total volume of timber cut and sold on the HLC NF from 1986 to 2016. Much of the timber cut from 2009 to 2013 was mountain pine beetle-killed lodgepole pine which was sold as nonsaw material. Firewood has been a consistent contributor to wood volume sold, and has been abundant in the last decade due to the availability of dead trees in areas affected by fire and mountain pine beetle. The last several years (2014-2016) have seen an increase in sawtimber sold compared to the last decade.

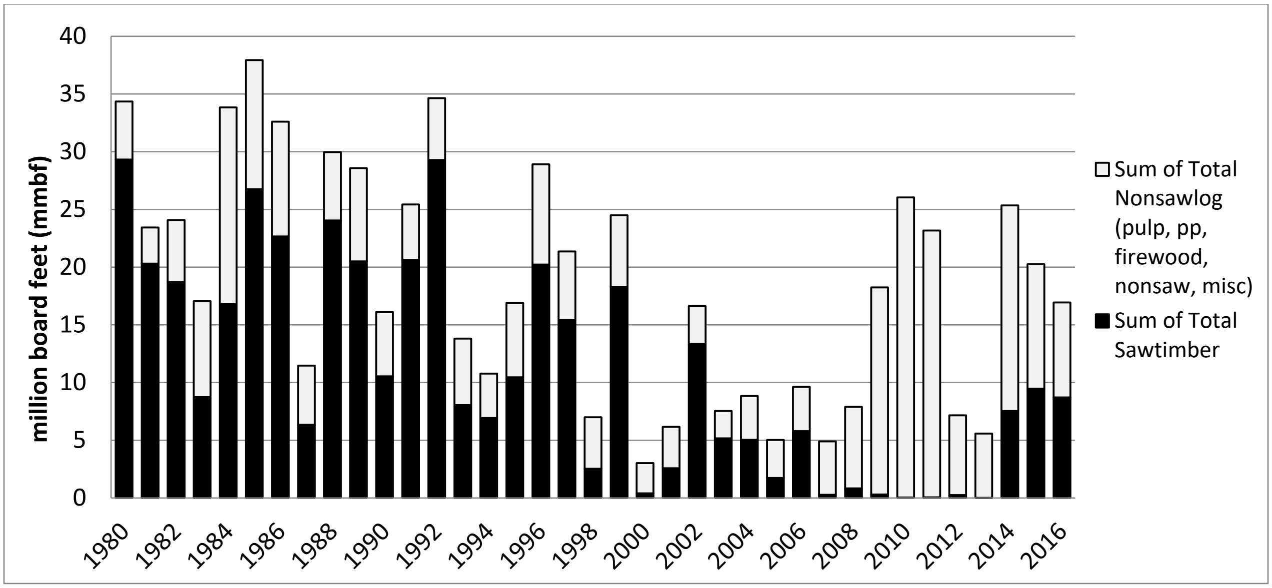


Figure 20. Timber product volume sold from the HLC NF 1986-2016

The long term sustained yield capacity calculated for the 1986 forest plans was 21.3 mmbf for the proclaimed Helena NF and 20.5 mmbf for the proclaimed Lewis and Clark NF. The allowable sale quantity as defined for the 1986 forest plans is 15 mmbf on the Helena NF and 12 mmbf on the Lewis and Clark NF, for a total of 27 mmbf. The actual annual timber volume of timber products offered averaged 12.54 mmbf for the period 2000 through 2016.

The primary species utilized for sawtimber is lodgepole pine. This is one of the most common species on the HLC NF and it dominates the most productive and accessible landscapes. Lodgepole is valuable for a variety of products and has been favored as a timber species due to the ease with which it regenerates. Douglas-fir is the second most prevalent sawtimber species.

Interrelated factors such as site productivity, climate, disturbances, and human activities influence the availability of timber. Stand replacing fires were common on the HLC NF in the late 1800’s. These fires along with early forest practices were followed by a relatively moist climate period suitable for tree establishment and growth. In general, forest cover established quickly in the early 1900’s in burned or cut-over areas. The moist conditions that prevailed during most of the next century limited the potential for wildfires and insect outbreaks. These factors along with forest management policies contributed to decades of successful fire suppression. Thus, relatively extensive continuous forests of the same age and density developed.

These forests were susceptible to drought stress when the climate shifted into a warm/dry climate phase in the 1980’s. The buildup of fuels that resulted in some areas along with the dry climate resulted in more large wildfires. From 1980 to 2013 approximately about 20% of the HLC NF burned in wildfire. Of this, about 55,400 acres burned in areas deemed suitable for timber production in the 1986 forest plans. Where stand-replacing fires occurred, forests were returned to an early successional stage of development, and it will be at least 50-60 years before the trees reach a size where commercial harvest may be feasible.

These factors also helped fuel a recent mountain pine beetle outbreak. At the peak of the outbreak in 2009, over 900,000 acres across the HLC NF were infested, over 400,000 of which were on lands suitable for timber production as defined in the 1986 forest plans. Mortality was most extensive in mature lodgepole pine forests. In areas where the sawtimber component was substantially impacted, the availability of lodgepole timber will be reduced until new forests grow to a merchantable size.

Timber demand

Ultimately, the U.S. market demand for lumber is a derivative for the demand for construction of residential and commercial structures. As a derived demand, lumber markets tend to reflect shifts in national housing construction rates. Across subsectors, residential construction in particular is the single largest consumer of lumber nationwide. Housing starts are measured by the U.S. Census Bureau. The losses and eventual recovery following the great recession in 2008 are evident. Since then, starts have rebounded, but to a more steady state rising and flattening out above 1 million annually (U.S. Census Bureau). Demand for new and remodeled housing can and will change over the planning decades, but for the present, markets which consume U.S. lumber are considered relatively healthy with room for growth.

Regionally, demand for sawlogs remains stable, but Montana Forest Industries experienced less rebounding and more flattening out post-recession. Employment regained 300 jobs since a low in 2010, with an estimated 7,556 jobs statewide in 2015, but compared to 2005, industry employment remains down a few thousand from an estimated high of 9,821 jobs. Similarly, in 2005 primary sales were over $1 billion, and more recently Montana Forest Industry gross sales have leveled out below $600 million; ($589 million in 2015). This evident downshift in Montana Forest Industries largely reflects permanent closures and loss of invested capital and infrastructure including the state's only pulp mill in 2010 (Morgan 2017).

Today, approximately 80 primary forest product firms are operating in Montana. Most of them are small and nearly all are directly dependent on timber from public lands. A much higher proportion of remaining mills exist in western Montana where the resource is still most economical. Collectively, these 80 firms have a vastly shrunken capacity from Montana's historic industry levels. Montana's total timber capacity and harvest levels have consistently trended down since 1990. Capacity to harvest ratio is historically higher, which has improved competitiveness of sawlog prices and helped ensure successful timber sales across Montana. Higher ratios also suggest the industry is capable of scaling in the short term to meet increased national lumber demand, as long as timber supply remains elastic. Empirical data indicates that sawlog prices may remain in a relative steady state or increase in Montana, save for another housing recession or similar market shock.

Relative to the multi-county plan area for the HLC NF, timber production remains of economic importance. The demand for timber has changed over time. In 1998, there were 32 active primary wood products facilities in the primary 13-county plan area. However, by 2017, this number dropped to 11.

In 2015, the amount of timber-related employment in the primary plan area was very small, with the largest amount occurring in the western area (Broadwater, Jefferson, Lewis and Clark, and Powell Counties), which derived a higher percentage of its employment (1.9 percent or 546 jobs) from timber-related industries than either the state (0.9 percent) or the nation (0.7 percent) (USDC 2017). The only two counties in the primary plan area that had any substantial amount of timber-related employment in 2015 were Broadwater County, where timber-related employment accounted for 19.3 percent of private employment (165 jobs) and Powell County, where it accounted for 25 percent (280 jobs). The 165 timber-related jobs in Broadwater County in 2015 occurred primarily in sawmills. In Powell County, most employment was associated with growing and harvesting, which accounted for 113 of the 280 timber-related jobs.

U.S. Census Bureau, County Business Patterns estimates 813 private jobs of the 16-county area's 233,079 total jobs were employed by the timber industry in 2015. These jobs include positions related to the growth and harvesting of trees, sawmills, and other wood products manufacturing. The economic impact analysis provided in the social science and economic section estimates 119 total direct, indirect, and induced jobs are currently associated with the timber program of the HLC NF.

Timber harvest

Timber harvest is a tool used not only to provide timber products and contribute to the local economy but also to achieve multiple resource objectives. These include but are not limited to reducing insect or disease impacts, improving wildlife habitat, increasing tree growth, improving timber productivity, lowering fuels and fire risk, and altering vegetation conditions to enhance forest resilience. Three main types of harvest were analyzed: even-aged regeneration harvest (such as clearcutting, shelterwood, and seed-tree cuts); uneven-aged regeneration harvest (such as group selection and single-tree selection); and intermediate harvest (such as commercial thins and improvement cutting).

Table 271 shows acres harvested from 1940 to 2013. Roughly 138,649 acres of harvest have been recorded. The majority (91%) occurred on lands suitable for timber production.

Table 271. Harvest by type and decade for the HLC NF, 1940-2017

Decade	Even-Aged Regeneration Harvest		Other Harvest		All harvest types	
	Total Acres	Average Annual	Total Acres	Average Annual	Total Acres	Average Annual
1940-1959	7,641	764	639	64	8,270	827
1960-1969	33,367	3,337	3,416	342	36,783	3,678
1970-1979	21,434	2,143	2,785	279	24,219	2,422
1980-1989	18,392	1,839	5,133	513	23,525	2,353
1990-1999	20,385	2,039	10,390	1,039	30,775	3,078
2000-2009	7,566	757	3,114	311	10,680	1,068
2010-2017	3,698	462[1]	5,866	733[1]	9,564	1,196[1]

1. The average is based on 8 years rather than a full decade

Included in the acre figures are salvage projects that occurred after wildfires. The volumes produced from salvage projects are part of the total volume sold in the past as depicted in Figure 20. However, these volumes are not part of the estimated future timber outputs over time shown in the environmental consequences section. In the past, salvage has occurred on a small proportion of burned acres on the HLC NF as shown in Figure 21. Since 1986, salvage has occurred on about 2% of wildfire acres, and was focused in lands suitable for timber production. Salvage cutting after fire is a controversial management approach. More information on the ecological impacts of post-fire salvage is provided in the terrestrial vegetation and snags/downed wood sections.

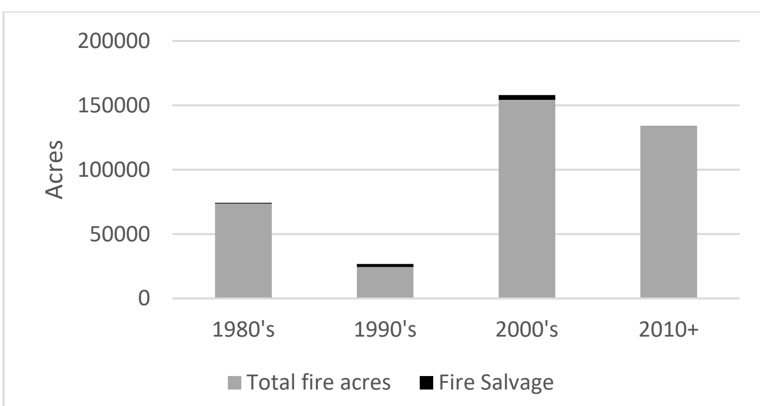


Figure 21. Fire salvage acres compared to total wildfire area burned by decade since 1986

Other activities associated with the tending of harvested stands occur on the HLC NF, including reforestation, pre-commercial thinning, and prescribed burning. Stands treated with regeneration harvest are reforested either naturally from available seed or artificially through planting. Reforestation also occurs following natural disturbances. This activity tends to be focused on lands suitable for timber production in order to maintain appropriate forest cover, but may also occur on other burned lands to meet other resource objectives. Pre-commercial thinning may occur on a subset of previously harvested areas to improve composition or density of young trees. Prescribed burning to reduce fuels and/or prepare seedbeds for reforestation are also common forest management activities.

Other Forest Products

Special forest and botanical products include, but are not limited to, mosses, fungi (including mushrooms), roots, bulbs, berries, seeds, wildflowers, forbs, sedges, grasses, nuts, ferns, boughs, bark, cones, burls, transplants, and Christmas trees. Mushrooms are also periodically harvested in burned areas. Other than personal use Christmas tree permits, the HLC NF offers little in the way of commercial or personal use permits for special forest products due to the limited demand relative to the resources needed to administer the permits. The supply of special forest products is dependent on ecological conditions and distribution of potential growing sites. Forest management or natural disturbances can influence the supply of certain products. For example, fire can increase availability of mushrooms, and thinning of young sapling stands and conifer regeneration can increase production of Christmas trees for a period of time.

Special forest and botanical products have importance to the Tribes as traditional and cultural uses. As per current handbook direction (FSH 2409.18, sec 87.13), the Forest considers “treaty rights, customary and traditional uses (including subsistence and other historical uses of plant material by Tribes), the federal trust responsibility to Tribes, and competitive market demands in determining which products would be excluded from or allowed for sale to commercial harvesters. When there is a shortage of any particular special forest product for tribal use, commercial permits would be issued only to the extent that the tribal use can be accommodated.”

Benefits to people

Timber products and other forest products are identified as multiple uses and key ecosystem services provided by the HLC NF. The economy of local communities can directly benefit from the use of these products. Please refer to the social and economics section for more information about multiple uses, key ecosystem services, and benefits to people.

3.29.6 Environmental consequences

Effects common to all alternatives

Timber suitability

Lands suitable for timber production were determined following the 2012 Planning Rule (USDA, 2012a) and associated directives (USDA, 2015). Lands that *may be suitable* for timber production are the same for all alternatives and total 667,119 acres. These lands are physically and biologically capable of timber production and have not been administratively withdrawn; the process for determining these factors is summarized in Figure 22. Based on management direction and desired conditions, lands determined to be suitable for timber production varies by alternative and represent a subset of the lands that may be suitable for timber production.

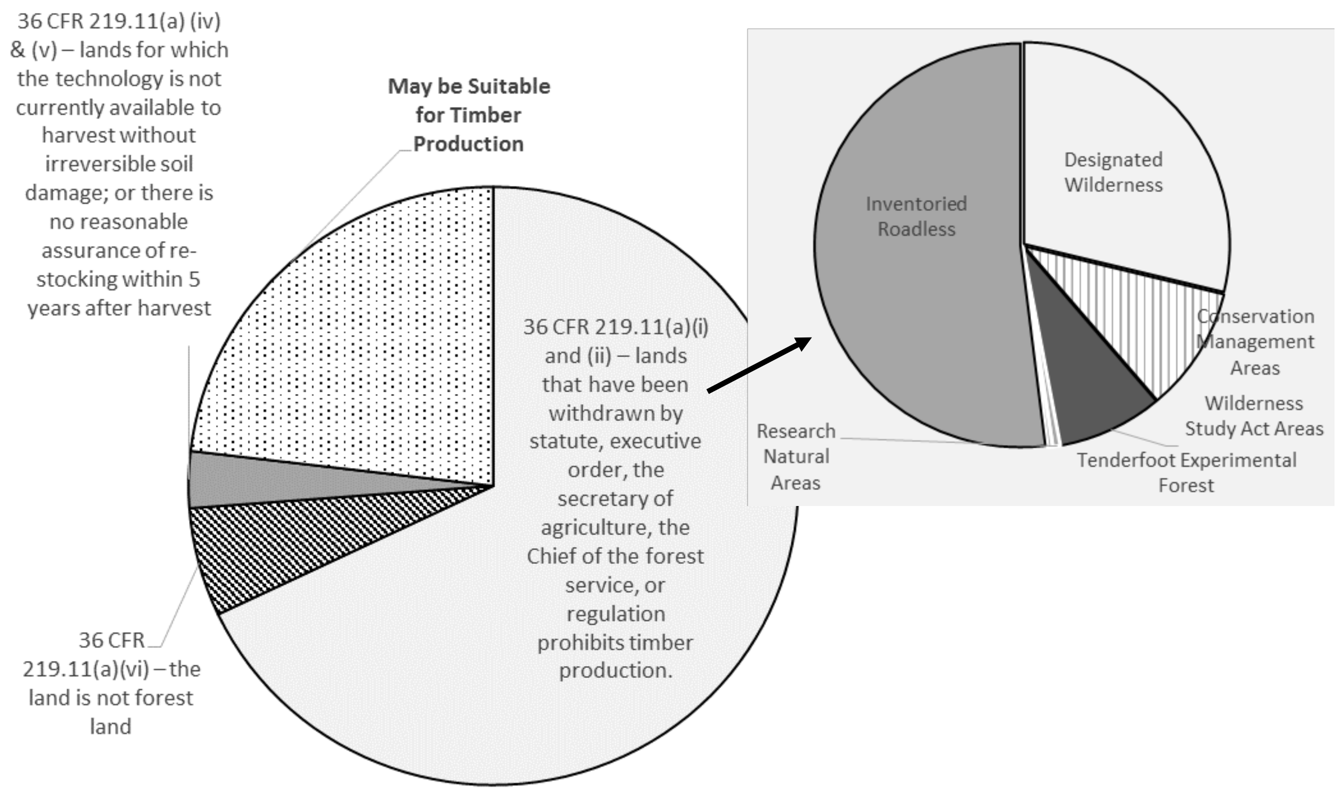


Figure 22. Determination of lands that may be suitable for timber production

Broad-scale information is used to determine suitability. Changes may occur at the project-scale level using site-specific data. Changes to lands suitable for timber production would be monitored during implementation of the plan.

Timber harvest is allowed on lands not suitable for timber production for purposes other than timber production, when consistent with management direction for the area. Timber harvest on these lands is not scheduled or managed on a rotation basis, but does contribute towards projected sale quantities. Unsuitable lands where harvest would never be allowed include designated wilderness, RWAs, WSAs, RNAs, and primitive recreation settings. Of these, only RWAs and primitive settings vary by alternative.

Timber supply and timber harvest

All alternatives provide for availability of timber. The availability of products would fluctuate based on disturbances as well as the implementation of harvest projects. In addition, the actual amount of timber offered would be influenced by a variety of factors, including site-specific environmental analyses, public involvement, harvest methods, and administrative appeals and litigation (Morgan & Baldridge, 2015). Site-specific project analyses would consider factors that are not well-represented by programmatic level modeling, such as specific design criteria that may apply to meet resource objectives such as scenic integrity and wildlife habitat requirements.

Under all alternatives the amount of harvest that occurs would be limited by the budget and workforce capacity, which are not expected to increase.

With any alternative, timber volume offered is influenced by factors outside the authority of the FS. For example, the USFWS provides direction that limits harvest levels to protect threatened and endangered species. Further, conditions and activities on adjacent lands can limit harvest when certain conditions are needed at broader scales, because harvest on other ownerships is taken cumulatively into account when assessing the environmental impacts of projects on NFS lands.

Timber demand

Under any alternative, if additional non-sawtimber infrastructure were developed in the nearby communities, new opportunities may arise that could enhance the amount and types of material utilized from NFS lands (for example, more biomass utilization could result in greater volume removal achieved versus the disposal of material in burn piles).

Other forest products

Under all alternatives, personal use of special forest products would be allowed across the Forest, so long as the use does not conflict with other management guidance, with the exception of the Tenderfoot Creek Experimental Forest. In this 8,870 acre research area, personal use of firewood, Christmas trees, boughs, and surface rock is prohibited in all alternatives. Personal use of other materials would be allowed.

Under all alternatives, commercial use of special forest products would not be allowed in designated wilderness, RWAs, the Tenderfoot Creek Experimental Forest, or RNAs.

Fire may influence the availability of some special forest products, such as mushrooms. Future wildfire patterns and amounts have a high degree of uncertainty; all alternatives would have potential to provide special forest products that are linked to fire. Timber harvest and other management activities may increase or decrease the availability of some special products. For example, the availability of Christmas trees may be increased after regeneration harvest. All alternatives propose harvest to some amount, and would have opportunity to affect the availability of associated products.

Areas that are suitable for commercial or personal use of special forest products and that allow access by road or trail would provide greater potential opportunities for gathering of special forest products. Conversely, the potential for over-harvest of special forest products may increase with greater access. In general, areas expected to have the most road access are those that are established in the plan as suitable for timber production, because roads are more likely to exist for vegetation management purposes.

Climate change

Climate is integrated into the SIMPPLLE model and is a major driver of vegetation change and effects of the alternatives over time, and thus may influence the availability of timber. Potential effects considerations to forests associated with climate change are described in the terrestrial vegetation section.

The lands that may be suitable for timber production were mapped with the best available data for vegetation and site potential. Lands at the margins of producing forest cover, where reforestation may not necessarily be assured due to harsh site conditions, were not included. The potential that future climate may further inhibit tree growth on sites that are currently suitable for timber production, particularly in the warm dry broad PVT, is unknown. It is possible that continued drought may cause shifts on some of the driest lands, and thus the lands suitable for timber production could decrease in the future. It would be paramount to determine suitability at the project level during implementation of the plan to identify such areas. It is not possible to further anticipate possible decreases in expected timber volume outputs.

The expected change in climate in future decades could influence availability of other forest products. Increased frequency or severity of fire could cause changes or shifts on the landscape in plant species compositions or abundance. Uncertainty exists regarding possible effects of climate change on vegetation, and thus on the availability and distribution of plants that may be gathered as special forest products.

Effects from forest plan components associated with:

Access and infrastructure

In all alternatives, limits related to road access on existing roads as well as construction of new roads (both permanent and temporary) could impact the ability to conduct harvest on portions of the forest, due to lack of economically feasible access. The magnitude of this influence cannot be calculated, but is implied within recreation opportunity settings that are included in the timber model.

Mining and mineral extraction

Mining undergoes site-specific analysis to determine effects and required mitigation, and effects to vegetation from mining is determined at the project level. Generally, the impacts to timber from mineral extraction on the forest are localized, and at the forestwide scale would be minor.

General wildlife management

Plan components for wildlife may limit specific actions such as timber harvest. In all alternatives, plan components for species such as bats and raptors would limit disturbances caused by harvest to specific areas during certain sensitive time periods, but these locations and restrictions would not be so extensive as to alter the general expected harvest levels.

Effects common to all action alternatives

All action alternatives contain the same plan components for timber and other forest products. The proposed plan was developed under the 2012 Planning Rule, and all action alternatives provide direction for sustainable levels of forest products. The expected effects of plan components related to timber for the action alternatives is summarized in Table 272.

Table 272. Summary of plan components for timber and other forest products– all action alternatives

Plan Component(s)	Summary of expected effects
FW-RMZ-STD and GDL	Numerous RMZ standards and guidelines would impact timber harvest, including direction regarding RMZs and certain activities within these zones. Collectively these components would limit harvest in riparian areas.
FW-SOILS-STD and GDL	Soil standards and guidelines would place limitations on detrimental soil conditions, skid trails, landings, temporary roads, and ground based equipment use, as well as guiding effective ground cover and coarse woody debris to be left behind. These measures place limitations on harvest, but conversely would result in protecting soil productivity and therefore would help provide for timber productivity in the long term.
FW-VEGT-OBJ-01; FW-PRISK-OBJ-01	These objectives would result in the accomplishment of timber harvest activities on the HLC NF.
FW-VEGT-GDL-02, 03, 04	These guidelines provide direction for reforestation and reseeding, helping to ensure the prompt establishment of appropriate vegetation after harvest.
FW-VEGF	The desired conditions, standards, and guidelines in this section frame the vision of future vegetation on the HLC NF, and as such provide a framework to guide timber harvest to achieve those conditions.
FW-WL-DC, GDL	Wildlife desired conditions and guidelines place limitations on harvest to protect wildlife, including timing restrictions for winter range and avoidance of nest and den sites. These measures would influence how projects are planned but would not substantially alter expected outputs.
FW-ROS-GDL	These guidelines describe appropriate levels of vegetation management within desired ROS classes. This limits timber harvest in primitive and semi-primitive non-motorized settings.
FW-REC-GDL-02; FW-REC-SUIT-01;	These guidelines address the use of timber harvest within developed recreation sites, eligible WSR corridors, and the Lewis and Clark National Historic Trail. These areas are

Plan Component(s)	Summary of expected effects
FW-WSR-GDL-01; FW-LCNHT-SUIT-01	not suitable for timber production and limitations on harvest would not substantially alter expected timber outputs or treatment acres.
FW-SCENERY-GDL-01	This guideline limits timber harvest in certain SIOs, primarily very high and high classes.
FW-IRA-GDL-01	This component influences harvest in IRAs. The establishment of IRAs greatly limits timber harvest across a large portion of the HLC NF.
FW-RECWILD-SUIT-04	This component ensures that no timber harvest would occur in RWAs; the amount of acres affected varies by alternative but has fairly small impacts on projected timber outputs and acres treated because most of these areas are also IRAs.
FW-RNA-SUIT-01	No timber harvest would occur in RNAs.
FW-RT-STD & GDL	New or temporary roads that are constructed and used for timber harvest would not adversely impact other resources.
FW-TIM-DC, GO, OBJ, STD, and GDL	Forestwide timber plan components provide extensive direction on timber management. These include limitations on timber harvest required by law, primarily the NFMA, such as assurance of restocking. An exception to the 40-acre maximum opening size created by even-aged harvest is specified for cool moist forests. These components collectively ensure that harvest occurs, is conducted within law and policy, is sustainable over time, and is designed to move the forest towards desired vegetation conditions.
BB-MISCOR-SUIT-01; LB-SMITH-SUIT-01; LB-SHOWSKI-SUIT-01; LB-TCEF-SUIT-01, 02, 03; LB-KHSB-SUIT-01; RM-TETONSKI-SUIT-01.	These components state that certain areas are unsuitable for timber production, although in some cases harvest may be allowed for other purposes. In addition, the LB-TCEF components limit the availability of other forest products. These areas are generally small and have little to no impact on the overall timber output or harvest acre estimates.
DI-SHRA-SUIT	This component for the South Hills Special recreation area varies by alternative. In alternative B, C, and D, this area is unsuitable for timber production and timber harvest for other purposes is emphasized. In alternative E, there is no special area; some of the lands within the area would be suitable for timber production.
EH-WMU-SUIT-01, 02; EH-TIM-GDL-01	While the Elkhorns Management Unit is not suitable for timber production, timber harvest could be used for purposes such as restoration. Conflicts would be avoided with elk winter range when conducting harvest of timber or other forest products.
RM-BTM-SUIT-01; RM-CMA-SUIT-01	The Badger Two Medicine area and conservation management areas are not suitable for timber production, although some harvest may be used for other purposes. These components would limit harvest on most of the lands on the Rocky Mountain Range GA which are not designated as wilderness.
SN-TIM-GDL-01	This guideline would direct managers to emphasize timber harvest as a tool to achieve purposes such as ponderosa pine habitat restoration in the Snowies GA, although the area is unsuitable for timber production.
UB-WL-GDL-01	This guideline would restrict harvest to some extent in some key locations for wildlife connectivity in the Upper Blackfoot GA.
FW-OFP-DC and GDLs	These components are designed to support sustainable levels of other forest products, including firewood.
GAs (Chapter 3)	The plan components found in GAs map the lands suitable for timber production, and include components to complement the forestwide plan components for all resources. GAs also include maps of ROS settings, SIOs, and special designations which would guide timber harvest on lands both suitable and unsuitable for timber production.

Timber supply

The Spectrum model projects an average of 23 cubic feet per acre per year of growth across all forested areas of the HLC NF across the 5-decade modeling period.

Sustained yield limits must be calculated for each proclaimed forest. A sustained yield limit of 5.03 million cubic feet (26.68 mmbf) was calculated for the proclaimed Helena NF; and 4.02 million cubic feet (21.30 mmbf) for the proclaimed Lewis & Clark NF, totaling 9.05 million cubic feet (47.98 mmbf) for the administratively combined HLC NF. The PTSQ may not exceed this amount, unless a departure limit is specified by the responsible official for the first decade or two of the plan to achieve multiple-use management objectives. No departure limit is currently proposed under any alternative.

Alternative A, no action

Alternative A is bounded by the forest plan components found in the existing forest plans (USDA, 1986a, 1986b) developed under the 1982 planning rule. The expected effects of plan components related to timber for the action alternatives is summarized in Table 273.

Table 273. Summary of plan components for timber and other forest products – 1986 forest plans, alternative A

Plan Component(s)	Summary of expected effects
Helena NF	
Forestwide Timber Standard, II/23(1)	This standard describes the requirements from the NFMA, such as requiring silvicultural prescriptions and using clearcutting only where it is the optimum method. This component is similar to components found in the draft revised forest plan and would ensure that timber activities are consistent with the law.
Forestwide Timber Standard, II/23 (3)	This standard for the design of transportation plans and logging systems would ensure that these are efficient and meet the needs of other resources.
Forestwide Timber Standard, II/23 (4)	This standard describes the 40-acre opening maximum. In contrast to the action alternatives, this standard does not supply an exception to the size limit. This standard would ensure compliance with NFMA regarding maximum size openings.
Forestwide Timber Standard, II/23 (5)	This standard requires feasibility analyses of sales over one mmbf and would help ensure that timber sales are economically viable.
Forestwide Firewood Standards, II/24 (1-6)	These components would help ensure a viable firewood program is provided.
Forestwide Cultural Resources Standards, II/15-16	Forestwide cultural resources components would ensure that cultural and historical sites are surveyed and protected from damage from timber harvest activities.
Forestwide Wildlife & Fisheries Standards II/17-22.	This section provides standards that would guide and/or limit timber harvest activities, including but not limited to elk hiding cover, elk thermal cover, Montana Cooperative Elk-Logging Study recommendations, grizzly bear, bald eagle, gray wolf, plant species of concern, old growth, and snags.
Forestwide Watershed, Soil, & Air Standards II/24-26.	This section provides soil standards that would guide and/or limit timber harvest activities. These standards are generally more qualitative and less specific than the revised plan components found in the action alternatives.
Forestwide Protection Standards, II/33	These standards would help guide timber management to be used as a tool for preventative pest management, and guide the forest to harvest stands at high risk for mountain pine beetle attack and to break up contiguous natural fuel. The effect may be to lessen tree mortality where harvest is feasible.
Forestwide Prescribed Fire Standards, II/34	These standards would ensure that prescribed fire that occurs in lands suitable for timber production would be conducted in a manner that enhances timber productivity.
Forestwide Riparian Standards, II/34-35	These standards would limit timber harvest in riparian areas, and are less quantitative than the plan components found in the draft revised plan.
Management Areas (III/2-III/93)	Management area guidance describes what areas are suitable for timber production. They also state the required visual quality objectives and other resource objectives (such as recreation, wildlife, range, soil, water, and minerals) that would guide and potentially limit timber harvest.
Lewis and Clark National Forest	

Plan Component(s)	Summary of expected effects
A-7, Cultural Resource Management	This component would ensure that cultural resources are protected.
C-1, Wildlife Coordination and Habitat Management; C-4, Wildlife Trees	This standard includes elements that would guide and/or limit timber harvest, including but not limited to big game cover analysis, Montana Cooperative Elk-Logging Study recommendations, TES, snags, and downed woody debris.
E1 (Timber Management), E2 (Firewood), E-3 (Reforestation), E-4, (Timber Harvest)	These standards provide detailed guidance for timber and other forest products, including reforestation, riparian considerations, soils, cultural resources, old growth forest, threatened and endangered species, economic feasibility of timber sales, and grizzly bears. The standards ensure compliance with law and policy.
F-3, Soil, Water and Air Protection	This standard includes components that would guide timber projects, such as sustaining site productivity.
P-1, Protection	This standard would result in harvest being emphasized in stands at high risk to mountain pine beetle; and to break up continuous natural fuels; controlling insects and disease with silvicultural and biological practices; and to use prescribed fire.
P-2, Debris Control	This standard would guide where dozer piling can occur and the location and how much woody debris could be left after timber harvest.
Management Areas (Chapter 3)	Management area guidance describes what areas are suitable for timber production. They also state the required visual quality objectives and other resource objectives (such as recreation, wildlife, range, soil, water, and minerals) that would guide and potentially limit timber harvest.

Timber suitability

Timber suitability for the no-action alternative is based on the 1986 forest plans as amended and implemented. The total land area considered suitable for timber management under the no-action alternative is roughly 15% of the HLC NF. Timber harvest would be allowed on lands unsuitable for timber production for purposes other than timber production, when consistent with other management direction. In alternative A, lands unsuitable for timber production where harvest is allowed represent roughly 40% of the HLC NF, although harvest may be very limited in some of these areas depending on management direction and objectives, as well as existing vegetation conditions. The following section compares timber suitability across all alternatives.

Timber supply

Timber supply metrics for the no-action alternative would be as described in the affected environment, including the allowable sale quantities (which total 27 mmbf for the HLC NF).

However, due to regulatory changes on the landscape, including changes to the areas that may be suitable for timber production, the estimates in the 1986 plans no longer reflect the management situation in the future if alternative A were selected. For these reason, and to make direct comparisons to the action alternatives, the allowable sale quantities in the 1986 forest plans were updated to display a PTSQ and PWSQ following current handbook requirements using the Spectrum model. As required by the planning rule and handbook direction, the PTSQ and PWSQ reflect currently foreseeable budget levels. However, for analysis purposes the sale quantities are also estimated without a budget constraint to understand sustainable volumes under potentially higher budgets.

The PWSQ is expected to be about 22 mmbf for the first decade and about 30 mmbf for the second decade. The following section provides a comparison of timber supply outputs across all alternatives.

Timber harvest

The harvest levels achieved during the implementation of the 1986 plans to date is shown in the affected environment section. The Spectrum model was used to estimate the expected acres of harvest treatments that would occur under alternative A, based on existing management direction found in the 1986 plans as well as new laws and regulation and the updated lands suitable for timber production. The following section provides a comparison of timber harvest acres across all alternatives.

Effects that vary by alternative

Timber suitability

Based on management guidance and desired conditions, the lands suitable for timber production vary by alternative, as shown in Table 274. Alternative A has the least amount of land suitable for timber production, and is nearly identical to alternative D. Alternative E has the most lands suitable for timber production. Alternatives B and C represent a midpoint, with about 3% more land suitable for timber production than alternative A but 6% less than alternative E. Nevertheless, overall the values are somewhat similar for all alternatives. The lands suitable for timber production in alternatives A, B/C, and D all represent roughly 15% of the HLC NF, and 16% in alternative E. There is relatively little variance because of primary factors that do not vary by alternative, such as the inherent capability of the land and designations such as IRAs.

Table 274. Lands suitable for timber production by alternative

Land Classification Category	A	B and C	D	E
A. Total NFS lands in the plan area	2,883,339	2,883,339	2,883,339	2,883,339
B. Lands not suited for timber production due to legal or technical reasons.	2,216,220	2,216,220	2,216,220	2,216,220
C. Lands that may be suited for timber production (A-B)	667,119	667,119	667,119	667,119
D. Total lands suited for timber production because timber production is compatible with the desired conditions and objectives established by the plan	430,489	442,601	434,730	474,184
E. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan (C-D)	236,630	224,518	232,389	192,935
F. Total lands not suited for timber production (B+E)	2,452,850	2,440,738	2,448,609	2,409,155

Table 275 displays the lands suitable for timber production by alternative in each GA. Alternative D results in slightly less land suitable for timber production across all GAs, while alternative E results in slightly higher amounts, most substantially in the Divide and Snowies GAs.

Table 275. Acres and percent of NFS land suitable for timber production by GA and alternative

GA	Alternative A		Alternative B/C		Alternative D		Alternative E	
Big Belts	43,538	14%	67,379	21%	67,283	21%	69,295	22%
Castles	17,743	26%	18,450	27%	17,859	26%	18,450	27%
Crazies	12,826	22%	7,089	12%	6,509	11%	7,517	13%
Divide	76,023	38%	62,640	31%	60,081	30%	71,656	35%
Elkhorns	0	0%	0	0%	0	0%	0	0%
Highwoods	1,170	3%	0	0%	0	0%	1,048	3%
Little Belts	208,975	26%	232,217	29%	226,716	28%	232,222	29%
Rocky Mountain	1,683	<1%	0	0%	1,458	<1%	0	0%
Snowies	16,030	14%	0	0%	0	0%	17,377	15%
Upper Blackfoot	52,502	16%	54,825	16%	54,825	16%	56,618	17%

To the extent that RWAs and primitive settings vary by alternative, so too does the area where harvest may be allowed on lands unsuitable for timber production. Table 276 compares the acres of unsuitable lands where harvest may occur forestwide. The total acres as well as those that are within IRAs are displayed. This distinction is useful because within IRAs, only very limited harvest could occur per the 2001 Roadless Area Conservation Rule. Alternative E has the most lands unsuitable for timber production where harvest could occur, but alternatives B/C have the most of these lands which are not also IRAs. The acres shown include nonforested vegetation types where little to no harvest would occur.

Table 276. Acres (and proportion) of NFS lands unsuitable for timber production by alternative

	Total acres unsuitable for timber production	Unsuitable lands where Harvest may Occur[1]	
		Total	Outside IRAs
Alternative A	2,452,850 (85%)	1,151,728 (40%)	418,133 (15%)
Alternative B/C	2,440,738 (85%)	1,573,374 (55%)	489,392 (17%)
Alternative D	2,448,609 (85%)	1,195,455 (41%)	444,840 (15%)
Alternative E	2,409,155 (84%)	1,664,257 (58%)	463,414 (16%)

1. Excludes lands where harvest would not be permitted for any purpose, such as designated wilderness, WSAs, RWAs, RNAs, or primitive recreation settings. For alternative A, additional areas are excluded based on management area direction that prohibits harvest.

Table 277 displays the lands unsuitable for timber production where timber harvest could occur by alternative and GA. Most GAs do not vary substantially across alternatives, with the Divide, Highwoods, Rocky Mountain Range, and Snowies showing the greatest shifts.

Table 277. Acres and proportion of NFS lands unsuitable for timber production where harvest can occur by GA and alternative

GA	Alternative A		Alternative B/C		Alternative D		Alternative E	
	Total[1]	Outside IRAs	Total[1]	Outside IRAs	Total[1]	Outside IRAs	Total[1]	Outside IRAs
Big Belts	191,757 (61%)	80,404 (26%)	201,578 (64%)	69,230 (22%)	179,325 (57%)	68,982 (22%)	215,061 (68%)	67,943 (22%)
Castles	23,005 (33%)	18,533 (27%)	51,258 (74%	21,876 (31%)	21,243 (31%)	20,258 (29%)	51,258 (74%)	21,876 (31%)
Crazies	23,314 (40%)	4,650 (8%)	50,579 (88%)	13,005 (23%)	26,190 (45%)	10,831 (19%)	50,150 (87%)	12,576 (22)
Divide	73,484 (36%)	46,793 (23%)	107,758 (53%)	73,827 (36%)	82,179 (41%)	69,094 (34%)	130,986 (65%)	66,984 (33%)
Elkhorns	113,833 (71%)	83,026 (51%)	161,251 (100%)	86,482 (54%)	112,021 (70%)	84,376 (52%)	161,251 (100%)	86,482 (54%)
Highwoods	14,105 (33%)	1,167 (3%)	42,291 (100%)	2,677 (6%)	33,692 (80%)	2,677 (6%)	41,242 (98%)	1,628 (4%)
Little Belts	270,531 (34%)	114,212 (14%)	472,298 (59%)	130,254 (16%)	381,168 (47%)	120,832 (15%)	486,783 (61%)	130,249 (16%)
Rocky Mountain Range	254,589 (33%)	28,307 (4%)	324,852 (42%)	32,281 (4%)	198,128 (26%)	7,730 (1%)	324,852 (42%)	32,281 (4%)
Snowies	31,271 (26%)	2,755 (2%)	22,243 (19%)	19,770 (17%)	22,244 (19%)	19,770 (17%)	11,942 (10%)	2,869 (2%)
Upper Blackfoot	155,841 (47%)	38,286 (11%)	139,267 (42%)	40,292 (12%)	139,267 (42%)	40,292 (12%)	190,731 (57%)	40,527 (12%)

1. Excludes lands where harvest would not be permitted for any purpose, such as designated wilderness, WSAs, RWAs, RNAs, or primitive recreation settings. For alternative A, additional areas are excluded based on management area direction that prohibits harvest.

Timber supply

Projected timber and wood sale quantities were estimated using the Spectrum model based on reasonably foreseeable budget levels, as shown in Table 278. The model was run with a mix of objective functions based on the theme of the alternative. Alternatives A, B/C, and D had the objective to move towards vegetation desired condition as quickly as possible, while meeting other resource constraints. Alternative E had an objective to first maximize timber and then move towards desired conditions. Outputs are average annual outputs (averaged across the decade). The model projected roughly 2/3rd of the volume to be removed from lands suitable for timber production and about 1/3rd to be removed from lands unsuitable for timber production. Alternatives A, B/C and D are nearly identical in expected timber outputs. Alternative E would remove the most volume.

Table 278. Average annual projected timber and wood sale quantities by alternative – decades 1 and 2 with reasonably foreseeable budget, Spectrum model

Category	Decade	Alternative A		Alternatives B/C		Alternative D		Alternative E	
		mmcf	mmbf	mmcf	mmbf	mmcf	mmbf	mmcf	mmbf
Timber Products[1] A1. Lands suitable for timber production	1	3.54	16.46	3.13	14.47	3.15	14.57	4.69	22.78
	2	3.62	17.02	3.67	17.36	3.71	17.56	4.53	21.92
Timber Products[1] A2. Lands not suitable for timber production	1	0.80	3.22	1.12	4.71	1.12	4.71	2.72	13.28
	2	2.02	9.22	2.05	9.41	2.01	9.23	2.88	13.93
PTSQ (A1 + A2)	1	4.34	19.68	4.25	19.18	4.26	19.28	7.41	36.06
	2	5.64	26.25	5.72	26.77	5.73	26.79	7.41	35.84
Other Wood Products[2] B. All lands	1	2.01	2.95	1.99	2.88	1.99	2.89	2.46	5.41
	2	2.19	3.94	2.21	4.02	2.21	4.02	2.46	5.38
PWSQ– (A1+A2+B)	1	6.35	22.63	6.24	22.06	6.25	22.17	9.87	41.46
	2	7.83	30.18	7.93	30.78	7.94	30.81	9.87	41.22

1. Timber Products and PTSQ include volumes from harvested material (other than salvage or sanitation) that meet timber product utilization standards.
2. Other Wood Products - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards (small diameter 3 -7 inches).

The Spectrum model was also run without a budget limitation, as shown in Table 279. Because all resource constraints are considered, these outputs levels represent what could be generated given the ecological conditions of the HLC NF, coupled with regulatory direction and the management emphasis of each alternative. To achieve the increased outputs, budgets would have to increase by the magnitude of $1 million per year to $12 million per year depending on the alternative and period. The sensitivity analysis conducted on the Spectrum model confirmed that the budget constraint was the most influential on projected volume outputs as well as planned harvest and attainment of the desired future conditions; see appendix B for a detailed sensitivity analysis.

Table 279. Average annual projected timber and wood sale quantities by alternative – decades 1 and 2, without a budget constraint, Spectrum model

Category	Decade	Alternative A		Alternatives B/C		Alternative D		Alternative E	
		mmcf	mmbf	mmcf	mmbf	mmcf	mmbf	mmcf	mmbf
	1	5.28	24.68	5.64	26.33	5.50	25.68	12.03	56.55

Category	Decade	Alternative A		Alternatives B/C		Alternative D		Alternative E	
		mmcf	mmbf	mmcf	mmbf	mmcf	mmbf	mmcf	mmbf
Timber Products[1] A1. Lands suitable for timber production	2	3.64	17.19	3.80	18.02	3.62	17.18	8.58	41.22
Timber Products[1] A2. Lands not suitable for timber production	1	1.30	5.33	1.69	7.02	1.75	7.32	6.89	31.79
	2	2.94	13.77	3.53	16.52	3.63	16.98	10.33	48.91
PTSQ (A1 + A2)	1	6.57	30.01	7.33	33.36	7.25	32.99	18.92	88.34
	2	6.57	30.96	7.33	34.53	7.25	34.16	18.92	90.13
Other Wood Products[2] B. All lands	1	2.34	4.50	2.45	5.00	2.44	4.95	4.18	13.25
	2	2.34	4.64	2.45	5.18	2.44	5.13	4.18	13.52
PWSQ (A1+A2+B)	1	8.91	34.51	9.78	38.36	9.69	37.95	23.10	101.6
	2	8.91	35.60	9.78	39.71	9.69	39.29	23.10	103.7
Amount annual budget would need to increase[3]	1	$3.6 million		$4.1 million		$4.1 million		$11.9 million	
	2	$1.0 million		$1.3 million		$1.4 million		$9.2 million	

1. Timber Products and PTSQ include volumes from harvested material (other than salvage or sanitation) that meet timber product utilization standards.
2. Other Wood Products - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards (small diameter 3 -7 inches).
3. The amount of money needed per year above the current budget constraint of $5.322 million to achieve the projected volume outputs.

The effects on timber production are related to objective functions of the model. Because of this, alternative E has the highest projected timber and wood sale quantities. However, because the attainment of desired conditions was limited by a constraint to achieve volume production, alternative E also does less to meet the desired future vegetation conditions, as described in subsequent sections of this section.

The sustained yield limit is constant (9.05 million cubic feet or 47.98 mmbf); and the PTSQ must be below this level. However, in alternative E, without a budget constraint, emphasizing timber production resulted in a scenario in which PTSQ could exceed the sustained yield limit due to two interrelated factors. First, there is a difference in the landbase considered for the sustained yield limit versus lands where volume can be removed to contribute to the PTSQ. Second, the application of non-declining even flow was different between the sustained yield limit run and the projected alternatives. Non-declining even flow means that the volume from a certain area is steady or increasing into the future. Refer to appendix B.

The modeling of alternative E, unconstrained by budget, provides insight into the potential level of volumes that could be achieved with more flexibility in scheduling where harvest occurs. However, the directives require that the Forest Plan display levels of harvest and volume removal that are within the fiscal capability and organizational capacity of the HLC NF. Further, the selected PTSQ cannot exceed the sustained yield limit unless a departure analysis is done, and the increased volume could only occur for the first two decades. Because alternative E with an unconstrained budget is not within fiscal capability of the HLC NF, it is not anticipated that such a departure analysis would be conducted.

Timber demand

National and international market forces as well as trade policies have decreased demand for regional timber. According to the Bureau of Business and Economic Research annual outlook in 2017, primary wood product sales, labor income, and employment levels are all down from previous years and historic averages. In 2017, two large mill closures occurred in Montana and surveyed, unused mill capacity remains proportionally high.

Alternative selection for the HLC NF plan would not directly affect timber demand, but may have some impact on timber supply elasticity and solvency for regional or state firms. Flexible timber supply chains are important for mills remaining in Montana to compete and scale to meet national and international lumber demand. Remaining mills in the region have an estimated additional capacity of 200 mmbf. Across alternatives a net wood quantity difference of 16.88 mmbf (alternative E compared to alternatives B/C) exists in the first decade of the plan period, which represents 8% of remaining capacity, statewide. Generally, substitution occurs where there is a mix of public and private land forests available to a mill. However, in counties such as Broadwater, or Deerlodge, and for a few of the most dependent of plan area firms, the HLC NF alternative selection may have a direct impact on supply availability and subsequently sawlog prices.

The influence over timber supply also directly relates to area employment. Timber industry employment, statewide, has dropped to approximately 7,300 jobs. In the HLC NF planning area, approximately 804 jobs exist within these industries. A difference of approximately 320 direct, indirect, and induced jobs are estimated between alternative E, and the other alternatives.

Timber harvest

Table 280 displays the projected acres of harvest that may occur to achieve the volumes shown in the previous section, both with and without a reasonably foreseeable budget constraint. Acres harvested are a mix of silvicultural prescriptions, including even-aged regeneration (clearcut, seedtree, shelterwood) and non-regeneration harvest (uneven-aged harvest or commercial thin).

With a reasonably foreseeable budget constraint, alternatives A, B/C, and D treat a similar amount acres; alternative E treats less. Alternative E achieves greater volume outputs because the stands selected for harvest contain more volume. Without a budget constraint, alternatives A, B/C, and D initially harvest nearly double the acres in the first period, but over time the amount declines to be similar to the levels achieved with a budget constraint. With alternative E, because of the objective function to maximize timber volume, the unconstrained budget run shows greater acres harvested in all periods. To achieve these acres, budgets would have to increase by the magnitude described in the timber supply section.

Table 280. Average annual acres treated by treatment type by alternative, decades 1 and 2, with and without a reasonably foreseeable budget constraint

Type and Decade of Harvest		Alternative A	Alternative B/C	Alternative D	Alternative E
Even-aged Regeneration Harvest	Decade 1 Constrained	3,414	3,326	3,199	1,955
	Decade 1 Unconstrained	4,709	5,821	5,579	9,384
	Decade 2 Constrained	2,007	1,747	1,771	1,759
	Decade 2 Unconstrained	2,099	2,745	2,662	6,198
Other Harvest	Decade 1 Constrained	694	766	876	381
	Decade 1 Unconstrained	2,390	2,500	2,500	2,500
	Decade 2 Constrained	2,500	2,500	2,500	1,000
	Decade 2 Unconstrained	2,500	2,500	2,500	2,500
Total Harvest	Decade 1 Constrained	4,108	4,091	4,075	2,336
	Decade 1 Unconstrained	7,099	8,321	8,079	11,884
	Decade 2 Constrained	4,507	4,247	4,271	2,759
	Decade 2 Unconstrained	4,599	5,245	5,162	8,698

The differences in the alternatives with respect to acres of projected harvest can also be demonstrated by the vegetation types of the stands the model chose to harvest to meet the objective functions, as shown in appendix B. In alternatives A, B/C, and D, the model selected primarily Douglas-fir and ponderosa pine cover types growing on warm dry broad PVTs for harvest. The model was driven to do this based on the desired conditions it was given (such as looking for opportunities to increase the amount of ponderosa pine and the large size classes). In alternative E, the model selected more lodgepole pine and spruce/fir and forests; these types tend to be more productive and therefore more volume removal could be achieved.

Spectrum made choices to maximize desired condition attainment using only desired conditions for cover type, size class, and density class. These are very broad depictions of the desired condition at the forestwide scale, and while the model chose to optimize this by focusing treatments in warm try types in alternatives A, B/C, and D the results should not be misinterpreted to indicate that harvest treatments would not also be appropriate in cool moist forests to contribute to other desired conditions, such as individual tree species presence, vertical structure, and/or landscape pattern (patch size).

Other forest products

Commercial use of other forest products is not allowed in designated wilderness, RWAs, WSAs, RNAs, or the Tenderfoot Creek Experimental Forest. The differences between alternatives is driven primarily by the acres included as RWAs. Table 281 displays the acres by alternative where commercial use of special forest products is not allowed. Commercial use of special forest products is allowed to the greatest degree in alternative E, and to the least in alternative D.

Table 281. Acres where commercial use of special forest products is not allowed by alternative

Alternative A	Alternatives B and C	Alternative D	Alternative E
793,455	972,298	1,233,811	759,223

Effects from forest plan components associated with:

Terrestrial vegetation

The revised plan for the action alternatives contains detailed desired conditions for terrestrial vegetation, and timber harvest is one of the tools available to help move the forest toward those conditions. Although these desired conditions are not enumerated in the existing 1986 forest plans, in practice HLC NF would likely be managed in the spirit of these desired conditions. The desired conditions translated into the Spectrum model included the desired distribution of vegetation types (species composition), size, and density classes. The most substantial desired shifts include an increase in ponderosa pine cover types, and an increase in large and very large size classes. The potential types, locations, and frequency of future harvest were influenced by these desired conditions.

The desired conditions for vegetation were a key component in the Spectrum modeling to ensure the future projected harvest types and volumes would be consistent with the plan components for terrestrial vegetation. Appendix B contains the results for the “desired condition penalty points” from the Spectrum model for each alternative over 5 decades. Fewer penalty points means that vegetation conditions were closer to the desired condition. Alternative A would be the best at moving the forest toward the desired condition, although B/C and D are also very similar. Alternative E incurs the most penalty points, indicating it does not achieve the desired conditions as well as the other alternatives. For alternatives A, B/C, and D, an unconstrained budget would improve the desired condition score, whereas with alternative E is does worse because of its objective to maximize timber volume outputs.

The desired condition penalty points provide a relative comparison of how well treatments in Spectrum contribute to terrestrial vegetation desired conditions. However, these results do not include dynamic interactions between treatments and ecological processes over time.

Fire, fuels, insects and disease

Plan components related to the management of natural disturbances and prescribed fire would have effects to timber. Insects, disease, prescribed fire, and wildfire can affect the production of timber by killing and damaging trees. Conversely, these events can also thin the forest and, while economic loss of specific trees may occur, can contribute to the long term forest health and timber productivity depending on the site and severity of disturbance.

Under all action alternatives, plan components associated with prescribed burning and other fuels management would generally complement timber management and vice versa, because all treatments would be designed to move towards desired vegetation conditions. Plan components in alternative A would also ensure that burning on lands suitable for timber production would complement timber production; less specificity is provided for lands unsuitable for timber production.

The Spectrum model included prescribed burning to move the forest toward desired future conditions. Burning treatments were applied both as maintenance treatments within harvested stands, as well as stand-alone burning prescriptions. Table 282 displays the acres of projected prescribed burning by alternative for the first two decades of the planning horizon. The ability to actually achieve burning is highly uncertain and dependent upon many factors including weather windows. Alternatives B/C and D are very similar, while alternative E projects less burning.

Table 282. Average annual acres burned[1] by alternative, reasonably foreseeable budget

	Alternative A	Alternative B/C	Alternative D	Alternative E
Decade 1	6,479	6,358	6,419	2,777
Decade 2	3,757	3,711	3,714	2,173

1. Spectrum model. Burning in forested vegetation. Additional burning would occur in nonforested vegetation.

The SIMPPLLE model included a predicted amount of wildfire on the Forest based on current fire suppression success and fire starts, as well as potential insect and disease activity. Refer to the terrestrial vegetation section for a summary of the acres affected. Under the action alternatives, plan components recognize the importance of these processes on the landscape. The no-action alternative emphasizes the control of these disturbances on lands suitable for timber production.

Under all alternatives, there exists potential for salvage or sanitation to harvest dead and damaged timber after natural disturbances and/or to attempt to slow or impede insect infestations. The degree to which these harvests are undertaken would depend upon the risks associated with wildfire, infestation spread into healthy stands, public safety, the presence of high value resources, and the management emphasis of the area. These would all be determined at the site-specific project level of analysis and decision. Sanitation and salvage treatments are not part of the estimated timber volume outputs over time. In the past, fire salvage has occurred on a fairly small proportion of burned acres on the HLC NF (about 2%). In general it would not be expected that future salvage would occur to a much greater degree than has been done in the past; however, the potential for future salvage would depend on the type and location of future fire events. It is possible that increasing large fires in lands suitable for timber production could result in an increased amount of salvage harvest, as permitted by plan components. This activity could result in additional volume outputs beyond what is predicted by the protected timber sale and wood sale quantities.

Recreation opportunity settings

Recreation opportunity settings are land allocations that influence access for harvest and/or how much timber harvest can occur on the landscape for alternatives B/C, D, and E. The existing 1986 forest plans (alternative A) did not include any system analogous to ROS; but these settings were modeled for this alternative to provide for a comparison to the action alternatives. For action alternatives, the mapped ROS classes were blended with other designations such as SIOs and timber suitability to reflect the theme of the alternative. These land allocations are underpinnings within the Spectrum model, and therefore their influence on expected timber outputs and harvest acres are expressed in the outputs shown in this section.

The acres allocated to summer recreation opportunity settings by action alternative are shown in Table 283 for lands suitable and unsuitable for timber production. Alternative D is the most limiting to timber harvest because it has the least lands suitable for timber production, and the most primitive recreation settings. In all alternatives, the bulk of lands suitable for timber production have a roaded natural recreation opportunity setting. However, alternatives A, B/C and D also have a substantial portion of suitable lands within semi-primitive motorized, whereas alternative E has very little. Alternative E has both the most acres overall of lands suitable for timber production, and those lands lie within the recreation opportunity settings most permissive to vegetation management.

Table 283. Acres of summer ROS classes by action alternative, by suitability for timber production

ROS Class	Alternative A		Alternative B/C[1]		Alternative D		Alternative E	
	Suitable	Unsuitable	Suitable	Unsuitable	Suitable	Unsuitable	Suitable	Unsuitable
Primitive	1.26[2]	758,130	0	846,121	0	1,231,795	0	723,945
Semi-Primitive Non-Motorized	73,986	957,149	0	955,564	0	617,040	0	1,058,026
Semi-Primitive Motorized	64,284	301,669	81,892	285,486	79,007	262,320	2,168	241,872
Roaded Natural	286,240	413,746	354,082	331,916	349,234	317,394	462,202	368,007
Rural	5,977	22,041	6,612	21,527	6,474	19,935	9,799	17,181

1. Alternative C varies slightly from alternative B in terms of ROS classes in unsuitable lands, and are within a few hundred acres for all classes. These differences are negligible in the context of the timber analysis, and the relative amounts and trends are the same. The acres for suitable lands are the same.
2. The small inclusion of primitive in suitable lands for alternative is likely the sum of tiny mapping errors.

- Primitive settings are not suitable for timber production, and no harvest is allowed. Plan components ensure that no vegetation management occurs. This setting often corresponds to designated and recommended wilderness. Natural processes are the drivers of vegetation change.
- Semi-primitive non-motorized areas are not suitable for timber production, although limited amounts of harvest can occur to maintain natural vegetation. These areas are often but not always associated with IRAs, and limitations on harvest from the Roadless Area Conservation Rule may also apply. These areas typically have poor access and either natural processes or prescribed fire would be drivers of vegetation change more often than timber harvest.
- Semi-primitive motorized settings may or may not be suitable for timber production based on other factors, and harvest for other purposes is generally allowed, although the plan specifies that vegetation management should create limited, widely dispersed treatment areas consistent with natural vegetation patterns. Harvest would be expected to occur at low to moderate levels.
- Roaded natural and rural areas may often be suitable for timber production, and where unsuitable for timber production harvest is generally allowed for other purposes. Typically there is good road access, and vegetation management may be evident while in harmony with the scenic character of the area. Harvest may be a commonly used tool in these areas.

Scenery management

SIOs are also land allocations that influence how much timber harvest can occur on the landscape for Alternatives B/C, D, and E. Scenic objectives are consistent with ROS classes and timber suitability, and therefore are reflected in timber projections. In all alternatives, a SIO of High makes up a substantial portion of lands unsuitable for timber production, which is largely driven by IRAs. This objective is also common on suitable lands, based on viewpoints and other criteria. Alternative D is generally the most limiting to timber harvest because it has the highest proportion of the very high SIO. All alternatives are similar with respect to the proportions of SIOs identified as high, moderate, and low across lands suitable for timber production. The acres allocated to SIOs by alternative are shown in Table 284.

Table 284. SIO, percent by lands suitable and unsuitable for timber production, by action alternatives B/C, D, and E

SIO	Alternative B/C		Alternative D		Alternative E	
	Suitable	Unsuitable	Suitable	Unsuitable	Suitable	Unsuitable
Very High	0%	36%	0%	51%	0%	31%
High	32%	58%	32%	43%	32%	63%
Moderate	36%	3%	36%	3%	35%	3%
Low	32%	3%	32%	3%	33%	3%
Very Low	0%	0%	0%	0%	0%	0%

- Harvest is precluded in areas with a very high scenic quality objective, where the valued landscape character should be intact and landscapes generally provide for ecological change only. Such areas typically correspond to primitive recreation opportunity settings, including wilderness, RWAs, WSAs, and RNAs.
- Areas with a high SIO primarily correspond to IRAs, WSR corridors, the King’s Hill Scenic Byway corridor, and the Continental Divide National Scenic Trail corridor. Timber production and/or harvest may be allowed on limited areas in some of these areas, but scenery (and other regulatory limitations) would result in low to moderate amounts of harvest. This SIO requires that landscape character appear intact, and management activities do not dominate the landscape.
- Areas with a moderate SIO are often suitable for timber production, or harvest for other purposes, depending on the other factors. These landscapes may appear slightly altered although management activities remain visually subordinate to the overall landscape character.
- Areas with low SIOs are also often suitable for timber production, or harvest for other purposes is allowed. These landscapes may appear altered, and management activities are visible. There are no lands with a very low SIO on the HLC NF.

The existing 1986 forest plans (alternative A) do not include the scenic management system or associated SIOs. However, visual quality objectives as described for the visual management system were specified by management area, as shown in Table 285.

Table 285. Acres of visual quality objective, by suitability for timber production, alternative A

Visual Quality Objective	Lands Suitable for Timber Production	Lands Unsuitable for Timber Production
Preservation	1	598,473
Retention	40,217	224,993
Partial Retention	121,283	526,454
Modification	268,987	1,103,300

- In areas with a preservation visual quality objective, only ecological changes are allowed; no timber harvest would occur. Primarily wilderness and RWAs have this objective. No lands suitable for timber production have a visual quality objective of preservation; the 1 acre inclusion in Table 285 is a result of the sum of very small mapping discrepancies.

- A retention visual quality objective allows for management activities which are not visually evident. While some harvest could be allowed, these lands are generally not suitable for timber production, and may correspond to designations such as IRAs.
- A partial retention visual quality objective indicates that management activities must remain visually subordinate to the characteristic landscape. Some of these lands are suitable for timber production, and harvest on unsuitable lands may occur, although the type and rate of harvest would likely be less than lands with a modification or maximum modification objective.
- With a modification visual quality objective, management activities such as timber harvest may visually dominate the original characteristic landscape. This is the most common visual quality objective on the HLC NF, for both lands suitable and unsuitable for timber production.

Under all alternatives, additional site-specific scenery requirements (such as in sensitive viewsheds) would influence project design and potentially the amount, type, and/or location of harvest activities.

IRAs

IRAs are not suitable for timber production and do not vary by alternative. Timber harvest may be allowed, but is limited under the Roadless Area Conservation Rule (2001). The legal requirements for management of IRAs would influence timber harvest and outputs. RWAs tend to overlap with IRAs, and no harvest is allowed. Therefore, to the extent that RWAs vary by alternative, so too does the amount of IRAs where harvest could possibly occur.

Table 286 displays the acres of IRAs by alternative where harvest could potentially occur (that is, IRAs that are not also RWAs, primitive recreation settings, or where harvest is otherwise prohibited). Alternatives A and D have the least IRAs where limited harvest could occur. In the case of alternative A, this is due to additional management area guidance that prohibits timber harvest. In the case of alternative D, this is because it has the most RWAs. Alternative E has the most IRAs that could potentially have harvest because it has no RWAs.

Table 286. Lands where harvest may occur in IRAs

	Alternative A	Alternatives B and C	Alternative D	Alternative E
Acres	733,595	1,083,682	750,615	1,200,842
% of NFS lands	25%	38%	26%	42%

In IRAs where harvest could be allowed, the legal requirements of the 2001 Roadless Area Conservation rule (U.S. Department of Agriculture, Forest Service, 2001) would limit the purposes for which harvest could occur, and the types of prescriptions that could be applied. The possible purposes of harvesting “generally small diameter timber” would include improving at-risk species habitat, or maintaining or restoring ecosystem composition and structure within the NRV. Appendix C of the Draft Plan provides guidance for implementing activities in IRAs. The effect of this direction would be to limit the acres of harvest and volume outputs that occur. Timber harvest in IRAs also requires additional analysis, and receives a great deal of public and agency scrutiny.

The Spectrum model was formulated to allow limited harvest in IRAs not precluded by any other designations, as a possible option in the management solution to move towards desired conditions. The model was calibrated to recognize the limiting factors of recreation opportunity settings and scenery management objectives by blending these characteristics along with IRAs into management area groups. “management group 2” represents IRAs and other areas with a semi-primitive non-motorized area recreation setting or very high to high SIOs. Table 287 displays acres where timber harvest could occur in this group, showing the percent of land that was allocated to harvest sometime over a 50-year modeling horizon, and the amount of harvest in the first two decades with a reasonably foreseeable budget.

Table 287. Total acres and first two decade average annual harvest acres in Spectrum management group 2[1]

Alternative	Total area of MAG[1] 2	Annual average acres of harvest, decade 1	Annual average acres of harvest, decade 2
Alternative A	999,281	205	291
Alternative B/C	815,085	206	293
Alternative D	530,933	204	275
Alternative E	910,764	117	176

1. Management group 2 includes IRAs, semi-primitive non-motorized recreation settings, and very high or high SIOs in lands unsuitable for timber production where harvest can occur.

Table 287 shows that while some limited harvest may be allowed in IRAs and other semi-primitive areas, very little is projected to occur as part of the modeled solution to move towards desired conditions. Alternative D has the fewest acres of management group 2 because it also has the most RWAs. Alternatives A and E have the most acres of IRA where timber harvest may be allowed. In all alternatives, management area group 2 would be influenced by natural disturbances and prescribed fire moreso than timber harvest.

Recommended wilderness

RWA designations have little impact on potential timber outputs. This is because RWAs tend to be located in areas that do not contain lands that may be suitable for timber production as shown in Table 288, and further because they tend to be located in designated IRAs where harvest is limited by the 2001 Roadless Area Conservation Rule. Alternative D has the greatest acres of RWAs that could have been suitable for timber production, and represents the highest degree to which potential timber production would be forgone for RWAs.

Table 288. Acres and proportion of RWAs that may be suitable for timber production by alternative

Alternative	Total RWA Acres	Acres of RWAs that may be suitable for timber production	Percent of RWAs that may be suitable for timber production
Alternative A	34,226	60	0.2%
Alternative B/C	213,076	4,062	2%
Alternative D	474,563	26,773	6%
Alternative E	0	0	0%

Livestock grazing

In all alternatives, livestock grazing would occur both in lands suitable for timber production, and in unsuitable areas where harvest occurs for other purposes. The amount of lands suitable for timber production that are also within current livestock allotments are shown in Table 289 by alternative. Alternative E has the most lands where harvest could occur in livestock allotments because it has the most lands suitable for timber production and no RWAs.

Table 289. Acres of lands where harvest can occur within livestock allotments

Alternative	Acres of lands suitable for timber production - in livestock allotments	Acres of lands unsuitable for timber production where harvest can occur – in livestock allotments
Alternative A	293,969	653,103
Alternative B/C	295,300	951,134
Alternative D	288,505	780,609
Alternative E	319,544	959,657

Management direction that addresses livestock grazing and timber harvest and production would have similar results across all alternatives. While grazing and trampling from livestock can damage seedlings and saplings, plan components would ensure that grazing is managed to avoid impacting the regeneration of forests impacted by harvest, fire, or other disturbances. Plan components would also ensure that grazing is managed in a manner that would not lower site productivity (through damages such as compaction), and therefore would not preclude the production of timber or other forest products under any alternative. The action alternatives also contain plan components that would encourage grazing activities that complement timber stand tending goals and vice versa where appropriate, such as reducing fine fuels to lower fire risk, and/or utilizing forage stimulated by harvest.

Watershed and conservation watershed network management

Watershed plan components exist for all alternatives, but are more specific in the action alternatives than alternative A. These components would affect timber management in that the scale and types of harvest would be influenced by the need to protect watershed function and water quality. This could result in limiting harvest in some cases, such as when forest cover needs to be retained to limit erosion; or increasing harvest, such as when vegetation modification or fuel reduction is needed to limit the effects of potential high severity wildfire. The management direction in the action alternatives recognizes more flexibility in these scenarios than the no-action alternative. The action alternatives also include components that specifically address conservation watershed network and restoration. In all alternatives, plan components related to reducing sediment by limiting or reducing road access may limit access for timber harvest, or reduce feasibility due to the cost of accessing some areas. Such limitations are more explicitly identified in the action alternatives than in the no-action alternative, but the impacts to future management would be similar for all alternatives.

Soils management

Under all alternatives, plan components related to soils would generally benefit the timber resource by ensuring that soil productivity (and thus, future timber growth) is maintained in the long term. Standards and guidelines related to soils would have the general impact of limiting timber production and harvest in some areas, to the extent that activities that may be detrimental to soils (such as repeated compaction, operating equipment on steep slopes, and the like) would be restricted. Such restrictions have been applied to recent timber management activities, and continuing these practices would help sustain future timber production and are generally the same for all alternatives. The action alternatives provide greater specificity in the standards and guides for soils than alternative A, particularly with respect to allowable detrimental disturbance and post-treatment ground cover requirements.

Aquatic habitat and riparian areas

Measures to protect aquatic habitat and riparian areas would apply under all alternatives. The desired conditions, management restrictions, and other regulations that apply to areas near streams, water bodies, and wetlands would limit the amount of timber that may be produced; affect the types of harvest that occur; and/or may reduce operational feasibility of harvest.

- Under alternative A, most of the HLC NF (east of the Continental Divide) would be directed by Montana SMZ laws and BMPs. The SMZs vary depending on the class of stream. Within these zones, no broadcast burning, clearcutting, or road construction would occur, and no ground-based equipment would be used. Various levels of green tree retention would be required depending on the type of stream present (Montana Department of Natural Resources and Conservation, 2006). Further, the 1986 Lewis and Clark forest plan included a riparian management area (R) that included specific plan components, including a description of specific harvests (uneven-aged management) that could occur within riparian areas. Under this alternative, riparian areas west of the Continental Divide are delineated as riparian habitat conservation areas with restrictions applied based on the INFISH (USDA, 1995c). This direction would apply to portions of the Divide GA and most of the Upper Blackfoot GA. The riparian habitat conservation area delineations and associated guidance are similar to the RMZs defined for the action alternatives.
- Under alternatives B, C, D, and E, RMZs would be established. The width of the zones depends on the class of stream, and both inner and outer management zones are defined. These zones are not exclusions zones, and vegetation management including harvest may occur. Limitations are more stringent in the inner riparian zones, where management must specifically benefit the aquatic resource. In the outer riparian zones, vegetation management may occur to achieve a wide range of desired conditions as long as it does not preclude achievement of desired conditions for riparian resources and wildlife in the inner zone. No salvage harvest could occur in the inner RMZ, and no clearcutting could occur in any part of the RMZ. Other standards and guidelines related to landing and road construction would also apply.

West of the Continental Divide, alternative A is similar to the action alternatives (B, C, D, and E) with respect to the sizes and management direction applied to riparian areas, although guidance for vegetation management in the outer RMZs is more flexible with the action alternatives. East of the Continental Divide (the majority of the HLC NF), the action alternatives would establish larger RMZs than alternative A. The inner zones for many streams, where vegetation management is most limited, would be fairly similar in width to SMZs under the no-action alternative. The outer zones would be larger in size than SMZs, but more flexibility to permit vegetation management may be applied in these areas.

Riparian areas as defined by any alternative are not suitable for timber production because management requirements and constraints preclude planning a scheduled flow of timber products. However, harvest may occur when consistent with management restrictions and desired conditions for the riparian resources. Under all alternatives, water features smaller than 120’ wide were not excluded from the mapping of lands suitable for timber production due to the difficulty in mapping. Rather, riparian areas associated with water features are considered to be unsuitable inclusions.

Management zones associated with riparian areas would be identified during project design because it is not possible to accurately map all zones at the broad scale. However, for the purposes of a programmatic comparison, estimated riparian areas for one category of stream (fish-bearing perennial), were identified to compare the magnitude of their influence on timber harvest across alternatives. Table 290 displays the estimated acres of these zones for each alternative, in lands suitable for timber production and unsuitable lands where harvest may occur for other purposes. The overlap of RMZs in lands suitable for timber production is smallest for alternative A, because the zones are represented by smaller widths east of the Continental Divide. Although the RMZs are the same for all action alternatives, the overlap of these areas on lands suitable for timber production in alternative E represents a slightly smaller percentage than alternatives B/C and D because the total acres suitable for timber production is greater. Additional riparian zones for other stream classes (perennial non-fish bearing and intermittent streams) would also influence timber management.

Table 290. Acres of land where harvest may occur, within RMZs associated with fish-bearing perennial streams[3, 4]

	Alternative A[1]	Alternative B/C[2]	Alternative D[2]	Alternative E[2]
Acres of RMZs in lands suitable for timber production	8,765	24,496	24,249	25,782
% of lands suitable for timber production in RMZs	2%	6%	6%	5%
Acres of RMZs in lands unsuitable for timber production where harvest may occur	22,682	69,350	52,533	73,843
% of lands unsuitable for timber production where harvest may occur in RMZs	2%	4%	4%	4%

1. Riparian areas for alternative A are defined using INFISH west of the Continental Divide, with a maximum possible width of 300’. Riparian areas for alternative A east of the Continental Divide are based on Montana SMZ law, based on a maximum possible width of 100’.
2. Riparian areas for alternatives B/C, D, and E are based on RMZ definitions both east and west of the Continental Divide, based on a maximum possible width of 300’ to encompass the outer zone.
3. For all alternatives, the stream mapping for areas west of the divide is based on the INFISH. For areas east of the divide, the stream mapping is based on fish distribution from Montana Fish Wildlife and Parks.
4. Additional riparian zones would be associated with stream classes other than fish-bearing perennial. Actual riparian zones on the ground could be smaller than the maximum widths based on slope and other factors.

RMZ guidance associated with fish-bearing perennial streams would have the potential to limit timber harvest on 2 to 6% of lands suitable for timber production or other lands where harvest could occur, depending on alternative. This influence is less for the no-action alternative as compared to the action alternatives. However, vegetation management could occur within the outer RMZs identified for the action alternatives. The most stringent guidance would apply to the inner RMZs, which would not differ substantially from the size of SMZs that apply to alternative A.

Previous harvest has not been common in the riparian zones for perennial fish-bearing streams, but has occurred. Based on database queries of activities recorded from 1940 to 2013, harvest occurred in riparian zones as defined for alternative A on about 2,688 acres, and on 6,426 acres of riparian zones as they would be defined for the action alternatives. These figures represent 2% and 5%, respectively, of the 138,649 acres of total harvest recorded on the HLC NF.

Based on the extent of RMZs in potential harvest areas, and because harvest may occur to some degree, the potential impact of the management restrictions in riparian areas is not likely so great that the projected timber volumes and expected harvest treatments generated by the Spectrum model would be affected to a great degree with respect to the programmatic timber analysis.

Continental Divide National Scenic Trail

The Continental Divide National Scenic Trail runs through the HLC NF plan area in the Divide, Upper Blackfoot, and Rocky Mountain Range GAs. Many stretches of this trail lie within designated wilderness, where timber harvest is prohibited. Other stretches are in IRAs, where timber harvest is constrained. However, some stretches of this trail are also located in areas where harvest could occur, including both areas that are suitable for timber production and those unsuitable for timber production where harvest can occur for other purposes. In these areas, harvest may occur but would be constrained by plan components associated with the trail, which are designed to maintain a high or very high SIO within a half mile of either side of the trail (FW-CDNST-GDL-02, 03). Guidelines also limit harvest-related activities such as temporary roads, skidding, hauling, and log landings (FW-CDNST-GDL-08, 09).

The overlap of lands where harvest could be permitted within ½ mile of the Continental Divide National Scenic Trail is shown in Table 291. Alternative D would have the least amount of overlap with the trail corridor in both lands suitable for timber production and unsuitable lands where harvest could occur for other purposes, largely as a function of RWAs. Alternative A has the most overlap of lands suitable for timber production, while alternative E has the most overlap of unsuitable lands where harvest may occur for other purposes. In these areas, the types of harvest and amount of volume removed may limited, and/or harvest projects may be more complex to implement to meet the guidelines for the trail.

Table 291. Acres where harvest may occur within a half mile on either side the Continental Divide National Scenic Trail

	Alternative A	Alternative B/C	Alternative D	Alternative E
Lands Suitable for Timber Production	15,142	11,069	10,700	12,321
Lands Unsuitable for Timber Production where Harvest may Occur	42,248	49,141	28,851	59,505

Elk management

Under all alternatives, the management of elk would limit the location, timing and duration of harvest and in some cases lower the amount of harvest because of certain required vegetation conditions (such as hiding and thermal cover). These plan components vary by alternative and GA. The potential influences of these components cannot be explicitly modeled and quantified.

Plan components related to elk are detailed and specific in alternative A, and include requirements for the maintenance of certain vegetation conditions, such as hiding or thermal cover as defined by tree canopy density. The effect of these components would be to limit harvest in some areas. Other components, such as open road densities and elk security standards, may limit the feasibility of some harvest projects.

Under the action alternatives, plan components related to disturbance to ungulates (specifically on winter range) would also influence the potential timing and duration of harvest activities. Hiding and thermal cover would also be considerations for determining desired vegetation conditions at the project scale. Elk security guidelines may limit harvest, and are found in alternatives B and E but not C or D. For all of these aspects of elk management, the potential constraints to timber management would be based on site-specific information and the best available science to provide for the needs of elk.

The Elkhorns GA has unique plan components under all alternatives, based on its designation as a wildlife management unit. These components are similar across all alternatives, and would result in any harvest that occurs being designed to benefit desired wildlife and vegetation conditions, hazardous fuel reduction, or protection of values at risk. This GA is not suitable for timber production under any alternative because of these considerations.

Grizzly bear management

Under all alternatives, grizzly bear management would be guided based on the Draft Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy (U.S. Department of Agriculture, Forest Service, 2013c). Management direction from the Conservation Strategy would be amended to the existing plans for alternative A; or incorporated into all action alternatives (see appendix I of the Draft Plan).

Management for grizzly bears may affect to a relatively small degree the amount of timber that is feasible to remove, as an indirect result of limits on road access and duration of project activities. These restrictions would apply to the primary conservation area and to zone 1. Where grizzly habitat management applies, grizzly bear secure core habitat is calculated based on distance from motorized routes, and management direction would result in no increase in open motorized route density, and no decrease in core, as compared to a 2011 baseline.

On the HLC NF, the primary conservation area occurs only on portions of the Upper Blackfoot and Rocky Mountain Range GAs, and zone 1 occurs only on a portion of the Upper Blackfoot GA. In all alternatives, very little to no land suitable for timber production is identified in the Rocky Mountain

Range GA. Table 292 shows how much land suitable for timber production overlaps with the primary conservation area and grizzly bear secure core habitat as currently calculated. The remainder of the primary conservation area and secure core habitat is in IRAs, wilderness, or other lands unsuitable for timber production. The area where potential harvest would be the most restricted are the grizzly bear secure core habitat areas, which are present on a small proportion of land suitable for timber production.

Table 292. Lands suitable for timber production within the grizzly bear primary conservation area and secure core grizzly bear habitat

Alternative	Rocky Mountain Range GA		Upper Blackfoot GA	
	Primary conservation area	Secure Core	Primary conservation area	Secure Core
A	1,683	1,597	18,549	1,037
B/C	0	0	15,712	375
D	1,458	339	15,712	375
E	0	0	16,364	434

Due to the limited influence that habitat management for grizzly bears would have on timber management at the programmatic level, no constraints were applied in the Spectrum model. The general effects would be to possibly lower the feasibility of some timber projects, primarily within the Upper Blackfoot GA, by influencing the access and duration of projects. The Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy plan components would not have an impact on required reforestation or prescribed burning associated, because exceptions apply to allow access to perform these activities.

Grizzly bear management may influence other special forest products, but to a very minor degree. While limiting road access may inhibit firewood gathering in some areas, components allow for the temporary use of access roads in projects to be used for such activities. Special considerations would apply for special use permits for beehives to limit potential grizzly-human conflicts; this use does not currently occur on the HLC-NF. Finally, projects that increase food for grizzlies (i.e., huckleberries) would need to avoid certain locations such as recreation areas.

Canada lynx management

All alternatives would incorporate the NRLMD (USDA, 2007a). This direction would influence timber activities in potential lynx habitat, which is identified based on PVTs. Refer also to appendix H of the Draft Plan. For the timber resource, the impacts of lynx management would have the greatest effect on lands suitable for timber production, but would also influence harvest that occurs on unsuitable lands.

The management guidance that would influence timber production and harvest in potential lynx habitat includes not allowing harvest in multi-storied forest except in specified situations; possibly limiting the extent of regeneration harvest depending on how much stand initiation habitat is present in a given LAU; and not allowing pre-commercial thinning in stand initiation habitat. Some exceptions and considerations would apply, including but not limited to treating lands adjacent to administrative sites, treating lands in the WUI, and conducting treatments to restore whitebark pine. The lynx management direction also notes the potential for vegetation management to occur that would help develop desired habitat characteristics. This may influence the type of harvest conducted in some areas; for example, uneven-aged harvests may be used to help develop multi-storied forests.

Although the management constraints are only required in occupied lynx habitat, the guidance should be considered on all lands. Occupied lynx habitat has been identified by the USFWS, and currently includes only the Upper Blackfoot and Rocky Mountain Range GAs. However, because the guidance should be considered on all lands, and there is potential for occupied habitat to change, lynx constraints are analyzed across the entire HLC NF. Lynx constraints were applied to the Spectrum model. The projected harvest quantities, types, and volume outputs shown in this section therefore reflect lynx management direction to the extent possible. These constraints included:

- Limiting the percent of areas that can have a regenerating harvest or prescribed burn
- Not allowing Precommercial thinning in certain vegetation types
- Not allowing treatment in multistoried habitat

Table 293 compares the lands suitable for timber production and the proportion of those lands that are also in potential lynx habitat. This shows that the magnitude of the potential influences of lynx habitat management in lands suitable for timber production are similar across all alternatives. In general, potential lynx habitat influences roughly half of lands suitable for timber production.

Table 293. Lands suitable for timber production within potential lynx habitat - acres

Alternative	Total lands suitable for timber production	Acres of land suitable for timber production in potential lynx habitat	Percent of land suitable for timber production in potential lynx habitat
A	430,489	243,730	57%
B/C	443,057	228,839	52%
D	435,014	223,902	51%
E	474,640	236,863	50%

Sensitivity analysis on the Spectrum model indicates that management constraints for lynx have a relatively minor effect on the timber analysis, causing an 8% reduction in PWSQ and 6% reduction in harvest acres in decade 1, as compared to an unconstrained baseline model scenario. This is only when looking at the sensitivity of the model to constraints; see appendix B for more information. Also see the terrestrial vegetation section for a description of effects from lynx management on vegetation management and desired conditions.

Cumulative Effects

The demand for timber products, supply from other sources, laws, and regulations all affect the amount of timber that may be harvested from the HLC NF. Budgets and court decisions also impact timber supply.

Changing human population

A stressor that may increase in the future is population level, locally and nationally, with resulting increasing demands and pressures on public lands. Locally, at present populations are increasing in the counties on the west side of the plan area, but are declining or stable in other areas. These changes may lead to increased tensions between the demand for timber and changing societal desires related to the mix of other uses public lands may provide. The sustainable use of other forest products may become increasingly vulnerable, requiring permitting and limitation of use.

Management of adjacent lands

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some GAs contain inholdings of such lands, while others are more unfragmented in terms of ownership. The GAs which are island mountain ranges are surrounded by private lands. Harvesting or conversion of forests on adjacent lands would affect vegetation conditions at the landscape level. State law applies to all harvest activities regardless of ownership; therefore, basic resource protections would be consistent. However, harvest practices on other lands would not necessarily be conducted to meet the same desired conditions as those outlined in the HLC NF Draft Plan.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF Draft Plan are summarized in Table 294, for those plans relevant to the timber resource.

Table 294. Summary of cumulative effects to timber from other resource management plans

Resource plan	Summary of effects
Forest Plans of Adjacent National Forests	The Flathead, Lolo, Beaverhead-Deerlodge, and Custer-Gallatin NFs are adjacent to the HLC-NF, and share boundaries on specific GAs (Rocky Mountain Range, Upper Blackfoot, Divide, Elkhorns, and Crazies). The Flathead and Custer-Gallatin are currently in forest plan revision under the 2012 Planning Rule. The Beaverhead-Deerlodge is guided by a recent forest plan (2009), under the 1982 rule. The Lolo is guided by a 1986 forest plan. All of the forest plans contain plan direction that meets the requirements of the NFMA, such as limitations on harvest, reforestation practices, and maximum sized openings. Generally speaking, management of the timber resource is consistent across NFs due to consistency in law, regulation, and policy. The management of the specific areas that are adjacent would be complementary across boundaries.
Montana Statewide Forest Resource Strategy	The forest action plan is complementary to the timber management on the HLC NF, by including strategies related to increased resilience, wildfire safety, and most especially providing forest products and biomass. The cumulative effect would likely be additive, in terms of the amount of timber harvest treatments that occur across the landscape and in a broad sense moving towards the vegetation desired conditions.
BLM Resource Management Plans	The Butte, Missoula, and Lewistown field offices manage lands that are intermixed with the HLC-NF. The Missoula and Lewistown areas are currently in revision. The Butte area is guided by a recent plan (2009). At a broad scale, the themes of the plans are similar to the HLC NF; timber management would have similar results.
County growth plans	Many of the county growth plans associated with the HLC NF plan area emphasize an interest in promoting the use wood products from NFS lands, as an economic contribution and to enhance the sustainability of forest landscapes. This would indicate that timber demand would remain an important feature in the local communities.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components have guidance specific to these areas. Treatments, including harvest, may be emphasized in these areas more so than others.

Timber demand

The demand for wood products allows for successful vegetation management and timber sales from the HLC NF. If demand for wood products increases, so too will demand for timber sales from the HLC NF. Alternatively, if demand decreases and mills close, there may be less desire for HLC NF timber. A decrease in demand may reduce the amount of timber sold regardless of the alternatives. Lower wood quantity may contribute to total public and private land timber supply chain elasticity, especially for mills isolated from other ownership and highly dependent on HLC NF forest ownership. If enough timber is collectively removed from markets, it would have the effect of increasing sawlog prices, decreasing operating profits for existing mills.

Conclusions

Managing lands suitable for timber production can provide a sustainable supply of timber products, which is important for local communities and provides other ecosystem benefits such as storing carbon in harvested wood products. Timber harvest, on lands suitable and unsuitable for timber production, is an important tool to achieve desired vegetation conditions and objectives for multiple resources.

All alternatives identify lands suitable for timber production and other lands where harvest can occur for purposes other than timber production. The magnitude of difference across alternatives is minor because the primary factors that influence these determinations do not vary by alternative, such as IRA designations and the inherent capability of the land to grow trees. The primary difference is due to management emphasis of certain areas, primarily the South Hills Recreation Area and the Little Snowies portion of the Snowies GA. There is not a substantial trade off with RWAs and lands suitable for timber production, because most of these lands are IRAs and unavailable for timber production regardless of whether or not they are RWAs.

In all alternatives, a substantial proportion of lands unsuitable for timber production where harvest may occur are IRAs; while some harvest could be allowed, it would be constrained to a great degree by the 2001 Roadless Area Conservation Rule. While alternative E has the most unsuitable lands where harvest may occur, alternatives B/C have the most unsuitable lands where harvest may occur that are not in IRAs.

All alternatives would produce timber volume. Alternatives A, B/C, and D are similar with respect to expected timber outputs, acres harvested, and achievement of desired conditions. Alternative E produces higher timber outputs, although it harvests fewer acres and does less to achieve the desired vegetation conditions than the other alternatives. The difference with alternative E is a function of management emphasis to maximize timber production, which results in harvesting fewer acres more intensively, in the most productive vegetation types. Alternatives A, B/C, and D do more to achieve desired conditions by harvesting more acres less intensively, in less productive vegetation types.

All alternatives are projected to have the potential to harvest acres and produce timber volumes that exceed the levels the HLC NF has produced in recent decades. This is in part due to factors which are not under FS control and are not included in the modeled metrics. Another factor is the proportion of sawtimber to nonsawtimber volume. For example, in the last decade, an emphasis toward non-sawtimber volume sold (dead lodgepole pine) occurred in the wake of the mountain pine beetle outbreak. Regardless of alternative, actual timber outputs will be influenced by factors outside of the FS control, including actual budgets received and appeals/litigation processes.

Projected timber outputs are displayed both with and without a budget constraint. The levels of timber volume and acres treated in model scenarios unconstrained by budget represent the levels that could be achievable within the regulatory and ecological capacity of the HLC NF, if budgets were not a factor. The constrained budget scenarios represent the levels of timber production that are likely achievable with a reasonably foreseeable budget level.

Alternative E would have the potential to produce more timber jobs than the other alternatives based on projected volume outputs. However, alternatives A, B/C, and D would harvest more acres, and therefore job opportunities that are related to the magnitude of area treated could actually be greater with those alternatives. The trend for timber demand is independent of alternatives, but alternatives may offer different supply chain flexibility to planning area firms.

Other forest products such as Christmas trees would remain available into the future to a similar degree in all alternatives. Potential commercial use of other forest products varies as a function of RWAs.

Table 295 shows a simplified summary of the timber indicators across alternatives.

Table 295. Timber indicators comparison of alternatives

Indicator	Greatest	to		Least
Acres suitable for timber production	E	BC	D	A
Acres unsuitable for timber production where harvest can occur	E	BC	D	A
PTSQ and wood sale quantity	E	ABCD		
Contribution to select desired vegetation conditions	ABCD	E		
Timber demand	ABCDE			

Indicator	Greatest	to	Least	
Acres harvested[1]	A	BCD	E	
Area where commercial use of other forest products is allowed	E	A	BC	D

3.30 Geology, Energy, and Minerals

3.30.1 Introduction

Minerals management of NFS lands requires interagency coordination and co-operation. Although the FS is responsible for the management of surface resources of NFS lands, the BLM is primarily responsible for management of government-owned minerals. Since it is not possible to separate mineral operations from surface management, the agencies have developed cooperative procedures to accommodate their respective responsibilities.

There are three types of mineral and energy resources:

- Locatable minerals include commodities such as gold, silver, copper, zinc, nickel, lead, platinum and some nonmetallic minerals such as asbestos, gypsum, and gemstones. Lands that are open to location under the Mining Law of 1872 guarantee U.S. citizens the right to prospect and explore lands reserved from the public domain and open to mineral entry. The right of reasonable and appropriate access for exploration and development of locatable mineral is guaranteed.
- Leasable minerals include commodities such as oil, gas, coal, geothermal, potassium, sodium phosphates, oil shale, sulfur, and solid leasable minerals on acquired lands. Areas of the Forest are open to leasable minerals exploration, development and production. A leasing decision will not be a part of this plan. The disposal of these leasable minerals is discretionary.
- Salable minerals include common varieties of sand, stone, gravel, cinders, clay, pumice and pumicite. The FS has the authority to dispose of these materials on public lands through a variety of methods. The disposal of these materials is discretionary.

Analysis area and indicators

The analysis area is the NFS lands within the Forest. The key indicators for minerals are:

- Locatable minerals – acres unavailable for mineral entry (not withdrawn);
- Leasable minerals – acres unavailable for leasing proposals and proposed no surface occupancy stipulation acreages;
- Salable minerals-acres unavailable for disposal of mineral materials; and
- Timing and access restrictions that could affect all mineral development.

3.30.2 Regulatory framework

Weeks Law Act of March 1, 1911 (P.L. 61-435, 72 Stat. 1571, as amended, 16 U.S.C. § 480 et seq): This act authorized the federal government to purchase lands for stream-flow protection, and maintain the acquired lands as national forests.

Mineral Resources on Weeks Law Lands Act of March 4, 1917 (P.L. 64-390, 39 Stat. 1149, 16 U.S.C. § 520): This act authorizes the Secretary of Agriculture to issue permits and leases for prospecting, developing, and utilizing hard-rock minerals on lands acquired under the authority of the act. This authority was later transferred to the Secretary of the Interior.

Mineral Leasing Act of February 25, 1920 (P.L. 66-146, 41 Stat. 437 as amended, 30 U.S.C. § 181 et seq.): This act authorizes the Secretary of the Interior to issue leases for the disposal of certain minerals (coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, and gas). The act applies to NFS lands reserved from the public domain, including lands received in exchange for timber or other public domain lands, and lands with minerals reserved under special authority.

Clarke-McNary Act of June 7, 1924 (P.L. 68-270, 43 Stat. 653 as amended, 16 U.S.C. § 505 et seq.): All lands to which title is accepted under section 7 of this act become NFS lands, subject to all laws applicable to the lands acquired under the Weeks Act of March 1, 1911.

Mineral Materials Act of July 31, 1947 (P.L. 80-291, 61 Stat. 681, as amended, 30 U.S.C. § 601 et seq.): This act provides for the disposal of mineral materials on the public lands through bidding, negotiated contracts, and free use.

Mineral Leasing Act for Acquired Lands of August 7, 1947 (P.L. 80-382, 61 Stat. 913, as amended, 30 U.S.C. § 351 et seq.): This act extends the provisions of the mineral leasing laws to federally owned mineral deposits on acquired NFS lands and requires the consent of the Secretary of Agriculture prior to leasing.

Multiple Use Mining Act of July 23, 1955 (P.L. 84-167, 69 Stat. 368, as amended, 30 U.S.C § 601 et seq.): This act requires the disposal of common varieties of sand, stone, gravel, pumice, pumicite, and cinders under the provisions of the Materials Act of July 31, 1947, and gives to the Secretary of Agriculture the authority to dispose of these materials. It provides that rights under any mining claim located under mining laws are subject to the right of the U.S. to manage and dispose of surface resources.

Geothermal Steam Act of December 24, 1970 (P.L. 91-581, 84 Stat. 1566, 30 U.S.C. § 1001-1025): This act provides the Secretary of the Interior the authority to lease NFS lands for geothermal steam development, subject to the consent and conditions the Secretary of Agriculture may prescribe.

Mining and Minerals Policy Act of December 31, 1970 (P.L. 91-631, 84 Stat.1876, 30 U.S.C. § 21a): This act states that the continuing policy of the federal government is to foster and encourage private enterprise in the development of economically sound and stable domestic mining and minerals industries and the orderly and economic development of domestic mineral resources.

Federal Coal Leasing Amendments Act of August 4, 1976 (90 Stat. 1083; 30 U.S.C. § 201 et seq.): This act amended the Mineral Lands Leasing Act of February 25, 1920 (para. 3) by specifying that coal leases on NFS lands may be issued only after the consent of the Secretary of Agriculture and adherence to conditions the Secretary may prescribe. The act also provides that no lease shall be issued unless the lands involved in the lease have been included in a comprehensive forest land and resource management plan and the sale is compatible with the Plan. The act authorizes the issuance of a license to conduct exploration for coal.

Surface Mining Control and Reclamation Act of August 3, 1977 (P.L. 95-87, 91 Stat. 445, 30 U.S.C. § 1201-1328): This act provides for cooperation between the Secretary of the Interior and states in the regulation of surface coal mining. It also restricts or prohibits surface coal mining operations on NFS lands, subject to valid existing rights and compatibility determinations.

Energy Security Act of June 30, 1980 (P.L. 96-294, 94 Stat. 611, 42 U.S.C. § 8855): This act directs the Secretary of Agriculture to process applications for leases and permits to explore, drill, and develop resources on NFS lands, notwithstanding the current status of the forest LRMP.

National Materials and Minerals Policy, Research and Development Act of October 2, 1980 (94 Stat. 2305; 30 U.S.C. §1601-1605): This act restates congressional intent to promote policies that provide for an adequate and stable supply of materials while considering long-term needs, a healthy environment, and natural resource conservation. The act also requires the Secretary of the Interior to improve the availability and analysis of mineral data in federal land use decision making.

Omnibus Parks and Public Lands Management Act of 1996 (P.L. 104-333, 110 Stat. 4093, 16 U.S.C. § 497c): This act automatically withdraws from all forms of appropriation under the mining laws and from disposition under all laws pertaining to mineral and geothermal leasing all lands located within the boundaries of ski area permits.

Federal Onshore Oil and Gas Leasing Reform Act of 1987 (30 U.S.C. § 181 et seq.): This act expands the authority of the Secretary of Agriculture in the management of oil and gas resources on NFS lands. The BLM cannot issue leases for oil and gas on NFS lands over the objection of the FS. The FS must approve all surface disturbing activities on NFS lands before operations commence.

Energy Policy Act of 2005 (P.L. 109-58): Directs federal agencies to undertake efforts to ensure energy efficiency; and the production of secure, affordable, and reliable domestic energy.

Executive Order 13211 issued May 18, 2001: This executive order titled “Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use” requires federal agencies to prepare and submit a Statement of Energy Effects to the Office of Management and Budget describing the effects of certain regulatory actions on energy supply distribution, or use.

Executive Order 13212 issued May 18, 2001: This executive order titled “Actions to Expedite Energy-Related Projects” requires federal agencies to take actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.

The Reorganization Plan No. 3 of 1946 (60 Stat. 1097; 5 U.S.C. appendix): This transferred the functions of the Secretary of Agriculture with respect to permits and leases for hard-rock minerals on acquired Weeks Law land to the Secretary of the Interior. However, Secretary of Agriculture Consent to the issuance of permits or leases is required.

128 Stat. 3828 (P.L. 113–291—Dec. 19, 2014) SEC. 3063: North Fork Federal Lands Withdrawal Area. “To withdraw certain Federal land and interests in that land from location, entry, and patent under the mining laws and disposition under the mineral and geothermal leasing laws and to preserve existing uses” (see figure B-53). Nothing in this section prohibits the Secretary of the Interior from taking any action necessary to complete any requirement under the NEPA of 1969 (42 U.S.C. 4321 et seq.) or the ESA of 1973 (16 U.S.C. 1531 et seq.) required for permitting surface-disturbing activity to occur on any lease issued before the date of enactment of this Act.

36 CFR 228 — Minerals: These regulations set forth rules and procedures governing use of the surface of NFS lands in conjunction with operations authorized by the general mining laws, oil and gas leasing, and mineral material disposal laws.

36 CFR Part 251 — Land Uses; **Part 290**—Cave Resources Management; **36 CFR Part 291**—Paleontological Resources Preservation

43 CFR 2300 — Land Withdrawals

Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9605, as amended.

Resource Conservation and Recovery Act Regulations, 40 CFR 260-270

Executive Order 12580, signed January 29, 1987

7 CFR 2.60 Delegation of Lead Agency Authority to the Chief of the Forest Service

40 CFR 300 National Oil and Hazardous Substances Pollution Contingency Plan

29 CFR 1910.120 Occupational Safety and Health Administration

EM-2160-1, FS Guide to Comprehensive Environmental Response, Compensation, and Liability Act, January 1996

Montana Wilderness Study Act (Public Law 95-150)

Tax Relief and Health Care Act of 2006, Public Law 109-432 Section 403(a)

Omnibus Public Land Management Act (16 U.S.C. 470aaa to 470aaa-11 (2009; "the Act")

Interagency agreements

The FS has entered into interagency agreements with agencies within the U.S. Department of Interior to cooperate and coordinate in the management of federally owned minerals within NFS lands. The principal agreements include:

- November 8, 1946, agreement with the BLM detailing procedures for mineral leases and permits administered under section 402 of the President's Reorganization Plan No. 3 of 1946.
- May 18, 1957, memorandum of understanding with the BLM describing work procedures for land applications, mining claims, and patents.
- March 4, 1977, cooperative agreement with the U.S. Geological Survey concerning oil and gas operations.
- May 20, 1980, agreement with the BLM describing the coordination of activities under the federal coal management program.
- November 26, 1980, cooperative agreement with the U.S. Geological Survey for operations under solid mineral leases and permits.
- December 3, 1981, memorandum of understanding with the U.S. Geological Survey and the BLM for the geothermal steam leasing program.
- December 11, 1989 memorandum of understanding with the MTDEQ (formerly Department of State Lands) to promote efficiency and effectiveness in administration and regulation of mineral resources.
- July 31, 1990, memorandum of understanding with the Office of Surface Mining Reclamation and Enforcement describing the management of surface coal mining operations on NFS lands.
- November 11, 1991, interagency agreement with the BLM describing the procedures by which the FS could authorize the BLM to offer NFS lands for oil and gas leasing.
- November 19, 1991, interagency agreement with the BLM describing the procedures for coordinated administration of oil and gas operations on federal leases within the NFS.

3.30.3 Best available scientific information used

Information regarding the geology, renewable, and nonrenewable mineral and energy resources of the HLC NFs is based on information from numerous sources, including statutes, laws, regulations, FS manuals, State of MT Natural Resource Information System data, Forest project and permit files, Montana Bureau of Mines and Geology publications and data, MTDNRC information, BLM minerals forecasts, U.S. Geological Survey published documents and maps, U.S. Bureau of Mines published documents, Environmental Protection Agency website and published documents and other literature.

The BLM keeps official records on leasable minerals and unpatented mining claims on public lands. Current records are kept in the Legacy Rehost 2000 (LR 2000) database. These records are the source for the documentation of leasable minerals and unpatented mining claims on the HLC NF.

3.30.4 Affected environment

A variety of mineral deposit types and mineral resources, including gold, silver, and copper, occur within the boundaries of the Forest. With respect to NF management, mineral resources are divided into three groups: locatable minerals, leasable minerals, and mineral materials. The authority of the FS to influence and regulate the exploration, development, and production phases of mining operations varies with each group. As a result, the FS manages mineral resource programs that are specific to each group.

Geology

The NFS lands managed by the HLC NF lie within the Northern Rocky Mountain and the Missouri Plateau Physiographic regions as mapped by the U.S. Geologic Survey (USGS 2000). The plan area is mostly within the Rocky Mountain physiographic region, which includes the visually stunning Rocky Mountain Front area; southward to the Upper Blackfoot, Divide, Elkhorn and Big Belt Mountains; and eastward to the Little Belts, Castles and Crazy Mountains areas. The island mountain ranges including the Big and Little Snowies, and Highwoods, as well as the more moderate terrain draping the Rocky Mountain Front eastward, are included within the flat-topped and dissected plateau area of the upper Missouri River physiographic region (ibid). Complex and diverse geology characterizes these regions.

Rock units

Rock unit descriptions include formations or rock types found across the forests but not necessarily in every part of the forest. In fact, some rock types are localized in their occurrence. Both forest regions are primarily underlain either at the surface or at depth by a wedge-shaped sedimentary rock package that includes the Precambrian Belt Supergroup which is tens of thousands of feet thick in the western part of the forest areas and tapers to several thousand feet thick in the easternmost forest areas. One area of much older Precambrian crystalline metamorphic rocks occurs underlying the Belt Supergroup sedimentary rocks in the Little Belt Mountains, unique for its occurrence in central Montana. These very old rocks include metamorphosed diorite that is about 2.6 to 2.8 billion years old, some of the oldest rocks in Montana. Also in the Precambrian crystalline rocks are gneisses composed of quartz and feldspar, and an unusual rock called the Pinto Diorite which consists of white feldspar ovoids in a matrix of black hornblende (Weed 1900). These rocks occur in the Belt Creek canyon between Neihart and Monarch.

Structure and history

The visible rock units of the forest areas are the result of an interesting and complex uplift and erosion history in western Montana as well as throughout the Rocky Mountains of North America.

Geologic areas of interest

As a result of the geologic events and processes, a variety of noteworthy scenic and/or geologically interesting, and geologically hazardous areas occur within the forest lands plan area (Table 296). Areas of geologically scenic and interesting areas are summarized below.

Table 296. Geologic areas of scenic and academic interest in HLC NF plan area

GA	Feature	Type	Description	Management Framework
Big Belts	Gates of the Mountains	Scenery, Views of Gates of Mountains Wilderness area, motorized recreation river	Renowned scenery as a result of barren, steep limestone cliffs in a canyon setting. Geologic feature of academic interest because it is an outstanding, accessible example of overthrust style structural deformation	No special restrictions, motorized aquatic recreation dominated area
Little Belts	Smith River - WSR	Scenery, nonmotorized Recreation river - designated in part	Popular floatable river that is administered by Montana Fish Wildlife and Parks permit system in cooperation with the FS. Floaters	WSR management restrictions

GA	Feature	Type	Description	Management Framework
		for its unique geology	start in Precambrian Belt sedimentary units and float 'upsection' into late Mesozoic sedimentary units - stunning cliffs and canyon scenery.	
Little Belts	Kings Hill Scenic Byway to Sluice Boxes State Park along Belt Creek	Scenery, Exposed limestone cliff walls, unusual geologic occurrence of Precambrian crystalline rocks	Motorized driving corridor with views of numerous mountain ranges including rocky mountain front from Kings Hill pass, as well as exceptional rock formations and waterfalls exposed along corridor	Designated federal scenic byway
Rocky Mountain Range and northeastern portion of Upper Blackfoot	Rocky Mountain Front Overthrust Belt	Scenery, large scale with views of Bob Marshall and Scapegoat Wilderness areas; Geologic feature of academic interest	Stunning and renowned scenery as a result of barren, steep limestone cliffs carved by alpine glaciers juxtaposed abruptly adjacent to rolling foothills. Geologic feature of academic interest because it is an outstanding, accessible example of overthrust style structural deformation. Scenery accessible to highway travelers along the front area and to nonmotorized backcountry users in the backcountry portion of the area.	9/25/2000 - Forest Plan Amendment Mineral Withdrawal withdrawing 405,000 acres from location of mining claims and mineral development 12/31/2006 - Congressional act - Withdrawal of certain federal land and interests in certain federal land from location, entry, and patent under the mining laws and disposition under the mineral and geothermal leasing laws.
Rocky Mountain Range, Little Bels, Snowies, Divide, and Big Belts	Caves	Natural geologic features occurring in Devonian to Mississippian carbonate sedimentary rock units. Academic and scientific interest.	Natural geologic features many that have been inventoried. Several very popular with the public and publicly accessible. Most are less well known except to caving organizations.	Two Nationally Significant caves on Lewis and Clark NF and eight Nationally Significant caves on Helena NF. Lewis and Clark Forest Plan amendment #13 provides management direction specific to the cave resource on the forest.

Paleontological resources

Paleontological resources are broadly synonymous with "fossils," as defined by statute (the Paleontological Resources Preservation subtitle of the Omnibus Public Land Management Act (16 U.S.C. 470aaa to 470aaa-11 (2009; "the Act")) and in FS regulations (36 CFR Part 291). The Act and the regulations stipulate that all paleontological resources on NFS shall be managed by the Secretary of Agriculture using scientific principles and expertise.

Geologic hazards

There are no inventory of strictly geologic hazard features in the plan areas, however an evaluation of hazards associated with recreation sites was prepared in 2011 and about a third of the sites have some type of potential geologic hazard that is included as part of monitoring site conditions (USDA 2011e; USDA 2011f).

Mineral and energy resources

The occurrence of precious and base metal minerals is the backdrop for much of the cultural history of the forest areas, particularly the Helena NF portion of the plan area. These occurrences impact land management to the present day due to the patenting of hard rock mining claims, development of mining roads, and location of rural communities surrounding and within the forest areas.

Energy resources have been explored across much of the plan area since the late 1950's but are less of a factor in development in and around the forest plan area to date because significant resources have not been discovered and/or tapped. The Rocky Mountain Front GA, the area with the most potential for hydrocarbon deposits in the two-forest planning area, is unavailable for the exploration and development of hydrocarbons due to mineral withdrawal and congressional action. However, less well-explored areas that have hydrocarbon potential, albeit low, occur in other portions of the plan area. This includes the southern portions of the Elkhorn and Big Belt Mountains, the northern portion of the Big Belt Mountains, and the eastern portion of the Lincoln Ranger District. Wind energy and geothermal energy, in addition to oil and gas energy deposits, are found in the plan area. As technology improves, and if access to explore for these deposits expands due to changes in federal policies, the search for and discovery of significant resources may occur in the future. There has been no production of hydrocarbon, wind, or geothermal deposits to date on the federal lands of the plan area.

Mineral material resources include sand, gravel, building or dimension stone, and riprap or general pit run for construction and industrial purposes. The geology of the plan area lends itself to a variety and abundance of general construction use materials and decorative stone applications.

Locatable minerals

Locatable minerals are those valuable mineral deposits subject to exploration and development under the General Mining Law of 1872 as amended.

The forest areas have been the focus of locatable mineral activities, precious and base metal exploration and mining, since the 1860's. Most of the lands of the plan area are open to the location of unpatented mining claims with the exception of designated wilderness areas, other nonwilderness lands withdrawn from mineral entry and NFS lands where the mineral estate has been separated from the surface estate. Approximately 88% or 870,000 acres of the Helena Forest area is open to the location of unpatented mining claims and approximately 34% or 640,000 acres of the Lewis and Clark NF area is open to the location of mining claims. The Helena NF areas have had substantially more unpatented mining claims and mining activity than the Lewis and Clark NF areas owing to the inherent geology and occurrence of mineral resources.

A large proportion of the Helena NF is included in designated historic mining districts and also portions of the Jefferson Division of the Lewis and Clark NF. Primary mineral deposits that have been developed to date include placer gold, as well as lode deposits of gold, silver, copper, lead, zinc and sapphires. Types of locatable mineral activity occurring on the forest include 1) historic and recent placer mining, and 2) historic and recent hard rock (lode) mining.

Historic and recent placer mining

Many drainage bottom areas have been patented as a result of placer mining. The estimated amount of gold mined from the gulches of the Helena NF is over 2.7 million ounces. The primary GAs that have had historic placer mining include the Big Belts, Divide, and Blackfoot River areas. A relatively small amount of placer mining has occurred in the Little Belts GA, primarily on the east side of the range in the Yogo Creek drainage area.

Current placer mining areas are located in the drainages of the Elkhorns, Big Belts, Divide, and Blackfoot River areas as well as the eastern Little Belts. Most of the currently permitted or permitted recent past operations are small scale resulting in much less than an acre of disturbance on an annual basis. Annually the forests administer 25-40 small-scale placer projects which range from hand scale work to small scale equipment work.

Historic and recent hard rock (Lode) mining

Hard rock mining activity is the pursuit of locatable type minerals such as gold, silver, copper, lead, and zinc in mineralized areas where the minerals are found in bedrock. Most of the historic locatable mining activity involved the development of underground workings such as adits and shafts to exploit mineralized vein structures. Early in mining history, mining areas became divided into mining districts where the miners would organize and develop rules and structure for claim location, development, and marketing. Mining districts are still an identifying characteristic of unpatented mining claim location and mineral activity areas. Each GA has a unique hard rock mining history; more information is available in the specialist report. The Divide GA has the greatest concentration of historic lode and placer mines of the two forests.

Public safety and other impacts

Hundreds of prospect-level to developed mine sites, as well as public safety hazards and environmental impacts have been inventoried (MT DEQ 1995; Metesh et al. 1998) and are known to occur on NFS lands of the plan area. In 1993 - 1994, the MT Department of State Lands Abandoned Mine Reclamation Bureau conducted a state-wide inventory of abandoned and inactive mine sites to characterize and rank the extent of public safety and environmental problems associated with these sites. Subsequent to the publication of these findings, the Environmental Protection Agency was requested to consider listing several areas of concentrated mine sites as federal superfund sites. These are discussed in detail below.

- Hazardous mine openings and features include shafts, adits, ventilation openings, buildings, highwalls, glory holes, and collapsing piles. Many had caved over the years only to be reopened by erosive processes, or discovered when a fire burned through an area and removed its vegetative cover. Some have become dumping areas for garbage. Many of these features have been inventoried and addressed in the past 20 years as part of a national effort by the FS and other agencies. Some features may provide habitat for bats. Therefore surveys for bats are also carried out to help determine appropriate closure devices or methods. Response actions have included backfilling, grating, foam plugs, installation of gated culverts, and combinations of the above. More work remains due to the extensiveness of mining activity in the plan area. New sites are regularly discovered or reported by the public, field - going staff, and minerals administrators. The forests in the plan area typically address 20 - 30 hazardous features annually.
- Hard rock mine sites and associated metal contaminants and environmental issues are documented in the findings of the Montana Department of State Lands Abandoned Mine Reclamation Bureau (MT DEQ 1995) and Metesh and others (1998). The specialist report contains a summary of the inventoried hard rock mine sites with resources issues by GA, including the number of reclaimed mine sites in those areas.
- Water quality impairments, as a result of historic hard rock mining, cause impacts to many surface and some ground waters of the plan area. The impaired water characteristics typically include low pH, elevated metal contaminants, loss or reduction of aquatic life, stream sediments containing metal contaminants, loss of streamside vegetation, and localized impaired groundwater. In some primary drainages, these impairments extend for miles downstream. While inventory and reclamation efforts continue to work toward addressing impaired waters, the scope of this issue has not been well defined nor is there a management framework that places priority on addressing a primary resource issue such as this.
- Many of the inventoried mines have been reclaimed in whole or in part by the FS, State of Montana, Environmental Protection Agency or jointly by the agencies. Reclamation of FS sites with hazardous substances has been done under the agencies’ Comprehensive Environmental Response, Compensation, and Liability Act authority.
- As a result of the inventory results and other inventory/investigation efforts by the State, FS and Environmental Protection Agency, several of the mining areas have become listed State or Federal

Superfund sites due to their mining-related impacts (EPA 2014). These include one State of Montana superfund site, the Upper Blackfoot Mining Complex site and three federal Superfund sites, the Upper Tenmile Creek Mining Area site, Barker-Hughesville Mining District site, and Carpenter-Snow Creek Mining District site. These sites and ongoing activities are described further in the specialist report.

Leasable minerals

Leasable mineral and energy resources include oil, gas, coal, geothermal, oil shale, and other solid minerals. Leasable public domain minerals are leased under authority of the Mineral Leasing Act of 1920, as amended. Acquired minerals are leased under the authority of the 1947 Mineral Leasing Act for Acquired Lands, as amended.

Nonrenewable energy minerals

In August 1997 the Lewis and Clark NF finalized their oil and gas leasing FEIS and issued their ROD. In 1999 the Helena NF finalized their oil and gas leasing FEIS, their final supplemental EIS, and their ROD for oil and gas leasing. The records of decision were signed by the Forest Supervisor and the State Director of the BLM. At that time there were few acres under lease on the Helena NF. On the Lewis and Clark NF there were several thousand acres of suspended leases on the Rocky Mountain Range GA. The leasing analyses and decisions followed the new regulations at 36 CFR228 Subpart E and included two components and a Forest Plan amendment. These decisions are the current situation for nonrenewable mineral resources and are summarized in Table 297.

Table 297. Summary of acres for leasing as per EISs and RODs 1997 and 1999

Forest	Legally Unavailable	Discretionarily Unavailable	No Lease	No Surface Occupancy	Controlled Surface Use, Timing Limitations, or Both	Standard Lease Terms
Lewis and Clark	614,458	0	356,111	363,033	528,851	0
Helena	144,500	185,100	0	384,700	258,700	24,700

Activity in the number of lease requests from industry is currently low in the plan area. There is no current exploration or development activity on NFS lands. A leasing decision will not be a part of this Forest Plan Revision. There is an interest in oil and gas leasing on the forest and there may be a need for a future oil and gas leasing decision as oil and gas leasing is part of the acceptable uses of the HLC NF. Until a leasing decision is completed no oil and gas exploration or development can take place.

- Currently, there are zero authorized oil and gas leases in effect for the Helena NF. There are eight lease requests, covering 15,259.13 acres that have been deferred pending the resolution of oil and gas leasing in roadless areas in the south Big Belts. These leases are believed to have been requested in connection with a gas drilling project that occurred in 2004 - 2006 near Ringling, MT.
- As a result of the 1997 ROD for Oil and Gas Leasing on the Lewis and Clark NF, most of the Rocky Mountain Range GA was identified as discretionarily unavailable for leasing, excluding the 19 leases that existed at the time of the analysis and decision. Of the 19 suspended oil and gas leases; 16 leases were cancelled by the BLM in 2016 and 2 leases remain in a suspended status pending outcome of litigation and will remain in an authorized status until litigation is resolved. There are zero pending oil and gas lease parcels for the Lewis and Clark NF.

There are minor surface resource impacts from historic oil and gas activity on the Helena NF area. A single well was drilled on Hogback Mountain in the 1980’s that resulted in construction of a short (less than ¼ mile) access road and drill pad. The road and pad area have been reclaimed but the disturbance remains visually apparent. There are no apparent impacts from past seismic activities on the Helena NF.

There has been no impact from the current leases in the Big Belts because there has been no surface activity on these leases.

There are no surface resource impacts from oil and gas related activities on the Jefferson Division of the plan area. There are no impacts on the cancelled leases in the Badger-Two Medicine area because there has been no surface activity on these leases. There are lingering impacts from 1980's era oil and gas leasing and development on the Rocky Mountain Range GA including un-reclaimed roads and noxious weeds.

Coal and other non-renewable leasable minerals

There is very little occurrence of or potential for coal and other nonrenewable leasable minerals in the two-forest area due to the intrinsic geology and the limited number of acres of acquired lands.

Renewable, leasable mineral, and energy resources

Renewable, leasable mineral resources include geothermal, wind, and solar energy resources.

On the Helena NF, 737,819 acres are available for geothermal leasing. On the Lewis and Clark NF, 31,730 acres near White Sulphur Springs are available for geothermal leasing. Portions of the plan area have some favorability for the occurrence of geothermal resources.

There is a known geothermal resource area east of NFS lands in the Marysville vicinity with a capped exploration well that is being monitored (MT DEQ, 2014b). There are currently no exploration or development projects for geothermal energy resources in the plan area. There are no impacts on NFS lands from geothermal exploration or development activity. The forecast for leasing and potential exploration for geothermal energy on the Helena NF area is deemed to be low. The Lewis and Clark NF would have to undertake a geothermal leasing NEPA analysis prior to making most of the forest available for leasing, thus the forecast for activity on those lands is deemed to be very low.

The plan area was found to have potential for the development of wind energy due to the available resource and proximity to transmission lines. The plan area was not found to have potential for the development of solar energy (US Department of Energy 2005).

Salable minerals

These minerals include petrified wood, common varieties of sand, rock, stone, cinders, gravel, pumice, clay and other similar materials. Such common variety mineral materials include deposits that, although they have economic value, tend to be relatively widely available and do not have a distinct and special value. These minerals are most commonly used as building stone, landscaping, and constructions materials.

Saleable mineral uses and developed pits are very common on the Jefferson Division of the Lewis and Clark NF. The Helena NF portion of the plan area has recurring salable minerals uses but at a much lower level and with very few developed pits.

Annually the plan area issues about 10-20 free use mineral material permits and has about 10 in-service project uses. The average annual in service use is about 3,000-5,000 cubic yards combined of material of all types per year. Primary materials used include crushed aggregate, pit run and rip rap. Salable mineral resources development is largely tied to road development activities conducted by the agency.

3.30.5 Environmental consequences

Effects common to all alternatives

The right to access locatable mining operations is a provision of the 1872 mining law. Access to a mining operation on NFS must be reasonable as defined by law and statute. New roads, trails or other types of access may be approved for a proposed mining operation as long as the proposal is incident to mining and within the scope of the next logical phase of mining development.

The Big Snowies and the Middle Fork Judith WSAs would be managed and regulated according to the direction provided in Public Law 95-150. This would continue to make 170,095 acres no longer compatible for mineral leasing and salable minerals, but still open to locatable mineral prospecting, exploration and development.

All IRA boundaries and acreages within the plan area were firmly established as a part of the 2001 Roadless Area Conservation Rule and would not change in any of the alternatives. Leasable and salable mineral development would not be compatible in these areas, but locatable mineral development is allowable within IRAs.

The current areas that are congressionally withdrawn from mineral entry would be carried forward in all alternatives. Since direction for wilderness management is detailed in law, regulation, and agency policy and in specific management plans, the effects to congressionally designated wilderness as a result of the revised plan do not differ by alternative. In all alternatives, the acres of the existing Bob Marshall, Scapegoat, and Gates of the Mountains Wilderness Areas would remain the same. Designated wilderness areas are withdrawn from mineral entry. Mining activities may still occur in designated wilderness areas as long as the proponent has demonstrated a valid existing right. Valid existing rights occur when unpatented mining claims on NFS lands i) Were properly located prior to an area being designated as a wilderness area; (ii) Were properly maintained thereafter under the applicable law; (iii) Were supported by a discovery of a valuable mineral deposit within the meaning of the U.S. mining laws prior to an area being congressionally designated as a wilderness area, which discovery has been continuously maintained since that date; and (iv) Continue to be valid.

There are many areas across the HLC NF that have been administratively withdrawn from mineral entry, including campgrounds, ranger stations, work stations, powerline corridors, and trailheads to name a few. These areas are not open to mineral entry and, therefore, locatable, leasable and salable minerals are not able to be developed in these areas.

Under all alternatives, forest plan components associated with access and recreation, vegetation, fire and fuels, watershed, soil, riparian, aquatic, lands, and special uses management would not result in any change in the lands available for locatable minerals, leasable minerals, or saleable minerals development.

Future placer mining activity

The future prospects of placer mining are related to the price of gold, accessibility of drainages to this type of mining activity, and available placer gold resource. The potential for a large, unworked, profitable gold bearing gravel resource appears to be low.

Future hard rock mining

Recently with the high prices of gold, companies have turned to removing old waste dumps and tailings piles to be reprocessed at custom mills. Several projects of this type have occurred annually on or around the Helena NF area in the past three years. This trend is expected to continue as long as gold prices remain strong and custom mills are available for processing the ore.

Future locatable minerals

Hard rock mineral activity in the next 10-15 years is projected to be approximately what is currently occurring, with a few exceptions which includes the: 1) hobby scale placer mining projects, 2) mine waste removals for reprocessing, 3) limited, small scale underground mine development on primarily gold prospects, and 4) continued exploration/development activities on deposits adjacent to forest lands such as the Black Butte Copper project adjacent to forest lands in the south Little Belts and exploratory activities to seek nearby, similar mineralization, Seven-Up Pete deposit, and Marysville area deposits. The primary areas of this activity are likely the areas of the current activities including the Upper Blackfoot, Divide, Elkhorns, and Big Belts GAs due to the inherent mineralized character of these regions. Two areas in the Little Belts are also of interest including the Sheep Creek area which is just outside NFS lands, and the Big Ben deposit in Carpenter Creek.

There is always the potential for an unforeseen exploration project on a known or previously unknown mineralized area where geologists have projected a valuable resource that was not previously exploited. The primary target of this type of activity is likely gold and copper.

Future saleable minerals

Federal Superfund activities will drive the need for a variety of mineral material products including topsoil, cover soil, drain rock, and rip rap particularly in the Belt Creek drainage area of the Little Belts GA, near the State superfund area in the Upper Blackfoot GA, in the Upper Tenmile federal Superfund site, and Little Blackfoot areas. There is an ongoing need for a certain level of material pits for use in forest system road maintenance activities. These project activities may result in an increased, localized demand for mineral materials from NFS lands. Stream restoration projects often require specific and graded material types. Suitable materials of these types may be found on forest lands. Public demand and interest will also drive activity related to mineral materials in the future.

Future leasable mineral and energy resources

This forecast of potential for leasable mineral activity is based on the Reasonably Foreseeable Development Scenarios prepared by the BLM for their resources management revision efforts (Glover and Stillwell 2014). The project plan area is covered almost entirely within the BLM's Lewistown Planning area and Butte Resources Areas (USDI and USDA 2008). A small amount of the BLM Missoula Resources Area covers the western portion of the Upper Blackfoot GA; however, this plan area has not been updated since 1984. Thus the forecast for leasable mineral activity for this area (Table 298) is based on the Helena NFs reasonably foreseeable development scenario as published in the 1998 forest leasing analysis (USDA 1998).

Table 298. Nonrenewable (oil and gas) mineral resources forecast

GA	Historic Activity	Potential for Occurrence of oil and gas resources	Reasonably Foreseeable Development
Big Belts	Moderate - seismic activity and wells drilled on northeast flank of Big Belts and east of the southern Big Belts south of Highway 12.	Moderate - North end is part of Imbricate Thrust Zone play area which has favorable geology but no proven resource. Low-Moderate - Southeast end of range has overthrust geology.	Low - expectation of up to five wells drilled in planning period in the area, however only a portion of the area is federal land.
Castles	Low - no historic drilling activity on federal lands	Low - unfavorable geology	Very Low
Crazies	Low - no historic drilling activity on federal lands	Low - unfavorable geology except for very northwest portion of the federal lands which has moderate occurrence potential.	Very Low
Divide	Low - no wells, no leases in past 20 years	Low - unfavorable geology	Very Low
Elkhorns	Low - no wells, no leases in past 20 years. One deep well south of Johnny's Gulch in 1991.	Low - unfavorable geology except in very southern portion of the area and just west of the Limestone Hills	Very low. Area is not open to leasing.

GA	Historic Activity	Potential for Occurrence of oil and gas resources	Reasonably Foreseeable Development
Highwoods	Low - one historic well drilled on federal lands with no show of resources	Low - unfavorable geology	Very Low
Little Belts	Low - no historic drilling activity on federal lands	Low - unfavorable geology	Very Low
Rocky Mountain Range	High - numerous oil and gas exploration wells drilled in pre-2014 non-wilderness portions of the area	High on very eastern edge of the area. Moderate to low westward.	No Activity* - area withdrawn from mineral entry and additional area added as wilderness in 2014.*With the exception of the suspended leases in the Badger-Two Medicine area.
Snowies	Low - no historic drilling activity on federal lands	Low - unfavorable geology	Very Low
Upper Blackfoot	Low - limited leasing in past 20 years. All leases expired.	Low - area is within Thrust Belt but rock formations not favorable	Very Low - Most of area has No Surface Occupancy stipulation. Occurrence potential is low.

There are currently no request for leases, nor is there any historic or ongoing exploration or development projects for renewable energy resources (wind/solar) on the federal lands in the plan area. There are no known commercial solar energy installations in the plan area and none are expected unless there is a substantial change in the economic climate and government supports. There are wind developments on private lands south of the Highwoods GA and in the vicinity of Judith Gap, which is southwest of the Big Snowies, east of the Little Belts, and east of White Sulphur Springs between the Little Belts and Castle Mountains. The potential for new development of wind energy on federal land in the planning horizon of 15 years is unknown.

Effects common to all action alternatives

Effects from forest plan components associated with:

Eligible wild and scenic river management

During plan development, the HLC NF identified rivers as eligible for consideration as wild, scenic, or recreational rivers under the Wild and Scenic Rivers Act. Mineral activities within these eligible river corridors are still allowable.

Twenty four of these rivers are classified as wild, for a total of 215.8 miles of river segments. Upon designation, Federal lands within the boundaries of designated river areas (one-quarter mile from the bank on each side of the river) classified as wild would be withdrawn from appropriation under the mining and mineral leasing laws by Sections 9(a) and 15(2) of the Wild and Scenic Rivers Act. Existing valid claims or leases within the river boundary would remain in effect, and activities may be allowed subject to regulations that minimize surface disturbance, water sedimentation, pollution, and visual impairment. Reasonable access to mining claims and mineral leases would be permitted. Mining claims, subject to valid existing rights, could be patented only as to the mineral estate and not the surface estate, subject to proof of discovery prior to the effective date of designation. For river segments classified as wild, no new mining claims or mineral leases can be granted.

Federal lands within the boundaries of designated river areas classified as scenic or recreational are not withdrawn under the Act from the mining and mineral leasing laws. Therefore, designated river segments classified as scenic or recreational, the filing of new mining claims or mineral leases is allowed but is subject to reasonable access and regulations that minimize surface disturbance, water sedimentation, pollution, and visual impairment.

Grizzly bear management

Habitat security requirements and other mineral mitigation measures for grizzly bear can be expected to affect locatable, leasable and salable mineral exploration and development. Where roads, and the access they provide, are necessary, limitations on road construction and operating seasons can be expected to have the effect of prolonging exploration or development work. Areas most affected would be bear management units in the NCDE primary conservation area (see standards FW-STD-E&M-01 thru 07 and guidelines (FW-GDL-E&M-01 thru 06). With alternative C, the no surface occupancy stipulation would apply to new oil and gas leases in all of the NCDE primary conservation area and zone 1. Although the potential on the Forest is very low, the no surface occupancy acreage proposed in alternative C would make it more costly, or infeasible to develop oil and gas resources within the primary conservation area and zone 1.

Canada lynx management

Locatable, leasable and salable mineral exploration and development is also likely to be affected in LAUs in occupied habitat. Guideline HU G12 in the NRLMD ROD gives direction that winter access should be limited to designated routes or designated over-snow routes.

Elk Management

EH-EMIN-GDL-01 and 02 may result in timing restrictions for mineral activities due to no surface occupancy requirements.

Alternative A, no action

The no-action alternative is represented by the existing 1986 Forest Plans, as amended. Law and regulation that have been adopted since the 1986 plans was analyzed as part of the No-action alternative (for example, the designation of IRAs).

Locatable minerals

Because alternative A recommends three wilderness areas, 34,265 acres would potentially be withdrawn from mineral entry under the U.S. General Mining Laws if these areas were to become designated. RWAs are open to mineral entry under the US mining laws until such time as they are congressionally withdrawn from mineral entry subject to valid existing rights. There would be no change to the miles of roads or trails available to motorized or mechanized transport or to the miles of open roads access to mineral or energy proposals.

Leasable minerals

Alternative A would continue to make 34,265 acres administratively unavailable for mineral leasing. There would be no change to the miles of roads or trails available to motorized or mechanized transport or to the miles of open roads for access to leasable proposals.

Salable materials

The three areas allocated as RWAs in alternative A (34,265 acres) would not be compatible for disposal of mineral materials. There would be no change to the miles of roads or trails available to motorized or mechanized transport or to the miles of open roads to access mineral materials.

Effects that vary by alternative

Locatable minerals

Alternative B recommends nine wilderness areas, totaling 213,076 acres that would potentially be withdrawn from mineral entry for locatable minerals. RWAs are open to mineral entry under the U.S. mining laws until such time as they are congressionally withdrawn from mineral entry subject to valid existing rights. Mining activities may still occur in designated wilderness areas as long as the proponent has valid existing rights. There would be 213 miles of roads or trails no longer available to motorized or mechanized transport and 12 miles of roads no longer open for access to mineral or energy proposals.

Alternative C would allow for increased access to mineral and energy projects compared to alternative B because the number roads or trails available to motorized or mechanized transport and miles of roads open is not restricted in those RWAs. Alternative C recommends nine wilderness areas, totaling 213,076 acres that would potentially be withdrawn from mineral entry for locatable minerals.

Alternative D would be the most restrictive alternative to mineral and energy development as it proposes the most acreage for RWAs. It also proposes the largest amount of roads or trails no longer available to motorized or mechanized transport and the most miles of roads no longer open that would cause access restrictions for mineral and energy development. Alternative D recommends sixteen wilderness areas, totaling 474,589 acres that would potentially be withdrawn from mineral entry for locatable minerals. There would be 430 miles of roads or trails no longer available to motorized or mechanized transport and 17 miles of roads no longer open for access to mineral or energy proposals.

Alternative E would be the least restrictive of all of the alternatives to energy and mineral development. This alternative does not propose any RWAs and does not propose any reduction in the miles of roads or trails available to motorized or mechanized transport or the number of miles of roads open. Because alternative E has no RWAs, no additional NFS lands are expected to be withdrawn from mineral entry for locatable minerals. There would be no change to the miles of roads or trails available to motorized or mechanized transport or to the miles of open roads access to mineral or energy proposals.

Nevada Mountain is a RWA in alternatives B, C and D. This area has been the location of historic and current mining activity. As of the writing of this report, there are over one hundred unpatented mining claims within the boundaries of this area. There is a very high potential for future mineral prospecting, exploration and development in this area. Mining activities could detract from the "wilderness character" of this area. This RWA includes the Nevada Mountain area and headwaters of Washington to Nevada Creeks, north and east including McClellan Gulch, and then easterly to upper Poorman Creek. This area is underlain by a granitic stock that has intruded into Belt series argillites and quartzites and has resulted in mineral deposits that have been prospected and mined by hard rock and placer mining methods. A potentially larger ore body at depth is suspected (Tysdal et al. 1996). McClellan Gulch was a very rich placer gold tributary of Poorman Creek. It has been estimated that $7,000,000 in gold came from the gravels of this gulch (Pardee & Schrader, 1933); McClernan 1983).

Leasable minerals

Alternative B would make 213,076 acres administratively unavailable for mineral leasing. There would be 213 miles of roads or trails no longer available to motorized or mechanized transport and 12 miles of roads no longer open for access to leasable proposals.

Under alternative C 213,076 acres would be administratively unavailable for mineral leasing.

Under alternative D, 474,589 acres would be administratively unavailable for mineral leasing. There would be 430 miles of roads or trails no longer available to motorized or mechanized transport and 17 miles of roads no longer open for access to leasable proposals.

Since there are no RWAs in alternative E, an additional 34,265 acres may be compatible for leasable materials. There would be no change to the miles of roads or trails available to motorized or mechanized transport or to the miles of open roads to access leasable materials. However, alternative E is affected by the IRA management regulations. Road construction or reconstruction associated with mineral leases may not occur in IRAs.

Salable materials

Areas allocated as RWAs would not be compatible for disposal of mineral materials. Alternative B would make 213,076 acres not compatible for the disposal of mineral materials. Access to salable minerals would decrease as there would be 213 miles of roads or trails no longer available to motorized or mechanized transport and 12 miles of roads no longer open for access to mineral proposals.

Under alternative C 213,076 acres would not be compatible for the disposal of mineral materials.

Under alternative D, 474,589 acres would not be compatible for the disposal of mineral materials.

Access to salable minerals would decrease as there would be 430 miles of roads or trails no longer available to motorized or mechanized transport and 17 miles of roads no longer open for access to mineral or energy proposals.

Since there are no RWAs in alternative E, an additional 34,265 acres would be compatible for the disposal of mineral materials. There would be no change to the miles of roads or trails available to motorized or mechanized transport or to the miles of open roads to access mineral materials.

Cumulative Effects

Cumulative effects evaluate the potential impacts to mineral resources from the action alternatives when combined with past, present, and reasonably foreseeable actions. All lands within the HLC NF GA boundaries form the geographic scope for cumulative effects. The temporal bound would be the life of the Forest Plan which is estimated to be a 15-year time span.

Requests for approval of small lode and placer mining operations may occur, but it is not possible to predict how many may be submitted in any given year, or how many might be approved. There is a high potential for locatable mineral development on most of the Forest. Since Congress has imposed a moratorium on patenting of mining claims, there would be no changes in the acres of patented lands unless Congress was to lift the moratorium.

Given the low probable occurrence of leasable minerals other than oil and gas on open/available lands on the HLC NF, the cancellation of the oil and gas leases on the Rocky Mountain Front by the U.S. Department of the Interior and the improbability of an EIS for oil and gas leasing being prepared in the next 15 years, there is little likelihood of mineral lease applications being made.

Mineral material use can be expected to continue for in-service needs (e.g., road maintenance and watershed improvement activities) and as a salable commodity to the public and would result in the further depletion of that non-renewable mineral resource from NFS lands.

Reclamation work is likely to occur on select abandoned mine sites as well as on mineral material sites that have reached the end of their useful life.

Portions of the HLCNF adjoin other NFs, each having its own forest plan. The HLCNF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 299, for those plans applicable to energy and minerals.

Table 299. Summary of cumulative effects to energy and minerals from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All plans address Energy and Minerals. Generally speaking, management of Energy and Minerals is consistent across all NFs due to law, regulation, and policy. The management of Energy and Minerals would be complementary and consistent. This includes specific adjacent landscapes that cross Forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
National Park Service – Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Mineral and energy projects in the Rocky Mountain Range GA and would be consistent with these conditions.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components related to Energy and Minerals, and would be complementary to the draft plan.

Conclusions

Access to locatable, leasable and salable minerals, as well as, opportunities for mineral entry, mineral leasing and mineral disposal would vary by alternative. The variations across alternatives are due to differences in RWAs, motorized, and mechanized access, as well as plan components related to restricting surface occupancy on future mineral and energy projects. Alternative E offers the most opportunities for mineral-related activities, followed by alternatives A, C, B and D, in order of decreasing opportunities.

3.31 Carbon Sequestration

3.31.1 Introduction

Carbon sequestration and associated climate regulation have been identified as key ecosystem services provided by the Forest. The potential effects of alternatives are analyzed relative to carbon storage (sequestration) potential. Concerns with carbon, climate change, and associated ecosystem responses have been raised during the forest plan revision process. The relationship between climate change and other resources are addressed in the appropriate resource section. This section addresses carbon sequestration.

Concerns with carbon, climate change, and associated ecosystem responses have been raised during the forest plan revision process. Carbon sequestration is one way to mitigate greenhouse gas emissions by offsetting losses through capture and storage of carbon. The FS recognizes the vital role that our nation's forests and grasslands play in carbon sequestration (USDA 2015).

The key indicators used are:

- The sequestration and storage of carbon pools (stocks) in terms of total ecosystem carbon (Tg, teragrams) and carbon in harvested wood products (MgC, megagrams of carbon)
- Natural/human- caused changes to landscape that influence carbon storage and sequestration (i.e., vegetation succession, vegetation treatments, fire, insect outbreaks, disease) – influence to carbon pools

Analysis area

The Forest has identified carbon sequestration (storage) and associated climate regulation as a key ecosystem service, and describes potential effects of the proposed action and alternatives at the scale of the Forest. The temporal scale for analyzing carbon stocks and emissions is the life of the plan (15 to 20 years), with some analysis occurring across the longer term (50 years), consistent with the analysis period for other key ecosystem characteristics associated with the terrestrial vegetation.

3.31.2 Regulatory framework

There are no applicable legal or regulatory requirements or established thresholds concerning management of forest carbon or greenhouse gas emissions. The 2012 Planning Rule and associated directives require an assessment of baseline carbon stocks and a consideration of this information in management of the forests (USDA, 2015). The FS continues to develop principles and direction for consideration of biological carbon in land management and planning decisions. Forests play an active role in controlling concentration of carbon dioxide in the atmosphere. Forests store large amounts of carbon in their live and dead wood and soil, and are an important carbon sink, removing more carbon from the atmosphere than they are emitting (Pan, 2011).

3.31.3 Assumptions

For the action alternatives, the strategies described in appendix C of the revised forest plan would generally be followed during implementation of the plan.

Numerous assumptions are included in the literature citations used for climate modeling and carbon estimates; each publication enumerates these assumptions.

3.31.4 Best available scientific information used

An ever-increasing body of knowledge exists regarding climate change and carbon sequestration. The best available science is used to summarize conditions relative to the HLC NF. This analysis relies on several recently published works by carbon and greenhouse gas emissions experts. This section also references vegetation modeling done for terrestrial vegetation and timber.

Estimates of future carbon stocks and their trajectory over time are uncertain due to the uncertainty associated with multiple interacting factors that influence them. This includes climate change and its effects on vegetation, which is difficult to predict, especially in the complex terrain and variable site conditions found on the HLC NF. While advances have been made in accounting for the relationship between greenhouse gases and climate change, difficulties remain in reliably attributing observed temperature changes to natural or human causes at smaller than continental scales (Intergovernment Panel on Climate Change (IPCC), 2007).

3.31.5 Affected environment

Forest ecosystems (including nonforested vegetation types) cycle carbon; they are in a continual flux, emitting carbon into the atmosphere and removing it, i.e. storing it as biomass. Carbon sequestration is the process by which atmospheric carbon dioxide is taken up by vegetation through photosynthesis and stored as carbon in biomass (tree trunks, branches, foliage and roots) and soils.

The importance of carbon storage capacity of the world’s forests is tied to their role in removing atmospheric carbon that is contributing to global warming. Forests and other ecosystems are carbon sinks because growing plants remove carbon dioxide from the atmosphere and store it. Sequestering, or storing, carbon in these ecosystems can help offset sources of carbon dioxide. In addition, transferring ecosystem carbon to harvested wood products results in carbon being stored and not contributing to net greenhouse gas emissions; substitution of wood for more fossil fuel-intensive materials has a carbon emissions benefit (USDA 2015).

Carbon stocks and trends

The 2.9 million-acre HLC NF is about 1.5 percent of the nearly 190 million acres of NFS lands in the United States. The NFS constitutes one-fifth (22%) of the Nation's total forest land area and contains one-fourth (24%) of the total carbon stored in all United States forests, excluding interior Alaska (USDA 2015). The NFS forest carbon resource has been growing since 1990, according to FIA data. NFS lands are not subject to conversion to other land uses, such as agriculture or development. Thus carbon storage alterations from land use conversions is not a major factor for the forestlands within NFs, including the HLC NF.

Total ecosystem carbon

The total ecosystem carbon stocks on the Helena side (western portion) of the HLC NF have slightly decreased since 1990, while the Lewis and Clark (eastern portion) remained fairly steady.

Carbon flux is the change in carbon stocks over time, calculated by taking the difference between the inventories and dividing by the number of years between the inventories (Woodall, Smith, & Nichols, 2013). A negative change means carbon is being removed from the atmosphere and sequestered by the forests (carbon sink), while a positive change means carbon is added to the atmosphere by forest-related emissions (carbon source) (USDA 2015). While the carbon flux for most timesteps on most NFs in the Northern Region are between 0 and -2, indicating that these forests balance as a carbon sink, the flux on the Helena NF is between 0 and +1, indicating that it is functioning as a carbon source. The flux on the Lewis and Clark NF is also slightly positive but very close to zero (ibid).

The recent disturbances from bark beetles and fires may have weakened pre-disturbance sequestration rates on the HLC NF. However, the affected forests remain forests, not converted to other land uses, and long-term forest services and benefits will be maintained. As forested stands develop, the strength of the carbon sink increases until peaking at an intermediate age and then gradually declining but remains positive (Pregitzer & Euskirchen, 2004). Carbon stocks continue to accumulate as stands mature, although at a declining rate, until impacted by future disturbances.

Harvested wood products

Carbon has been removed from the Forest through harvest of trees over the past 100 or more years. Some of this carbon is stored in wood products or in landfills and contributes to the total forest carbon storage on the Forest. The cumulative carbon stored in harvested wood products from 1910 to 2010 is in decline.

Influence of disturbance on carbon stocks

Forests are highly dynamic systems that are continuously repeating the natural progression of establishment, growth, death, decay and recovery, while cycling carbon throughout the ecosystem and the atmosphere. Natural and human-related disturbances, such as wildfires, insect and disease activity, timber harvesting and weather events, can cause both immediate and gradual changes in forest structure, which in turn affect forest carbon dynamics by transferring carbon between the different ecosystem and atmospheric carbon pools.

The types and pattern of major disturbances affecting carbon stores over a 20 year period on the Helena and Lewis and Clark NFs respectively are displayed in Figure 23 and Figure 24. Across the HLC NF, there were substantial fire impacts from 2000 to 2007 as well as substantial insect impacts from 2006 to 2011, more-so than the Regional trends due to a recent mountain pine beetle outbreak. Beetle outbreaks redistribute carbon from live (sinks) to dead pools (sources), although slow decomposition of snags and recovered tree growth can result in resilience of aboveground carbon stocks (Hansen et al 2015). Harvest affected a relatively smaller proportion and has declined slightly throughout the monitoring period.

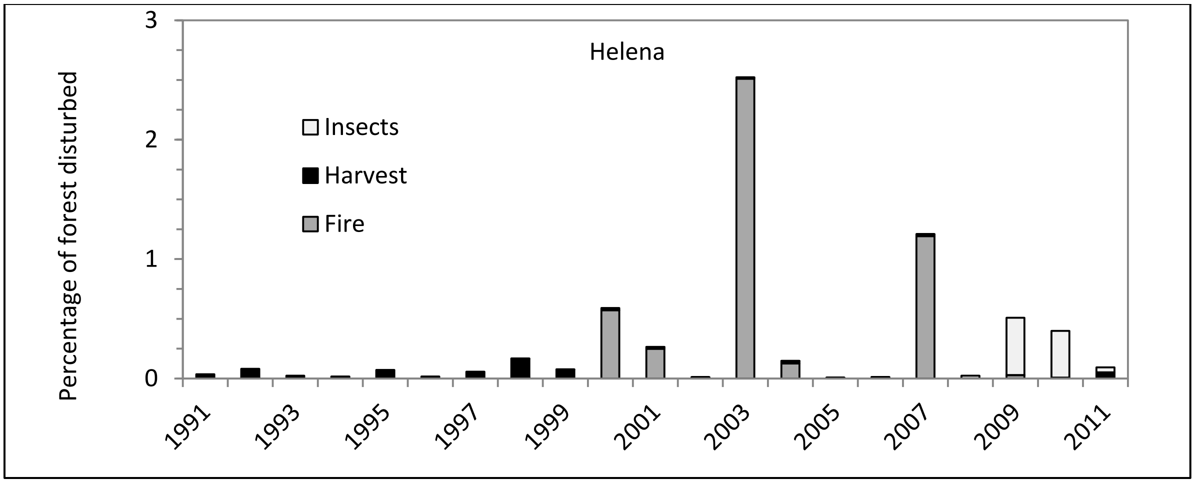


Figure 23. The percentage of forested areas disturbed from 1991 to 2011 by disturbance type on the Helena National Forest (USDA, 2017e)

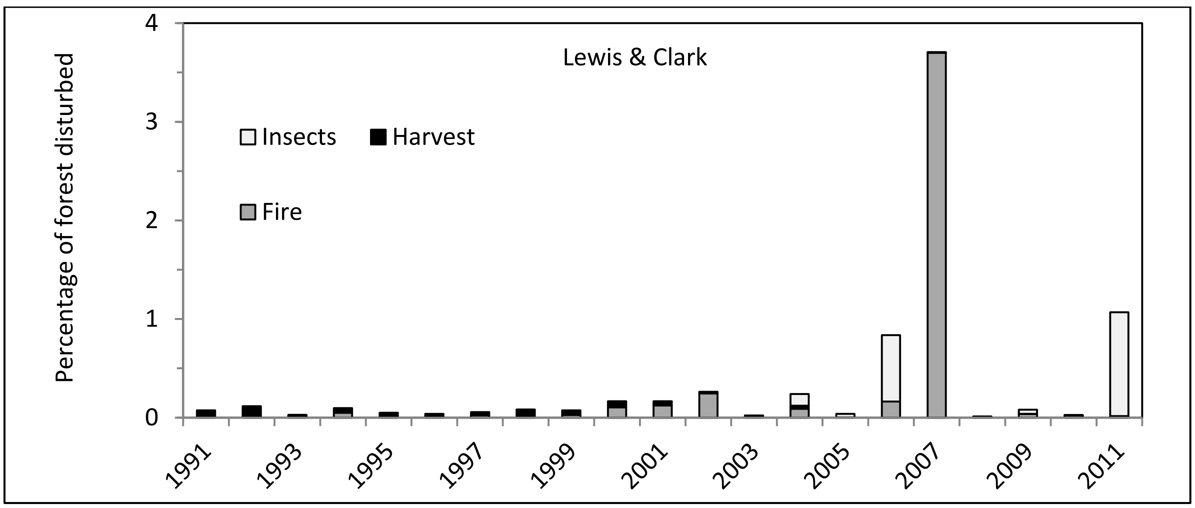


Figure 24. The percentage of forested areas disturbed from 1991 to 2011 by disturbance type on the Lewis and Clark National Forest (USDA, 2017e)

Figure 25 displays the estimated effect of the various disturbances on carbon storage for the Helena and Lewis and Clark NFs. Root disease is not a substantial disturbance on the HLC NF.

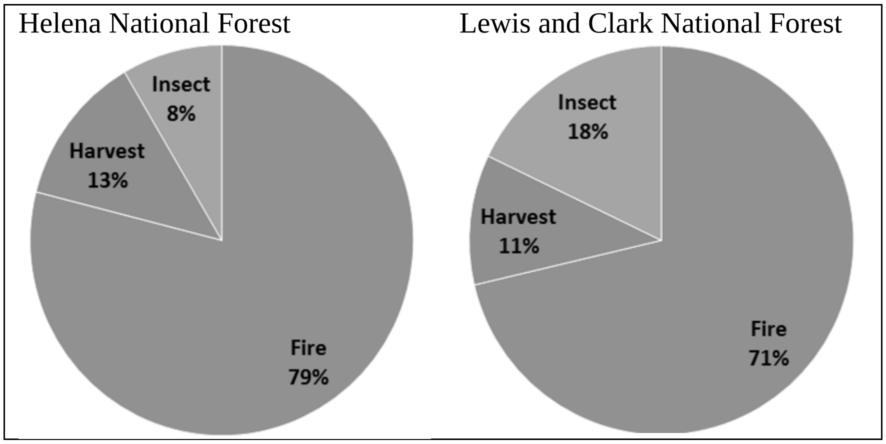


Figure 25. The proportional effect of fire, insect, disease[1] and harvest on carbon storage on the HLC NF 1990-2011, (ForCaMF model; USDA, 2017)

1. Disease was included in this modeling, but was not recorded on the HLC NF.

Fire, which disturbed the greatest amount of forest area also had the greatest impact on carbon storage on the HLC NF, according to results from the ForCaMF model. Lost carbon storage through harvest and insects accounts for a substantially smaller amount.

The impact of a disturbance is felt beyond the year it happens. The increased impact on carbon stocks from the effect of increased wildfire activity in the years since 2000 is clearly reflected. The effects of these fires will continue through future decades because carbon added through growth and recovery may not equal carbon that would have been added through continued growth, and because decaying material will mitigate carbon added through recovery.

Forests in the Helena portion of the HLC NF were a carbon sink from 1950-1993 then switched to a carbon source (USDA 2017e). This shift corresponds to the increased effects of disturbances, aging, and climate effects. Forests in the Lewis and Clark portion of the HLC NF switched from mostly a carbon sink to a source in the 1970s and carbon stocks have continued to decline (ibid). Increased disturbance and aging effects were responsible, though unfavorable climate conditions also played a role.

3.31.6 Environmental consequences

Forests are biological systems that continually gain and lose carbon. Disturbances and forest management can affect net carbon stores by changing the amount of carbon stored in various pools and by altering the rate at which carbon accumulates in the ecosystem (net ecosystem productivity) (Fahey et al., 2009). Whether forests show a net gain (sink) or net loss (source) depends on the balance of these processes, and must be interpreted in light of the long development trajectories of forests in the Northern Rockies. There is general understanding of forest conditions and carbon storage dynamics and capacity, as well as estimates as to how disturbances may impact carbon stores. However, carbon sequestration and emission dynamics from forested ecosystems can be very complex and uncertain. This analysis focuses on expected trends of carbon stocks and the forest carbon flux, and the potential influence of various strategies and approaches to management of the HLC NF.

Effects common to all alternatives

Regardless of alternative, natural ecosystem processes would result in a continual flux in carbon storage and emission into the future over the short and long term, in response to the interactions between climate, disturbances, successional processes, and resulting changes in forest conditions and patterns.

The HLC NF, to the best of our knowledge, is functioning as a carbon source, releasing more carbon than it stores. Under all alternatives, lands on the HLC NF would continue to support native vegetation (forests and nonforested vegetation), and would not be converted to other uses. Therefore, long-term potential for carbon sequestration would be maintained. As forests re-grow from recent fire and insect disturbances, over time the HLC NF may function as a carbon sink. However, fire and other natural disturbances are expected to continue to occur over the next few decades. In addition, to some degree, timber harvest would affect the quantity of carbon stored in both the ecosystem and forest products over time. Forest-level carbon stocks would vary in response to the complex interactions between such factors.

All alternatives include some level of forest management. Forests can be managed to sustain and perhaps increase their ability to remove carbon from the atmosphere. Carbon sequestration may be enhanced through management strategies that maintain resilient forests that are adapted to a changing climate and other stressors, and reforest lands disturbed by wildfires and other natural events. Management strategies applicable to the HLC NF center on creating conditions that are resistant and resilient to disturbances that may be amplified by climate change.

Under all alternatives, from the standpoint of effects to carbon, the expected levels of disturbances that may most substantially influence carbon storage (wildfire, harvest, bark beetles, and prescribed fire) would be generally similar. Figure 26 displays projected percent of the HLC NF affected by these disturbances in the future in terms of the mean annual percent area averaged across the alternatives.

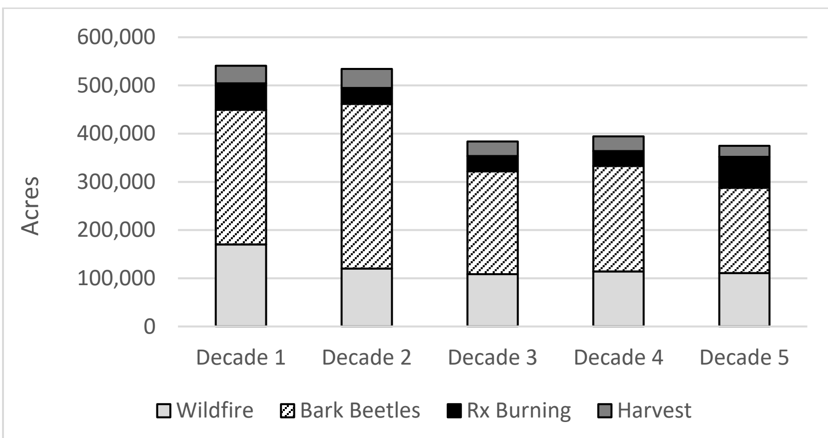


Figure 26. Projected mean area affected per decade by wildfire, bark beetles, prescribed fire, and harvest on the HLC NF over a 5 decade period

1. Source: Spectrum model for harvest; SIMPPLLE model for wildfire and insect/disease activity.

Figure 26 demonstrates that carbon storage across the HLC NF over the next approximately 15 years would be influenced primarily by natural disturbances more so than timber harvest. The majority of the Forest occurs in largely unroaded areas not suitable for timber production. Timber harvest would occur across a limited area; where it does occur, if carbon stored in harvested wood products is factored in, this would offset some of the proportion of carbon lost to tree removal. The estimated range of percent area affected by wildfire and bark beetles in the future is wide, and consistent with those the forest has experienced in the recent past.

Though FIA data indicate that the HLC NF is a net carbon source, there is uncertainty to that status, as well as uncertainty with the status of the Forest over the next 20 to 50 years.

Effects from forest plan components associated with:

Terrestrial vegetation:

Under all action alternatives, plan components for terrestrial vegetation would ensure that forested and nonforested plant communities are managed to be within their NRV, therefore ensuring that the carbon sequestration capacity is maintained over the long term on the HLC NF. Alternative A does not prescribe desired conditions based on the NRV, but would also result in the lands of the HLC NF being managed for native vegetation communities and therefore would provide a similar potential for carbon sequestration.

Fire and fuels management

Of all the potential disturbances on the landscape, fire (both natural and human ignitions) would have the greatest potential to cause short term reductions in carbon sequestration by removing vegetation as well as causing carbon emissions via the generation of smoke. However, fire is also a primary mechanism for restoring and maintaining native vegetation with conditions consistent with the NRV, thereby contributing to carbon sequestration potential over the long term. Plan components for fire and fuels management would help ensure the long term sustainability of vegetation communities while also allowing for flexibility in allowing fire to play its natural role on the landscape. These factors would generally be the same for all alternatives.

Timber

Plan components for timber management would allow for the short-term, localized reduction of carbon sequestration through the removal of living vegetation. The magnitude of this is greatest in alternative E and least in alternative D, but the difference between alternatives is minor. However, plan components that guide timber management, including desired vegetation conditions, would ensure that forest resiliency is promoted by these activities and therefore timber management would contribute to the long-term capacity of forests to sequester carbon.

Mining and mineral extraction

Mining undergoes site-specific NEPA analysis to determine effects and required mitigation, and effects to vegetation from mining is determined at the project level. The impacts to carbon stores from mineral extraction on the forest would be localized, and insignificant at the forestwide scale.

Livestock grazing

In all alternatives, livestock grazing would occur on the HLC NF. Plan components would ensure that grazing is managed in a manner that would maintain desirable vegetation communities, and therefore would not preclude the carbon sequestration potential of rangelands under any alternative.

Old growth

Old growth forests provide particularly concentrated sites for carbon sequestration on the landscape. These forests would fluctuate in location and abundance over time based on natural disturbances and successional processes, regardless of alternative. Plan components under the action alternatives specifically call for increasing the amount, distribution, and patch size of old growth over time, and therefore should increase the amount of carbon sequestered in these areas. The no-action alternative also includes minimum retention of certain proportions of old growth on the landscape, but would not necessarily result in the increase in overall abundance of these areas relative to the existing condition.

Aquatic habitat, RMZs, and watershed

Measures to protect aquatic habitat, RMZs, and watersheds would generally result in vegetation being maintained as needed for watershed function, and would result in a greater likelihood of vegetation cover being maintained within RMZs specifically. These measures would be greater for the action alternatives than the no-action alternative. The retention of vegetation in riparian areas would provide areas of refugia, potential old growth, and seed sources to contribute to the larger resilience (and therefore carbon sequestration potential) of vegetation on the landscape over time.

Effects common to all action alternatives

A key principle in carbon management is to emphasize ecosystem function and resilience (USDA 2015). Ecosystem resilience is also a central tenant of the 2012 Planning Rule. All action alternatives incorporate an ecologically based approach to vegetation management, including direction to manage for conditions that would occur under a natural disturbance regime, and thus be more resilient in the face of future uncertainties.

As required by planning regulations (USDA, 2015), the strategy for vegetation management on the HLC NF under the action alternatives is to provide for ecological sustainability and resilience, supporting a diversity of plant and animal communities, and to provide for social and economic contributions to local communities. In response to this direction, desired conditions for key vegetation components were developed that describe, to the best of our ability, conditions that would maintain or improve forest and ecosystem resilience and promote the adaptability of vegetation. Though the forest plan provides direction for management of the forest over a relatively short period of time (the next 15 years), desired conditions were developed with the long term view in mind as well. This is necessary because ecological, social and economic sustainability concepts require a long-term perspective. The forest plan direction in the action alternatives provide more clarity and stronger integration of ecological concepts and management for resilient forest conditions than alternative A.

All action alternatives would result in a similar and desirable trend towards improved forest resilience over the next five decade period. The forest plan direction and the management strategies and tools to achieve desired conditions, would be consistent with the adaptation actions described earlier for addressing concerns related to carbon and the role of forests as carbon sinks. All action alternatives would thus increase the likelihood of sustaining the HLC NF’s ability to sequester carbon over both the short and long term.

All action alternatives include components addressing carbon storage and sequestration potential through maintenance or enhancement of biodiversity and function, and managing for resilient forests. Indirectly, all the plan direction associated with these concepts work towards achieving this desired condition. Table 300 enumerates the plan components that relate to carbon storage in the revised forest plan, and the expected effects of this direction.

Table 300. Summary of revised plan components related to carbon sequestration

Plan component	Expected effects
VEGT, VEGF, VEGNF	Desired conditions for vegetation, and the standards and guidelines that help achieve them, are designed to maintain and create vegetation able to accommodate gradual changes related to climate and tend to return toward a prior condition after disturbance (i.e., resilience). Management tools available to achieve these desired conditions would include prescribed fire, timber harvest, planting, and thinning in young forests.
FW-CARB-DC-01	The revised forest plan recognizes the importance of the role of the Forest related to carbon storage and sequestration, establishing a desired condition that directly addresses carbon sequestration. This DC focuses on sustaining this key ecosystem service through maintenance or enhancement of ecosystem biodiversity and function and managing for resilient forests adapted to natural disturbance processes and changing climates. This

Plan component	Expected effects
	approach to management of forests for purposes of contributing to climate change mitigation is supported by a number of scientific sources (Hurteau, Koch, & Hungate, 2008; North & Hurteau, 2011; E. Reinhardt & Holsinger, 2010; Ruddell, Walsh, & Kanakasabai, 2006; Ryan et al., 2010; Schaedel et al., 2017; Wiedinmyer & Hurteau, 2010).

The forest management strategies incorporated into the revised plan direction for all action alternatives are centered on the goal of maintaining or increasing forest resilience and resistance. The desired conditions are designed to sustain and create forests with the composition and structure that are able to accommodate gradual changes related to climate and with the capacity to return toward a prior condition after disturbances. Increasing forest resistance and resilience to fire, drought, insects and disease slow the release of carbon and retain larger portions in forest carbon pools, which is important considering that natural disturbances of fire and insect/disease has accounted for most of the carbon stock loss over the past 20 years. All action alternatives result in a similar and desirable trend towards improved resilience over the next five decades, and would have a potential beneficial effect on sustaining or improving the natural carbon sequestration potential of the forest lands.

Examples of the management strategies that are incorporated into forest plan direction and would contribute to carbon sequestration potential include the following (Harmon & Marks, 2002; Kobziar, Moghaddas, & Stephens, 2006; Krankina & Harmon, 2006; Millar, Stephenson, & Stephens, 2007):

- manipulating forests to favor rapid growth;
- increasing abundance and distribution of large diameter trees of fire resistant species;
- lowering forest densities and forest fuel conditions;
- rapid reforestation after disturbances;
- maintaining healthy, vigorous trees;
- minimizing severe disturbance by fire, insects and disease;
- keeping sites fully occupied with trees;
- sequestering carbon after harvest in wood products; and
- providing wood and biomass for fuel.

Some management treatments may reduce carbon at the stand level in the short term but result in maintaining or improving carbon sequestration potential in the long term. Some examples include pre-commercial thinning in young, sapling stands, and prescribed fire and other fuel treatments. Thinning in young forests is a beneficial treatment to achieve forest conditions that improve resistance and resilience (such as desired species, tree sizes and densities) and to achieve climate change mitigation though carbon sequestration. Though thinning reduces carbon stores in the short term, there may be no discernable difference in thinned versus unthinned stands in total above-ground carbon stores several decades after thinning, due to the larger trees and differences in understory and woody material (Schaedel et al., 2017). Similarly, there are short-term loss of carbon stores with prescribed burning or other fuel treatments, but studies suggest there may be long-term benefits in the event of a future wildfire, with lower fire severity in the treated stands resulting in less consumption of live and dead tree biomass, higher tree survival, lowered decompositions emissions, and shortened recovery times (Hurteau et al., 2008; North & Hurteau, 2011; E. Reinhardt & Holsinger, 2010; Wiedinmyer & Hurteau, 2010). This fuel reduction effect is most pronounced in dry forest types that historically experienced low to moderate (mixed) severity fire.

To provide insight into the relative relationship across alternatives, the Spectrum model was used to estimate future carbon stored in above-ground pools. Impact of fire and insect/disease disturbances was factored into the model. Refer to appendix B for detailed discussion of the Spectrum modeling. Figure 27 displays the estimated amount of carbon sequestered over the next 50 years on the HLC NF. Absolute values of the carbon are less important that the relative comparison of trends over time. These model results provide insight into the relative proportion of carbon stored on the Forest, and to the rate and relative nature of carbon changes over time with anticipated disturbances. The total amount of carbon is projected to decline over time. All alternatives are similar with respect to this trend, with the highest levels in alternative D and the lowest levels in alternative E.

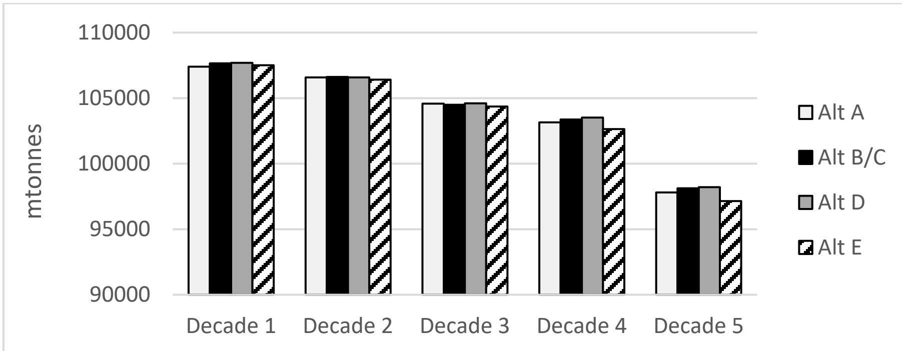


Figure 27. Estimated carbon (mtonnes) on the HLC NF projected over the next 5 decades, Spectrum model

Under the anticipated levels of fire, harvest, and growth rates of forests, the Spectrum model suggests that there would be a continuing downward trend in total carbon, consistent with the trend estimated in the recent past. This trend is likely in large part due to expected wildfire activity. The recovery of disturbed areas and the growth and increasing productivity of young forests over time would maintain some level of carbon sequestration. Carbon removed by harvest treatments at future anticipated levels would not adversely impact the live forest inventory carbon stores because of the relatively small portion of the live forest inventory expected to be harvested. Carbon storage in harvested wood products would continue to steadily contribute carbon to the total carbon pool, consistent with what has occurred in the recent past.

Alternative A, no action

The existing Forest Plans contain no plan components or direct acknowledgment related to carbon sequestration, or the use of management approaches to mitigate greenhouse gas emissions and climate change. Management would continue similarly as in the recent past, resulting in a similar pattern of carbon storage and flux as discussed in the affected environment section. Both existing plans contain direction aimed at promoting the sustainability of vegetation that could trend the forest towards greater resiliency, and thus enable the Forest to provide carbon sequestration over both the short and long term.

Cumulative effects

Within the U.S., land use conversions from forest to other uses (primarily for land development or agriculture) are identified as the primary human activities exerting negative pressure on the carbon sink that currently exists in this country’s forests (Conant et al., 2007; McKinley et al., 2011; Ryan et al., 2010). The population is growing in some communities associated with the HLC NF, primarily on the west side of the plan area, and conversion of forest lands to non-forest purposes may occur to some degree on private lands near the Forest.

The impact of the alternatives and proposed forest plan direction on atmospheric concentrations of greenhouse gasses or global warming is not likely to be large at the global scale, considering the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities contributing globally to that pool.

Federally owned forest lands are managed to ensure sustainable timber yields, and unlike other parts of the world, over-harvesting of timber is not a primary concern for decreased carbon sequestration

(Halofsky et al., in press-b). Sustainable management practices and promoting healthy, resilient forest ecosystems increase the ability of the forest to provide long-term carbon sequestering services (ibid).

An area of vulnerability to forest resilience and associated carbon sequestration and storage values is the increased risk of uncharacteristic fire, insect, and disease activity that might occur with climate change. Once a tree dies or loses a leaf or other plant part containing carbon, it will decompose and its sequestered carbon is either respired into the atmosphere or transformed into soil carbon. Large, high severity fires or large-scale insect outbreaks, can affect regional carbon stocks and flux within forest ecosystems. In the short term (decades), disturbances with high tree mortality can convert carbon sinks to a carbon source (Kurz, Dymond, et al., 2008; Kurz, Stinson, & Rampley, 2008; Kurz, Stinson, Rampley, Dymond, & Neilson, 2008). Over the long term (centuries), the effects of disturbances on the regional carbon balance are neutral, assuming similar vegetation regrows on the disturbed area and the long-term frequency and severity of disturbances does not change (Canadell et al., 2007; Kashian, Romme, Tinker, Turner, & G., 2006). It is possible that over the very long term, climate changes may alter site conditions and disturbance patterns on the HLC NF to a degree that substantially impacts forest regrowth or vegetation types. This may reduce the Forest’s capacity for carbon sequestration. This effect would be small in relation to global capacity to sequester carbon (Halofsky et al., in press-b). The net effects on forest health and carbon sequestration have a high degree of uncertainty, primarily because of uncertainty in the magnitude of future climate change, and complex interactions of forest with disturbances, climate and ecological processes.

Conclusions

The HLC NF is likely functioning as a carbon source due to recent disturbances. However, it is not possible to conclude this with certainty. The forest may shift to a carbon sink in the future, if the carbon stored by regrowth outpaces carbon losses from future disturbances. All of the action alternatives do more to explicitly promote resilience, and thus the long-term carbon storage potential than the no-action alternative. However, there is not a measurable difference between alternatives, because in all cases native vegetation (forests and nonforested plant communities) would be maintained on NFS lands; the land would not be not converted to other uses. Natural disturbances would influence carbon storage much more so than forest management activities, and although the future is highly uncertain, the degree to which disturbances impact the landscape would be similar for all alternatives.

NFs are especially important for the persistent, long-term contribution to greenhouse gas mitigation they are capable of providing. This is because land use conversion from forests to other uses is a primary human activity affecting carbon stores both globally and nationally, and forests on NFS lands are not subject to conversion to non-forest uses.

Natural ecosystem processes and disturbances would continue to be the primary influence on carbon storage, accumulation and emission patterns. Forest plan direction for vegetation management is designed to maintain and increase forest resistance and resilience to fire, drought, insects, and disease. All action alternatives are expected to result in a similar and desirable trend towards improved forest resilience. This is beneficial because it will help sustain or improve the carbon sequestration potential of the forest lands.

HLC NF lands would continue to experience fluctuation in carbon stores and accumulation into the near future (i.e., 20 to 50 years), consistent with the natural variation that would be expected in an ecosystem influenced mostly by natural disturbance regimes and ecosystem processes. Projected impacts of fire and insect/disease on forest cover and potential loss of carbon is much greater than the projected amount of harvest. Under any alternative, harvest would have little impact on a potential future scenario of carbon accumulation and loss.

Uncertainties in the amount of future disturbances exist, especially related to factors associated with climate changes. If changes in natural fire regimes occur, perhaps to a regime of more frequent, more severe, and/or more extensive areas burned over shorter time periods, then the relationship between carbon sequestered in live forest inventory and that within decaying dead trees after fire could shift.

3.32 Climate

3.32.1 Introduction

Climate is described by the long-term characteristics of precipitation, temperature, wind, snowfall, and other measures of weather that occur over a long period in a particular place (Halofsky et al., in press-b), and is a primary driver of the ecosystem.

The HLC NF lies at the boundary between the warm, wet, maritime airflows from the Pacific Ocean and the cooler, drier airflows from Canada. The climate of the plan area varies, but is dominated by cold continental, cold-dry continental, and cool temperate with maritime influence (McNab and Avers 1994). Summers are generally dry, and the precipitation in winter is primarily snow. In some areas, spring and fall precipitation is also snow. Total precipitation is generally 10-50” per year, although it can be higher in some mountainous areas. Winter temperatures can fluctuate widely, and harsh chinook winds are a highlighted climatic feature.

3.32.2 Information sources

An ever-increasing body of knowledge exists regarding climate and climate change. This summary is based in large part upon the work of the Northern Rockies Adaptation Partnership, which is a “science-management” collaboration with the goals of 1) assessing vulnerability of natural resources and ecosystem services to climate change; and 2) developing science-based adaptation strategies that can be used by NFs to understand and mitigate the negative effects of climate change. The Northern Rockies region includes the U.S. FS Northern Region 1 and the adjacent Greater Yellowstone area, spanning northern Idaho, Montana, Northwest Wyoming, North Dakota, and South Dakota. Five subregions are identified and assessed; the HLC NF is in the Eastern Rockies subregion.

Global climate models are the principal source of future climate projections, and are effective at simulating global climate characteristics; however, because the spatial patterns of regional climate are far more heterogeneous than suggested by global climate model outputs, specific downscaling techniques are utilized to provide inputs for regional and sub-regional analyses (Daniels et al., 2012). The Northern Rockies Adaptation Partnership compiled downscaled climate information to a sub-regional level, which is a scale that is meaningful for the HLC NF and its surrounding landscapes.

The Coupled Model Intercomparison Project began in 1995 to coordinate a common set of experiments for evaluating changes to past and future global climate; this approach allows for comparison of results from different global climate models around the world (Halofsky et al., in press-b). Version 3 simulations were forced with emissions scenarios from the Special Report on Emissions Scenarios, which represent futures with different combinations of global population growth and policies. Conversely, version 5 simulations are driven by “representative concentration pathways” which do not define emissions but rather concentrations of greenhouse gases and other agents that influence the climate, and do not assume any particularly climate policy actions (ibid). The Northern Rockies Adaptation Partnership considered Coupled Model Intercomparison Project version 5 climate scenarios but also utilizes the best available information from multiple literature sources, some of which are based upon version 3 modeling results.

Climate projections embody a number of uncertainties, including the uncertainty of future emissions driven by socioeconomic processes and unpredictable policy choices, variability internal to a given global climate model’s simulation of weather and climate, variability related to parameterization and other model characteristics, and uncertainty or error in observed climate data used in downscaling global climate model output (Daniels et al., 2012).

3.32.3 Current climate and recent historical trend

Historic trends in climate are correlated to changes in ecosystem components, and therefore future climate is an important component of the effects analyses for forest plan revision. Natural climate cycles have occurred historically and will continue into the future. Human activities such as fuel burning, industrial activities, land-use change, animal husbandry, and agriculture lead to increases in ambient greenhouse gases, which contribute to the “greenhouse effect” (Melillo et al 2014). Warming temperatures are the most certain consequence of increased carbon dioxide in the atmosphere (Halofsky et al., in press-b).

The climate of the Northern Region fluctuates between cool and warm periods and is affected by multiple factors. The influences of sea surface temperature and atmospheric pressure are thought to directly influence drought in the western U.S. (Kitzberger et al. 2007). Multiple indices exist to measure sea surface temperatures, including the Pacific Decadal Oscillation, which tracks variations in the northern Pacific that tend to cycle every 20 years (Zhang et al. 1997). Correlations between these variations and ecological disturbances such as wildfire have been shown. Also, in the Northern Rocky Mountains the majority of the variability in peak and total annual snowpack and streamflow is explained by season-dependent interannual-to-interdecadal changes in atmospheric circulation associated with Pacific sea temperatures (Pederson, Graumlich, Fagre, Kipfer, & Muhlfeld, 2010).

Recent climate cycles can be demonstrated by variations in the Pacific Decadal Oscillation. The early 1900’s was a relatively normalized period where warm and cool years were relatively equally represented and fluctuations fairly low. The following period until the 1940’s was dominated by warm conditions, while the period from about 1950 to 1980 was dominated by cool conditions. During this cool period, ecological disturbances such as wildfire affected a relatively small area, although this was also influenced by human actions such as fire suppression and livestock grazing. Since the 1980’s, the Northern Region and the HLC NF have experienced a warm Pacific Decadal Oscillation cycle, along with increased extent and frequency of disturbances including wildfire and insect outbreaks.

Other climate data shows trends for temperature and precipitation over the recent historical period. In the Eastern Rockies subregion, the Northern Rockies Adaptation Partnership found that from 1895 to 2012, the annual mean monthly maximum temperature increased by about 2.2 degrees Fahrenheit, while the annual mean monthly maximum temperature increased by about 1.8 degrees Fahrenheit with little to no change in annual mean monthly precipitation (Halofsky et al., in press-b). Current climate conditions in this subregion include an annual mean monthly maximum temperature between 53 and 54 degrees Fahrenheit; an annual mean monthly minimum temperature around 30 degrees Fahrenheit; and an annual mean monthly precipitation just over 2 inches.

3.32.4 Future climate and expected impacts

The influence of future climate spans across all resources. Natural variation in climate will continue, coupled with the effects of anthropogenic influences. Different climate models project differing rates of change in temperature and precipitation because they operate at different scales, have different climate sensitivities, and incorporate feedbacks differently. However, the climate models are unanimous in projecting increasing average annual temperatures over the coming decades. The authors of the Northern Rockies Adaptation Partnership found that [**emphasis added**]:

“*Global climate models project that the Earth’s current warming trend will continue throughout the 21st century in the Northern Rockies. Compared to observed historical temperature, average warming across the five NRAP subregions is projected to be about* ***4 to 5 °F by 2050****, depending on greenhouse gas emissions. Precipitation may increase slightly in the winter, although the magnitude is uncertain. Climatic extremes are difficult to project, but they will probably be more common, driving biophysical changes in terrestrial and aquatic ecosystems. Droughts of increasing frequency and magnitude are expected in the future, promoting an increase in wildfire, insect outbreaks, and non-native species. These* *periodic disturbances, will rapidly alter productivity and structure of vegetation, potentially altering the distribution and abundance of dominant plant species and animal habitat." (Halofsky et al., in press-b)*

Index

Literature

*Aaberg, S. A., Crofutt, C., Green, J., Finley, J., Eckerle, W., & Taddie, S. (2007). Archaeological and Geoarchaeological Investigations and Data Recovery at 24ME631, 24ME633 and 24ME747 as Part of the Dry Range Land Exchange, Meagher County, Montana. Aaberg Cultural Resources Consulting. Geoarchaeological Sections Prepared By: Western GeoArch Research. *Document contains confidential information, resides in Heritage Program files (copies not available). Not for release under FOIA.

Abele, S. C., Saab, V. A., & Garton, E. O. (2004). *Lewis's woodpecker (melanerpes lewis): A technical conservation assessment [online]*. Retrieved from http://www.fs.fed.us/r2/projects/scp/assessments/lewisswoodpecker.pdf

Achambault, D.J. (2007) Efficacy of herbicides under elevated temperature and CO2. In Newton P.C.D., Carran A., Edwards G.R., and Niklans, P.A. (2007) Agroecosystems in a Changing Climate, CRC Press, Baston, MA, pp. 262-279.

Agee, J. K., & Skinner, C. N. (2005). Basic principles of forest fuel reduction treatments. *Forest Ecology and Management, 211*(1-2), 83-96. doi:http://dx.doi.org/10.1016/j.foreco.2005.01.034

Al-Chokhachy, R. (2010). *Preliminary fine sediment analyses for pibo sites in mt*.

Allendorf, F. W., Leary, R. F., Spruell, P., & K., W. J. (2001). The problems with hybrids: Setting conservation guidelines. *Trends in Ecology and Evolution, 16*(11), 613-622.

American Public Health Association (APHA). (2013). Improving Health and Wellness through Access to Nature. APHA. Retrieved from https://www.apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2014/07/08/09/18/improving-health-and-wellness-through-access-to-nature

Anderson, H. E. (1982). *Aids to determining fuel models for estimating fire behavior* (General Technical Report INT-122). Retrieved from Ogden, UT: https://www.fs.fed.us/rm/pubs_int/int_gtr122.pdf

Archer, E., & Ojala, J. V. (2016). *Stream habitat condition for sites in the helena national forest*. Retrieved from Logan, UT:

Archer, E. and J. V. Ojala, 2017. Stream Habitat Condition for Sites in the Helena National Forest, Split by Missouri & Columbia River Basins. PacFish / InFish Biological Opinion (PIBO) Monitoring Program, USDA Forest Service, Logan, UT, November 2017

Arno, S. F., & Hoff, R. J. (1989). *Silvics of whitebark pine (pinus albicaulis)* (General Technical Report INT-253). Retrieved from Ogden, UT:

Baker, W. L., & Ehle, D. S. (2003). *Uncertainty in fire history and restoration of ponderosa pine forests in the western united states*. Retrieved from Fort Collins, CO:

Ballantine, D. J., Walling, D. E., Collins, A. L., & Leeks, G. J. L. (2008). The phosphorus content of fluvial suspended sediment in three lowland groundwater-dominated catchments. *Journal of Hydrology, 357*(1-2), 140-151. doi:http://dx.doi.org/10.1016/j.jhydrol.2008.05.011

Banci, V. (1994). *Chapter 5: Wolverine* (General Technical Report RM-254). Retrieved from Fort Collins, CO:

Barrett, S. W. (1993). *Fire history of tenderfoot creek experimental forest, lewis and clark national forest: Final report*.

Barrett, Stephen W. 1997. Historical fire regimes on the Beaverhead-Deerlodge National Forest, Montana. Beaverhead Portion. Final Report Contract No. 43-0356-6-0107. June 1997.

Barrett, S. W., Arno, S. F., & Menakis, J. P. (1997). *Fire episodes in the inland northwest (1540-1940) based on fire history data* (General Technical Report-INT-GTR-370).

Beall, R.C. 1976. Elk habitat selection in relation to thermal radiation. Pages 97-100. -In Elk-logging roads. Symp. Proc. Univ. of Idaho, Moscow.

Beck, B. S. (1989). *Historical overview of the helena and deerlodge national forests*. Retrieved from Butte, MT:

Behnke, R. J. (1992). *Native trout of western north america* (Vol. 6). Bethesda, MD: American Fisheries Society.

Belsky, A. J., & Gelbard, J. L. (2000). *Livestock grazing and weed invasions in the arid west*. Retrieved from Portland, OR: http://www.publiclandsranching.org/htmlres/PDF/BelskyGelbard_2000_Grazing_Weed_Invasions.pdf

Belsky, A. J., Matzke, A., & Uselman, S. (1999). Survey of livestock influences on stream and riparian ecosystems in the western united states. *Journal of Soil and Water Conservation*, *54*, 419-431.

Benda, L., & Dunne, T. (1997). Stochastic forcing of sediment supply to channel networks from landsliding and debris flow. *Water Resources Research, 33*(12), 2849-2863. doi:http://dx.doi.org/10.1029/97WR02388

Besser, T. E., Highland, M. A., Baker, K., Cassirer, E. F., Anderson, N. J., Ramsey, J. M., . . . Jenks, J. A. (2012). Causes of pneumonia epizootics among bighorn sheep, western united states, 2008-2010. *Emerging Infectious Diseases*, *18*(3), 406-414. doi:http://dx.doi.org/10.3201/eid1803.111554

Biederman, J. A., Somor, A. J., Harpold, A. A., Gutmann, E. D., Breshears, D. D., Troch, P. A., . . . Brooks, P. D. (2015). Recent tree die-off has little effect on streamflow in contrast to expected increases from historical studies. *Water Resources Research, 51*(12), 9775-9789. doi:10.1002/2015wr017401

Boisvenue, C., & Running, S. W. (2010). Simulations show decreasing carbon stocks and potential for carbon emissions in rocky mountain forests over the next century. *Ecological Applications, 20*(5), 1302-1319. doi:http://dx.doi.org/10.1890/09-0504.1

Bollenbacher, B., Bush, R., Hahn, B., & Lundberg, R. (2008). *Estimates of snag densities for eastside forests in the northern region* (08-07 v2.0). Retrieved from Missoula, MT:

Boulanger, J., & Stenhouse, G. B. (2014). The impact of roads on the demography of grizzly bears in alberta. *PLoS ONE, 9*(12), 22. doi:http://dx.doi.org/10.1371/journal.pone.0115535

Bowker, J. M., D. Murphy, H. K. Cordell, D. B. K. English, J. C. Bergstrom, C. M. Starbuck, C. J. Betz and G. T. Green. 2006. Wilderness and Primitive Area Recreation Participation and Consumption: An Examination of Demographic and Spatial Factors. Journal of Agricultural and Applied Economics 38(2): 317-326.

Brown, J. K., Reinhardt, E. D., & Kramer, K. A. (2003). *Coarse woody debris: Managing benefits and fire hazard in the recovering forest* (General Technical Report RMRS-GTR-105). Retrieved from Ogden, UT: https://www.fs.fed.us/rm/pubs/rmrs_gtr105.pdf

Burcham, M., Edge, W. D., & Marcum, C. L. (1999). Elk use of private land refuges. *Wildlife Habitat and Land Management*, *27*(3), 833-839.

Burden, R. F., & Randerson, P. F. (1972). Quantitative studies of the effects of human trampling on vegetation as an aid to the management of semi-natural areas. *Journal of Applied Ecology, 9*(2), 439-457. doi:http://dx.doi.org/10.2307/2402445

Bush, R., & Lundberg, R. (2008). *Wildlife habitat estimate updates for the region one conservation assessment*. Retrieved from Missoula, MT: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5130739.pdf

Canadell, J. G., Pataki, D. E., Gifford, R., Houghton, R. A., Luo, Y., Raupach, M. R., . . . Steffen, W. (2007). Saturation of the terrestrial carbon sink. In J. G. Canadell, D. E. Pataki, & L. F. Pitelka (Eds.), *Terrestrial ecosystems in a changing world* (pp. 59-78). Berlin, Germany: Springer Berlin Heidelberg.

Casey, D. (2000). *Partners in flight bird conservation plan montana*.

Center for Climate and Energy Solutions (C2ES). (2017). Business Support for the Paris Agreement. Retrieved from https://www.c2es.org/international/business-support-paris-agreement.

Center for Natural Resources & Environmental Policy (CNREP). (2015). Stakeholder Listening Sessions Summary. University of Montana, Helena, MT.

Center for Natural Resources & Environmental Policy (CNREP). (2015a). “Need to Change” Community Conversation Workshops Summary Report. University of Montana, Helena, MT.

Center for Natural Resources & Environmental Policy (CNREP). (2016). “Draft Desired Conditions” Community Conversations Workshops Summary Report. University of Montana, Helena, MT.

Center for Natural Resources & Environmental Policy (CNREP). (2016a). Resource Management Area Community Workshops. University of Montana, Helena, MT.

Center for Natural Resources & Environmental Policy (CNREP). (2016b). Summary of Public Comments on Forest Resource Areas. University of Montana, Helena, MT.

Chadde, Steve W., Kimball, Shannon F., Evenden, Angela, G. (1996). Research Natural Areas of the Northern Region: Status and Needs Assessment. Missoula, Montana. USDA.

Chen, I.-C., Hill, J. K., Ohlemuller, R., Roy, D. B., & Thomas, C. D. (2011). Rapid range shifts of species associated with high levels of climate warming. *Science, 333*, 1024-1026.

Christensen, A. G., Lyon, L. J., & Unsworth, J. W. (1993). *Elk management in the northern region: Considerations in forest plan updates or revisions* (INT-303). Retrieved from Ogden, UT: https://www.fs.fed.us/rm/pubs_int/int_gtr303.pdf

Cilimburg, A. (2006). *Northern region landbird monitoring program 2005 flammulated owl surveys final report* (FS - 13669). Retrieved from University of Montana, Missoula, MT 59812:

Cissel, J. H., Swanson, F. J., McKee, W. A., & Burditt, A. L. (1994). Using the past to plan the future in the pacific northwest. *Journal of Forestry, 92*(8), 30-46.

Clary, W. P., & Kinney, J. W. (2002). Steambank and vegetation response to simulated cattle grazing. *Wetlands, 22*(1), 139-148.

Clary, W. P., & Webster, B. F. (1990). Riparian grazing guidelines for the intermountain region. *Rangelands, 12*(4), 209-212.

Clayton, J. L. (1990). *Soil disturbance resulting from skidding logs on granitic soils in central idaho* (Research Paper INT-436). Retrieved from Ogden, UT: https://ia801002.us.archive.org/2/items/soildisturbancer436clay/soildisturbancer436clay.pdf

Climburg, A. (2006). *2005 flammulated owl surveys: Final report*.

Cohen, W. B., Yang, Z., Stehman, S. V., Schroeder, T. A., Bell, D. M., Masek, J. G., . . . Meigs, G. W. (2016). Forest disturbance across the conterminous united states from 1985–2012: The emerging dominance of forest decline. *Forest Ecology and Management, 360*, 242-252.

Cole, David N. (2005). Symbolic Values: The Overlooked Values That Make Wilderness Unique. International Journal of Wilderness 11(2): 23-28.

Conant, R. T., Paustian, K., García-Oliva, F., Janzen, H. H., Jaramillo, V. J., Johnson, D. E., & Kulshreshtha, S. N. (2007). Agricultural and grazing lands. In A. W. King, L. Dilling, G. P. Zimmerman, D. M. Fairman, R. A. Houghton, G. Marland, A. Z. Rose, & T. J. Wilbanks (Eds.), *Ccsp, 2007. The first state of the carbon cycle report (soccr): The north american carbon budget and implications for the global carbon cycle. A report by the u.S. Climate change science program and the subcommittee on global change research*. Asheville, NC: National Oceanic and Atmospheric Administration, National Climatic Data Center.

Cook, C., & Dresser, A. (2007). Erosion and channel adjustments following forest road decommissioning, six rivers national forest. In M. Furniss, C. Clifton, & K. Ronnenberg (Eds.), *Advancing the fundamental sciences: Proceedings of the forest service national earth sciences conference, san diego, ca, 18-22 october 2004*. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Cook, J. G. (2002). Nutrition and food. In D. E. Toweill & J. W. Thomas (Eds.), *North american elk: Ecology and management* (pp. 259-349). Washington, DC: Smithsonian Institution Scholarly Press.

Cook, J. G., Irwin, L. L., Bryant, L. D., Riggs, R. A., & Thomas, J. W. (2005). Thermal cover needs of large ungulates: A review of hypothesis tests. In M. J. Wisdom (Ed.), *The starkey project: A synthesis of long-term studies of elk and mule deer* (pp. 185-196): Alliance Communications Group.

Cook, J. G., Quinlan, L. J., Irwin, L. L., Bryant, L. D., Riggs, R. A., & Thomas, J. W. (1996). Nutrition-growth relations of elk calves during late summer and fall. *Journal of Wildlife Management, 60*(3), 528-541.

Copeland, J. P., Mckelvey, K. S., Aubry, K. B., Landra, A., Persson, J., Inman, R. M., . . . May, R. (2010). The bioclimatic envelope of the wolverine (gulo gulo): Do climatic constraints limit its geographic distribution? *Canadian Journal of Zoology, 88*, 233-246. doi:http://dx.doi.org/10.1139/Z09-136

Cordell, H. K., J.C. Bergstrom and J.M. Bowker (Eds.). 2005. The Multiple Values of Wilderness. State College, PA: Venture Publishing, Inc.

Costello, C. M., Mace, R. D., & Roberts, L. (2016). *Grizzly bear demographics in the northern continental divide ecosystem, montana: Research results (2004–2014) and suggested techniques for management of mortality*. Retrieved from Helena, MT:

Craig, M.E., Scott M. Pearson, and Jennifer M. Fraterrigo. 2015. Grass invasion effects on forest soil carbon depend on landscape-level land use patterns. Ecology 96:2265–2279.

Crane, K. K., Mosley, J. C., Brewer, T. K., Torstenson, W. L., & Tess, M. W. (2001). The influence of cattle grazing on elk forage conditions and habitat selection *Proceedings, american society of animal science, western section, june 20–22, 2001, montana state university, bozeman*. Bozeman, MT: Montana State University.

Dale, V. H., Joyce, L. A., Steve, M., Neilson, R. P., Ayres, M. P., Flannigan, M. D., . . . Wotton, B. M. (2001). Climate change and forest disturbances. *BioScience, 51*(9), 723-734.

Daniels, A. E., Morrison, J. F., Joyce, L. A., Crookston, N. L., Chen, S.-C., & McNulty, S. G. (2012). *Climate projections faq* (General Technical Report RMRS-GTR-277WWW). Retrieved from Fort Collins, CO:

Deaver, Sherri, 1995. Ethnographic Overview of Selected Portions of the Lewis and Clark National Forest and Adjacent Bureau of Land Management Lands. Volume 1: Narrative. USDA Forest Service, Lewis & Clark National Forest, MT. *confidential report, only available internal hardcopy.

DellaSala, D. A., Anthony, R. G., Bond, M. L., Fernandez, E. S., Frissell, C. A., Hanson, C. T., & Spivak, R. (2013). Alternative views of a restoration framework for federal forests in the pacific northwest. *Journal of Forestry, 111*(6), 420-429. doi:http://dx.doi.org/10.5849/jof.13-040

Dickard, M., Gonzalez, M., Elmore, W., Leonard, S., Smith, D. C., Smith, S., Wyman, S. (2015). *Riparian area management: Proper functioning condition assessment for lotic areas*. Retrieved from Denver, CO:

Dissmeyer, G. E. E. (2000). *Drinking water from forests and grasslands: A synthesis of the scientific literature* (General Technical Report SRS-39).

DiTomaso, J. M., Brooks, M. L., Allen, E. B., Minnich, R., Rice, P. M., & Kyser, G. B. (2006). Control of invasive weeds with prescribed burning. *Weed Technology, 20*(2), 535-548. doi:http://dx.doi.org/10.1614/WT-05-086R1.1

Eby, L. A., Helmy, O., Holsinger, L. M., & Young, M. K. (2014). Evidence of climate-induced range contractions in bull trout *salvelinus confluentus* in a rocky mountain watershed, u.S.A. *PLoS ONE, 9*(6), e98812. doi:http://dx.doi.org/10.1371/journal.pone.0098812

Edge, D. W., & Marcum, C. L. (1991, 10-12 April). *Topography ameliorates the effects of roads and human disturbance on elk.* Paper presented at the Elk Vulnerability Symposium, Montana State University, Bozeman, MT.

Fahey, T. J., Woodbury, P. B., Battles, J. J., Goodale, C. L., Hamburg, S., Ollinger, S., & Woodall, C. W. (2009). Forest carbon storage: Ecology, management, and policy. *Frontiers in Ecology and the Environment*. doi:http://dx.doi.org/10.1890/080169

Fiedler, C. E. (2002). Natural process-based management of fire-adapted western forests. In D. M. Baumgartner, L. R. Johnson, & E. J. DePuit (Eds.), *Small diameter timber: Resource management, manufacturing, and markets--proceedings of conference held february 25-27, 2002, in spokane, washington* (pp. 147-151). Pullman, WA: Washington State University Cooperative Extension.

Finch, D. M. (2012). *Climate change in grasslands, shrublands, and deserts of the interior american west: A review and needs assessment*. Retrieved from Fort Collins, CO: https://www.fs.fed.us/rm/pubs/rmrs_gtr285.pdf

Franklin, J. F., Mitchell, R. J., & Palik, B. J. (2007). *Natural disturbance and stand development principles for ecological forestry* (General Technical Report NRS-19). Retrieved from Newtown Square, PA: https://www.nrs.fs.fed.us/pubs/3293

Fule, P. Z., Crouse, J. E., Roccaforte, J. P., & Kalies, E. L. (2012). Do thinning and/or burning treatments in western USA ponderosa or jeffrey pine-dominated forests help restore natural fire behavior? *Forest Ecology and Management, 269*, 68-81. doi:http://dx.doi.org/10.1016/j.foreco.2011.12.025

Glover, J. F. and D. P. Stilwell. 2014. Final Report, Reasonably Foreseeable Development Scenario for Oil and Gas Activities in the Lewistown Planning Area, central Montana.

Golladay, S. W., Martin, K. L., Vose, J. M., Wear, D. N., Covich, A. P., Hobbs, R. J., . . . Shearer, A. W. (2016). Achievable future conditions as a framework for guiding forest conservation and management. *Forest Ecology and Management, 360*, 80-96.

González-Cabán, Armando; Haynes, Richard W.; McCaffrey, Sarah; Mercer, Evan; Watson, Alan, tech. eds. 2007. Fire social science research–selected highlights. Gen. Tech. Rep. PNW-GTR-736. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 65 p

Graham, R. T., Harvey, A. E., Jurgensen, M. F., Jain, T. B., Tonn, J. R., & Pagedumroese, D. S. (1994). *Managing coarse woody debris in forests of the rocky mountains*. (0146-3551).

Grant, G. E., Lewis, S. L., Swanson, F. J., Cissel, J. H., & McDonnell, J. J. (2008). *Effects of forest practices on peak flows and consequent channel response: A state-of-science report for western oregon and washington*. Retrieved from Portland, OR: https://www.treesearch.fs.fed.us/pubs/30179, https://www.fs.fed.us/pnw/pubs/pnw_gtr760.pdf

Gratson, M. W., & Whitman, C. L. (2000). Road closures and density and success of elk hunters in idaho. *Wildlife Society Bulletin, 28*(2), 302-310.

Green, P., Joy, J., Sirucek, D., Hann, W., Zack, A., & Naumann, B. (1992). *Old-growth forest types of the northern region (errata corrected 02/05,12/07,10/08/,12/11)* (R-1 SES 4/92). Retrieved from Missoula, MT:

Gresswell, R. E. (1999). Fire and aquatic ecosystems in forested biomes of north america. *Transactions of the American Fisheries Society, 128*(2), 193-221. doi:http://dx.doi.org/10.1577/1548-8659(1999)128<0193:FAAEIF>2.0.CO;2

Grove, A. J., Wambolt, C. L., & Frisina, M. R. (2005). Douglas-fir's effect on mountain big sagebrush wildlife habitats. *Wildlife Society Bulletin, 33*(1), 74-80.

Gruell, G. E., Brown, J. K., & Bushey, C. L. (1986). *Prescribed fire opportunities in grasslands invaded by douglas-fir: State-of-the-art guidelines* (General Technical Report INT-198). Retrieved from Ogden, UT:

Gruell, G. E., Schmidt, W. C., Arno, S. F., & Reich, W. J. (1982). *Wildlife* (General Technical Report INT 130). Retrieved from Ogden, UT:

Gucinski, H., Furniss, M. J., Ziemer, R. R., & Brookes, M. H. (2001). *Forest roads: A synthesis of scientific information* (General Technical Report PNW-509). Retrieved from Portland, OR: https://www.fs.fed.us/pnw/pubs/pnw_gtr509.pdf

Gude, Patricia, Ray Rasker, and Jeff van den Noort. 2008. “Potential for Future Development on Fire-prone Lands.” Journal of Forestry 106(4): 198-205

Hagle, S. K. (2006). *Armillaria root disease: Ecology and management* (Information Report 11.1). Retrieved from Washington, DC:

Hahn, Beth and Peter Landres, 2016. In Supplement to Minimum Requirements Analysis/Decision Guide (MRA/MRDG): Evaluating Proposals for Ecological Intervention in Wilderness. Aldo Leopold Wilderness Research Institute. June 2016. In: Aquatic Investigations in the North Fork of the Blackfoot River upstream of the North Fork Falls 2005-2017. MFWP July 2017

Halofsky, Jessica E. and David L. Peterson. 2016. Climate change vulnerabilities and adaptation options for forest vegetation management in the northwestern USA. Atmosphere 2016, 7, 46; doi:10.3390/atmos7030046.

Halofsky, J. E., Peterson, D. L., Dante-Wood, S. K., Hoang, L., Ho, J. J., & Joyce, L. A., editors (Eds.). (in press-a). *Climate change vulnerability and adaptation in the northern rocky mountains* (Vol. RMRS-GTR-xxx). Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.

Hann, W. J., Shlisky, A., Havlina, D., Schon, K., Barrett, S. W., DeMeo, T. E., . . . Frame, C. K. (2008). *Interagency fire regime condition class (frcc) guidebook*.

Hansen, R. M., & Reid, L. D. (1975). Diet overlap of deer, elk, and cattle in southern colorado. *Journal of Range Management, 28*(1), 43-47. doi:http://dx.doi.org/10.2307/3897577

Hansen, Matthew E.; Morris C. Johnson, Barbara J. Bentz, James C. Vandygriff; and A. Steven Munson. 2015. Fuel loads and simulated fire behavior in "old-stage" beetle-infested ponderosa pine of the Colorado plateau. For. Sci. 61 (0): 000-000.

Hanson, Clayton L.; J. Ross Wight; Charles W. Slaughter; Fred B. Pierson; and Ken Spaeth. 1999. Simulation models and management of rangeland ecosystems: past, present, and future. Rangelands, Vol. 21, No. 4 (Aug 1999), pp. 32-38.

Harmon, M. E., & Marks, B. (2002). Effects of silvicultural practices on carbon stores in douglas-fir -- western hemlock forests in the pacific northwest, u.S.A.: Results from a simulation model. *Canadian Journal of Forest Research, 32*, 863-877. doi:http://dx.doi.org/10.1139/XOl-216

Harper, A. (2014). Personal Communication.

Harpman, David A., Welch, Michael P., Bishop, Richard C. 1994. Non-use economic value: Emerging policy analysis tool. U.S. Bureau of Reclamation. Denver, Co. 26 pp.

Harrison, S., E. Damschen, and B.M. Going. 2009. Climate Gradients, Climate Change and Special Edaphic Floras. Northeastern Naturalist 16(Special Issue 5):121-130.

Harsch, M. A., & Ris Lambers, J. H. (2015). Species distributions shift downward across western north america. *Global Change Biology, 21*(3), 1376. doi:http://dx.doi.org/10.1111/gcb.12697

Heinemeyer, K. S., J. R. Squires, M. Hebblewhite, J. S. Smith, J. D. Holbrook, J. P. Copeland. 2017. Wolverine – Winter Recreation Research Project: Investigating the interactions between wolverines and winter recreation. Final Report, December 15, 2017. 71pp. Available at: www.roundriver.org/wolverine.

Henderson, R. E., Sterling, B. A., & Lemke, T. O. (1993). *The lower clark fork elk study: Final report 1985-1990*. Retrieved from Helena, MT:

Henjum, M. G., Karr, J. R., Bottom, D. L., Perry, D. A., Bednarz, J. C., Wright, S. G., . . . Beckwitt, E. (1994). *Interim protection for late-successional forests, fisheries, and watersheds: National forests east of the cascade crest, oregon and washington* (The Wildlife Society Technical Review 94-2). Retrieved from Bethesda, MD:

Hessburg, P. F., & Agee, J. K. (2003). An environmental narrative of inland northwest united states forests, 1800–2000. *Forest Ecology and Management, 178*, 23-59. doi:http://dx.doi.org/10.1016/S0378-1127(03)00052-5

Hessburg, P. F., Agee, J. K., & Franklin, J. F. (2005). Dry forests and wildland fires of the inland northwest USA : Contrasting the landscape ecology of the pre-settlement and modern eras. *Forest Ecology and Management, 211*, 117-139. doi:http://dx.doi.org/10.1016/j.foreco.2005.02.016

Hessburg, P. F., Smith, B. G., & Salter, R. B. (1999). Detecting change in forest spatial patterns from reference conditions. *Ecological Applications, 9*(4), 1232-1252.

Heyerdahl, E. K., Miller, R. F., & Parsons, R. A. (2006). History of fire and douglas-fir establishment in a savanna and sagebrush–grassland mosaic, southwestern montana, USA. *Forest Ecology and Management, 230*(1–3), 107-118. doi:http://dx.doi.org/10.1016/j.foreco.2006.04.024

Hillis, J. M., Thompson, M. J., Canfield, J. E., Lyon, L. J., Marcum, C. L., Dolan, P. M., & McCleerey, D. W. (1991). Defining elk security: The hillis paradigm. In A. G. Christensen, L. J. Lyon, & T. N. Lonner (Eds.), *Proceedings of a symposium on elk vulnerability* (pp. 38-43). Bozeman, MT: Montana Department of Fish, Wildlife and Parks.

Hitt, N. P., & Frissell, C. A. (2000). An evaluation of wilderness and aquatic biointegrity in western montana. In S. F. McCool, D. N. Cole, W. T. Borrie, & J. O'Loughlin (Eds.), *Wilderness science in a time of change conference--volume 2: Wilderness within the context of larger systems--missoula, montana, may 23-27, 1999* (pp. 138-142). Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.

Hitt, N. P., Frissell, C. A., Muhlfeld, C. C., & Allendorf, F. W. (2003). Spread of hybridization between native westslope cutthroat trout, *oncorhynchus* clarki lewisi, and nonnative rainbow trout, *oncorhynchus* mykiss. *Canadian Journal of Fisheries and Aquatic Sciences*, *60*(12), 1440-1451. doi:http://dx.doi.org/10.1139/f03-125

Hobbs, R. J., & Humphries, S. E. (1995). An integrated approach to the ecology and management of plant invasions. *Conservation Biology, 9*(4), 761-770.

Holbrook, J. D., J. R. Squires, L. E. Olson, N. J. DeCesare, and R. L. Lawrence. 2017. Understanding and predicting habitat for wildlife conservation: the case of Canada lynx at the range periphery. Ecosphere 8(9):e01939. 10.1002/ecs2.1939

Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, *4*, 1-23.

Hornocker, M. G., & Hash, H. S. (1981). Ecology of the wolverine in northwestern montana. *Canadian Journal of Zoology*, *59*(7), 1286-1301. doi:http://dx.doi.org/10.1139/z81-181

Huntington, C., Nehlsen, W., & Bowers, J. (1996). A survey of healthy native stocks of anadromous salmonids in the pacific northwest and california. *Fisheries, 21*(3), 6-14. doi:http://dx.doi.org/10.1577/1548-8446(1996)021<0006:ASOHNS>2.0.CO;2

Hurteau, M. D., Koch, G. W., & Hungate, B. A. (2008). Carbon protection and fire risk reduction: Toward a full accounting of forest carbon offsets. *Frontiers in Ecology and the Environment, 6*, 6. doi:http://dx.doi.org/10.1890/070187

IGBC. (1986). *Interagency grizzly bear guidelines*. Retrieved from https://www.nps.gov/yell/learn/nature/upload/IGB_Guidelines.pdf

IGBC. (1998). *Interagency grizzly bear committee taskforce report (revised from 1994)*. Retrieved from http://www.igbconline.org/index.php/historical-documents, http://www.igbconline.org/index.php/who-we-are/about-the-igbc

Inman, R. M., Bergen, S., & Beckman, J. P. (2013). *Wolverine connectivity in greater yellowstone: A circuitscape analysis at the metapopulation scale*. Retrieved from

Inman, R. M., Brock, B. L., Inman, K. H., Sartorius, S. S., Aber, B. C., Giddings, B., Chapron, G. (2013). Developing priorities for metapopulation conservation at the landscape scale: Wolverines in the western united states. *Biological Conservation, 166*, 276-286. doi:http://dx.doi.org/10.1016/j.biocon.2013.07.010

Inman, R. M., Packila, M. L., H., I. K., McCue, A. J., White, G. C., Persson, J., Sartorius, S. S. (2012). Spatial ecology of wolverines at the southern periphery of distribution. *Journal of Wildlife Management, 76*(4), 778-7925. doi:http://dx.doi.org/10.1002/jwmg.289

Interagency Lynx Biology Team. (2013). *Canada lynx conservation assessment and strategy*. Retrieved from Missoula, MT:

Intergovernment Panel on Climate Change (IPCC). (2007). *Climate change: 2007 synthesis report*. Retrieved from Geneva, Switzerland:

Intergovernment Panel on Climate Change. (2007). Climate change: Impacts, adaptation and vulnerability. In M. L. Parry, O. F. Canziani, & J. P. Palutikof (Eds.), *Contribution of working group ii to the fourth assessment report of the intergovernmental panel on climate change (ipcc)* (pp. 976). Cambridge, U.K.; New York: Cambridge University Press.

Isaak, D. J., Young, M. K., Nagel, D. E., Horan, D. L., & Groce, M. C. (2015). The cold-water climate shield: Delineating refugia for preserving salmonid fishes through the 21st century. *Global Change Biology, 21*(7), 2540-2553. doi:http://dx.doi.org/10.1111/gcb.12879

Isaak, D., M. Young, D. Nagel, D. Horan, M. Groce, and S. Parkes. 2017. Climate Shield bull trout and cutthroat trout population occurrence scenarios for the western U.S. Rocky Mountain Research Station, U.S. Forest Service Data Archive, Fort Collins, CO. DOI: pending.

Jacobs, J. (2007). Invasive plant management: Options and actions *Invasive plant management: Cipm online textbook*. Bozeman, MT: Natural Resources Conservation Service,.

Jenkins, M. J., Hebertson, E., Page, W., & Jorgensen, A. (2008). Bark beetles, fuels, fires and implications for forest management in the intermountain west. *Forest Ecology and Management, 254*, 16-34.

Johnson, E. A., Miyanishi, K., & Weir, J. M. H. (1995). Old-growth, disturbance, and ecosystem management. *Canadian Journal of Botany, 73*, 918-926.

Jones, W.M. 2003. Kootenai National Forest peatlands: description and effects of forest management. Report to the Kootenai National Forest, Montana. Montana Natural Heritage Program, Helena. 14 pp. plus appendices.

Karr, J. R., & Chu, E. W. (1999). *Restoring life in running waters: Better biological monitoring* (rev. ed.). Washington, DC: Island Press.

Kartesz, J.T. (1999). A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. In: Synthesis of the North American Flora. Version 1.0 (eds Kartesz, J.T. & Meacham, C.A.). North Carolina Botanical Garden, Chapel Hill, NC

Kashian, D. M., Romme, W. H., Tinker, D. B., Turner, M. G., & G., R. M. (2006). Carbon storage on landscapes with stand-replacing fires. *BioScience, 56*(7), 598-606. doi:http://dx.doi.org/10.1641/0006-3568%282006%2956%5B598%3ACSOLWS%5D2.0.CO%3B2

Kaye, Margot W.; Dan Binkley, and Thomas J. Stohlgren. 2005. Effects of conifers and elk browsing on quaking aspen forests in the central Rocky Mountains, USA. Ecological Applications, 15(4), 2005, pp. 1284-1295.

Keane, R. E., Tomback, D. F., aubrey, C. A., Bower, A. D., Campbell, E. M., Cripps, C. L., Smith, C. M. (2012). *A range-wide restoration strategy for whitebark pine (pinus albicaulis)*. Retrieved from Fort Collins, CO: https://www.treesearch.fs.fed.us/pubs/40884

Kegley, S., & Sturdevant, N. J. (2006). *Spruce budworm defoliation and mortality on flesher pass-june 2006* (Trip Report TR-01-10).

Kendall, K. C., Jeffrey, B. S., Boulanger, J., Macleod, A. C., Paetkau, D., & White, G. C. (2009). Demography and genetic structure of a recovering grizzly bear population. *Journal of Wildlife Management, 73*(1), 3-17. doi:http://dx.doi.org/10.2193/2008-330

Kershner, J. L., Bischoff, C. M., & Horan, D. L. (1997). Population, habitat, and genetic characteristics of colorado river cutthroat trout in wilderness and nonwilderness stream sections in the uinta mountains of utah and wyoming. *North American Journal of Fisheries Management, 17*(4), 1134-1143. doi:http://dx.doi.org/10.1577/1548-8675(1997)017<1134:PHAGCO>2.3.CO;2

Kessler, J., Bradley, C., Rhodes, J., & Wood, J. (2001). *Imperiled western trout and the importance of roadless areas: A report by the western native trout campaign*. Retrieved from Tucson, AZ:

Kitzberger, T., P.M. Brown, E.K. Heyerdahl, T.W. Swetnam, T.T. Veblen. 2007. “Contingent Pacific-Atlantic Ocean influence on multicentury wildfire synchrony over western North America.” PNAS 104(2): 543- 548.

Kline, J. D., & Mazzotta, M. J. (2012). *Evaluating tradeoffs among ecosystem services in the management of public lands* (General Technical Report PNW-865). Retrieved from Portland, OR: https://www.fs.fed.us/pnw/pubs/pnw_gtr865.pdf

Klock, G. O. (1975). Lmpact of five postfire salvage logging systems on soils and vegetation. *Journal of Soil and Water Conservation, March-April*, 78-91.

Knight, G. C. (1989). *Overview: Ecological and cultural prehistory of the helena and deerlodge national forests montana*.

Kobziar, L., Moghaddas, J., & Stephens, S. L. (2006). Tree mortality patterns following prescribed fires in a mixed conifer forest. *Canadian Journal of Forest Research, 36*(12), 3222-3238. doi:http://dx.doi.org/10.1139/x06-183

Kolb, T. E., Agee, J. K., Fule, P. Z., McDowell, N. G., Pearson, K., Sala, A., & Waring, R. H. (2007). Perpetuating old ponderosa pine. *Forest Ecology and Management, 249*(3), 141-157. doi:http://dx.doi.org/10.1016/j.foreco.2007.06.002

Kolb, T. E., Holmberg, K. M., Wager, M. R., & Stone, J. E. (1998). Regulation of ponderosa pine foliar physiology and insect resistance mechanisms by basal area treatments. *Tree Physiology, 18*, 375-381.

Kosterman, M. K. (2014). *Correlates of canada lynx reproductive success in northwestern montana.* (Master's thesis), University of Montana, Missoula, Montana. Retrieved from http://scholarworks.umt.edu/cgi/viewcontent.cgi?article=5406&context=etd

Krankina, O. N., & Harmon, M. (2006). Forest management strategies for carbon storage *Forests, carbon and climate change: A synthesis of science findings* (pp. 79): Oregon Forest Resources Institute.

Krupp, Fred. (2015). Statement on Paris Agreement from Environmental Defense Fund President Fred Krupp. Environmental Defense Fund. Retrieved from https://www.edf.org/media/statement-paris-agreement-environmental-defense-fund-president-fred-krupp.

Kujala, Q. Montana Fish, Wildlife and Parks, pers. commun 21 August 2017, and J. Gude, Montana Fish, Wildlife and Parks, pers. commun. 21 August 2017).

Kurz, W. A., Dymond, C. C., Stinson, G., Rampley, G. J., Neilson, E. T., Carroll, A. L., . . . Safranyik, L. (2008). Mountain pine beetle and forest carbon feedback to climate change. *Nature, 452*, 987-990. doi:http://dx.doi.org/10.1038/nature06777

Kurz, W. A., Stinson, G., & Rampley, G. J. (2008). Could increased boreal forest ecosystem productivity offset carbon losses from increased disturbances? *Philosophical Transactions of the Royal Society B-Biological Sciences, 363*(1501), 2261-2269. doi:http://dx.doi.org/10.1098/rstb.2007.2198

Kurz, W. A., Stinson, G., Rampley, G. J., Dymond, C. C., & Neilson, E. T. (2008). Risk of natural disturbances makes future contribution of canada's forests to the global carbon cycle highly uncertain. *Proceedings of the National Academy of Sciences, 105*(5), 1551-1555. doi:http://dx.doi.org/10.1073/pnas.0708133105

Lackey, R. T. (2001). Values, policy, and ecosystem health. *BioScience, 51*(6), 437-443. doi:http://dx.doi.org/10.1641/0006-3568(2001)051[0437:Vpaeh]2.0.Co;2

Lake, P. S. (2000). Disturbance, patchiness, and diversity in streams. *Journal of the North American Benthological Society, 19*(4), 573-592. doi:http://dx.doi.org/10.2307/1468118

Lamb, C.T., G. Mowat, A. Reid, L. Smit, M. Proctor, B.N. McLellan, A.E. Nielsen, S. Boutin. 2018. Effects of habitat quality and access management on the density of a recovering grizzly bear population. Journal of Applied Ecology 2018, 1-12.

Laughlin, Daniel C., Jonathan D. Bakker, Michael T. Stoddard, Mark L. Daniels, Judith D. Springer, Cara N. Gildar, Aaron M. Green, and W. Wallace Covington. 2004. Toward reference conditions: wildfire effects on flora in an old-growth ponderosa pine forest. Forest Ecology and Management 199 (2004) 137-152.

Lee, D. C., Sedell, J. R., Rieman, B. E., Thurow, R. F., Williams, J. E., Burns, D., . . . Van Eimeren, P. (1997). *Chapter 4: Broadscale assessment of aquatic species and habitats* (General Technical Report PNW-GTR-405). Retrieved from Portland, OR:

Leege, T. A. (1984). *Evaluating and managing summer elk habitat in northern idaho*. Retrieved from

Lehmkuhl, J. F., Kennedy, M., Ford, D. E., Singleton, P. H., Gaines, W. L., & Lind, R. L. (2007). Seeing the forest for the fuel: Integrating ecological values and fuels management. *Forest Ecology and Management, 246*(1), 73-80. doi:http://dx.doi.org/10.1016/j.foreco.2007.03.071

Leptich, D. J., & Zager, P. (1991). Road access management effects on elk mortality and population dynamics. In A. G. Christensen, L. J. Lyon, & T. N. Lonner (Eds.), *Proceedings of elk* *vulnerability: A symposium* (pp. 330). Bozeman, MT: Montana Department of Fish, Wildlife and Parks and Montana Chapter of The Wildlife Society.

Lewis and Clark County. 2011. “Lewis and Clark County outdoor air quality regulations”. Accessed December 9, 2014, <http://www.lccountymt.gov/fileadmin/user_upload/Health/Environmental/Air_Quality/Documents/Air_ Quality-final_draft-for-BER.pdf

Lindh, B. C., & Muir, P. S. (2004). Understory vegetation in young douglas-fir forests: Does thinning help restore old-growth composition? *Forest Ecology and Management*, *192*(2-3), 258-296. doi:http://dx.doi.org/10.1016/j.foreco.2004.01.018

Linkhart, B. D., & McCallum, D. A. (2013). Flammulated owl (*psiloscops flammeolus*). *The Birds of North America.* Retrieved from https://birdsna.org/Species-Account/bna/species/flaowl

Litschert, S. E., & MacDonald, L. H. (2009). Frequency and characteristics of sediment delivery pathways from forest harvest units to streams. *Forest Ecology and Management, 259*(2), 143-150. doi:http://dx.doi.org/10.1016/j.foreco.2009.09.038

Lyon, J. L., & Canfield, J. E. (1991). *Habitat selections by rocky mountain elk under hunting season stress.* Paper presented at the Elk Vulnerability Symposium, Montana State University, Bozeman, MT.

Lyon, J. L., & Christensen. (1992). *A partial glossary of elk management terms* (INT-288).

Lyon, J. L., & Christensen, A. G. (2002). Elk and land management. In D. E. Toweill & J. W. Thomas (Eds.), *North american elk: Ecology and management* (pp. 557-575). Washington, DC: Smithsonian Institution Scholarly Press.

Lyon, L. J. (1977). *Attrition of lodgepole pine snags on the sleeping child burn, montana* (USDA Forest Service Research Note INT-219). Retrieved from Ogden, UT:

Lyon, L. J. (1979). Habitat effectiveness for elk as influenced by roads and cover. *Journal of Forestry, 77*(10), 658-660.

Lyon, L. J., Lonner, T. N., Weigand, J. P., Marcum, C. L., Edge, W. D., Jones, J. D., Hicks, L. L. (1985). *Coordinating elk and timber management: Final report of the montana cooperative elk-logging study 1970-1985*. Retrieved from Bozeman, MT:

Mace, R. D., & Roberts, L. J. (2012). *Northern continental divide ecosystem grizzly bear monitoring team annual report, 2011*. Retrieved from Kalispell, MT:

Mace, R. D., Waller, J. S., Manley, T. L., Lyon, L. J., & Zuuring, H. (1996). Relationships among grizzly bears, roads and habitat in the swan mountains, montana. *Journal of Applied Ecology, 33*(6), 1395-1404. doi:http://dx.doi.org/10.2307/2404779

Marlon, J. R., Bartlein, P. J., Gavin, D. G., Long, C. J., Anderson, R. S., Briles, C. E., . . . Walsh, M. K. (2012). Long-term perspective on wildfires in the western USA. *Proceedings of the National Academy of Sciences, 109*(9), E535-543. doi:http://dx.doi.org/10.1073/pnas.1112839109

Marten, Leanne M. (2016, 6 September). Clarification on Lynx Habitat Mapping in R1.

Martinez, P. J., Bigelow, P. E., Deleray, M. A., Fredenberg, W. A., Hansen, B. S., Horner, N. J., Viola, A. E. (2009). Western lake trout woes. *Fisheries, 34*(9), 424-442. doi:http://dx.doi.org/10.1577/1548-8446-34.9.424

McCaffrey, Sarah M and Christine S. Olsen. (2012). Research perspectives on the public and fire management: a synthesis of current social science on eight essential questions. Gen. Tech. Rep. NRS-104. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 40 p.

McCallum, D. A. (1994). *Flammulated owl*. Retrieved from Philadelphia and Washington, DC:

McClernan, H.G. 1983. Metallic Mineral Deposits of Lewis and Clark County, Montana, Montana Bureau of Mines and Geology Memoir 52.

McGowan-Stinski (2001)Tu, Mandy; Hurd, Callie; Randall, John M.; and The Nature Conservancy, "Weed Control Methods Handbook: Tools & Techniques for Use in Natural Areas" (2001). All U.S. Government Documents (Utah Regional Depository). Paper 533. http://digitalcommons.usu.edu/govdocs/533

Mckenzie, D., Peterson, D. L., & Littell, J. J. (2009). Global warming and stress complexes in forests of western north america. In A. Bytnerowicz, M. Arbaugh, C. Andersen, & A. Riebau (Eds.), *Wildland fires and air pollution* (Vol. 8, pp. 319-338). Amsterdam, The Netherlands: Elsevier.

McKinley, D. C., Ryan, M. G., Birdsey, R. A., Giardina, C. P., Harmon, M. E., Heath, L. S., Skog, K. E. (2011). A synthesis of current knowledge on forests and carbon storage in the united states. *Ecological Applications*, *21*(6), 1902-1924. doi:http://dx.doi.org/10.1890/10-0697.1

McLellan, B. N. (2015). Some mechanisms underlying variation in vital rates of grizzly bears on a multiple use landscape. *Journal of Wildlife Management, 79*(5), 749-765. doi:http://dx.doi.org/10.1002/jwmg.896

McNab, W. Henry and Peter E. Avers 1994. Ecological Subregions of the United States. WO-WSA-5.

Means, R. E. (2011). Synthesis of lower treeline limber pine (pinus flexilis) woodland knowledge, research needs, and management considerations. In R. E. Keane, D. F. Tomback, M. P. Murray, & C. M. Smith (Eds.), *The future of high-elevation, five-needle white pines in western north america: Proceedings of the high five symposium*. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

Metesh, J, J. Lonn, R. Marvin, P. Hargrave, and J. Madison. 1998. Abandoned-Inactive Mines, Helena National Forest, Volume I – Upper Missouri River Drainage, Montana Bureau of Mines and Geology, Open-File Report/MBMG 352, 189 p.

Management and Engineering Technologies International (METI) (2010). USDA Forest Service Protocols for Delineation of Economic Impact Analysis Areas

Metlen, K. L., & Fiedler, C. E. (2006). Restoration treatment effects on the understory of ponderosa pine/douglas-fir forests in western montana, USA. *Forest Ecology and Management, 222*(1–3), 355-369. doi:http://dx.doi.org/10.1016/j.foreco.2005.10.037

Meyerson, L. A., & Mooney, H. A. (2007). Invasive alien species in an era of globalization. *Frontiers in Ecology and the Environment, 5*(4), 199-208.

Montana Fish, Wildlife, and Parks. 2005, Montana Statewide Elk Management Plan

Montana Fish, Wildlife, and Parks. 2015 Elk Refuge Areas and Their Impacts http://fwp.mt.gov/fishAndWildlife/management/elk/

Montana Fish, Wildlife, and Parks. (2016). *Incidental lynx take 2000-2015--montana*.

Millar, C. I., & Stephenson, N. L. (2015). Temperate forest health in an era of emerging megadisturbance. *Science, 349,* 823-826.

Millar, C. I., Stephenson, N. L., & Stephens, S. L. (2007). Climate change and forests of the future: Managing in the face of uncertainty. *Ecological Applications, 17*(8), 2145-2151. doi:http://dx.doi.org/10.1890/06-1715.1

Mitchell, R. G., & Preisler, H. K. (1998). Fall rate of lodgepole pine killed by the mountain pine beetle in central oregon. *Western Journal of Applied Forestry, 13*(1), 23-26.

Montana Department of Environmental Quality, State Lands, Abandoned Mine Reclamation Bureau 1995. Abandoned Hard Rock Mine Priority Sites, Summary Report.

Montana Department of Environmental Quality. (1998). Montana water quality 1998. Retrieved from http://deq.mt.gov/Portals/112/Water/WQpb/CWAIC/Reports/IRs/1998/1998_305b.pdf

Montana Department of Environmental Quality. 2010. Montana/Idaho Airshed Group. Operating guide. Montana/Idaho Airshed Group, Smoke Management Program, accessed November 19, 2014, <http://www.smokemu.org/docs/2010%20Operations%20Guide.pdf>

Montana Department of Environmental Quality. (2014). Montana 2014 final water quality integrated report. Retrieved from Helena, MT: http://deq.mt.gov/Portals/112/Water/wqpb/cwaic/Reports/IRs/2014/2014FinalIR.pdf

Montana Department of Environmental Quality. 2014b. Marysville Geothermal Site website, http://deq.mt.gov/Energy/EnergizeMT/Geothermal/Sites/marysville

Montana Department of Environmental Quality. (2016). Draft 2016 water quality integrated report. Retrieved from http://deq.mt.gov/Water/WQPB/cwaic/reports

Montana Department of Environmental Quality. 2017. State of Montana, Regional Haze 5 Year Progress Report. 2017. Montana Department of Environmental Quality.

Montana Department of Fish, Wildlife and Parks. (1978). *1978 montana statewide comprehensive outdoor recreation plan (scorp)*. Retrieved from Helena, MT:

Montana Department of Fish, Wildilfe, and Parks. (2004). Montana statewide elk management plan 2004. Retrieved from Helena, MT: http://fwp.mt.gov/fishAndWildlife/management/elk/managementPlan.html

Montana Department of Fish, Wildlife and Parks. (2005). *Elk survey data*.

Montana Department of Fish, Wildlife and Parks (MFWP) 2007. Memorandum of understanding and conservation agreement for westslope cutthroat trout and Yellowstone Cutthroat trout in Montana. Helena, Montana.

Montana Department of Fish, Wildlife and Parks. (2013). *U.S. Forest service and montana department of fish wildlife and parks collaborative overview and recommendations for elk habitat management on the custer, gallatin, helena, and lewis and clark national forests*.

Montana Department of Fish, WIldlife, and Parks. (2014) Northcentral Montana Westslope Cutthroat Trout Restoration Update. Montana Fish Wildlife and Parks. Great Falls, Montana. 16 pages.

Montana Department of Fish, Wildlife and Parks. 2017. Montana Statewide Elk Management Population Status Charts and Maps. http://fwp.mt.gov/fishAndWildlife/management/elk/default.html#elkPopulationDistribution. Accessed August 1, 2017.

Montana Department of Natural Resources and Conservation. (1999). Best management practices for grazing.

Montana Department of Natural Resources and Conservation. (2006). Montana guide to streamside management zone law and rules.

Montana Natural Heritage Program, Montana Fish, Wildlife, and Parks. Montana field guide. from Montana Natural Heritage Program and Montana Fish, Wildlife and Parks http://fieldguide.mt.gov/default.aspx

Montana Natural Heritage Program. (2014). Montana natural heritage program species of concern report. Retrieved from Helena, MT: http://mtnhp.org/SpeciesOfConcern/; http://fieldguide.mt.gov/statusCodes.aspx#soc

Montana Natural Heritage Program. field guide – cited for flam owls – citation not provided in specialist report.

Moody, J. A., & Martin, D. A. (2001a). Initial hydrologic and geomorphic response following a wildfire in the colorado front range. *Earth Surface Processes and Landforms, 26*(10), 1049-1070. doi:http://dx.doi.org/10.1002/esp.253

Moody, J. A., & Martin, D. A. (2001b). Post-fire, rainfall intensity-peak discharge relations for three mountainous watersheds in the western USA. *Hydrological Processes, 15*(15), 2981-2993. doi:http://dx.doi.org/10.1002/hyp.386

Morgan, T. A., & Baldridge, J. (2015). *Understanding costs and other impacts of litigation of forest service projects: A region one case study*. Retrieved from Missoula, MT:

Morgan, Todd A., Steven W. Hayes and Chelsea P. McIver. 2017. Forest Products: Market and Supply Challenges Continue. IN: 2017 Montana Economic Report, http://www.bber.umt.edu/pubs/Seminars/2017/EconRpt2017.pdf

Mosley, Jeffrey C.; Philip S. Cook; Amber J. Griffis, and Jay O'Laughlin. 1999. Guidelines for Managing Cattle Grazing in Riparian Areas to Protect Water Quality: Review of Research and Best Management Practices Policy. Idaho Forest, Wildlife and Range Policy Analysis Group. Report No. 15, December 1997. Internet Edition December 1999.

Mowat, G., Poole, K. G., & O'Donoghue, M. (2000). Ecology of lynx in northern canada and alaska. In L. F. Ruggiero, K. B. Aubry, S. W. Buskirk, G. M. Koehler, C. J. Krebs, K. S. McKelvey, & J. R.

Squires (Eds.), *Ecology and conservation of lynx in the united states* (pp. 265-306). Boulder, CO: University Press of Colorado.

Muhlfeld, C. C., Kalinowski, S. T., McMahon, T. E., Taper, M. L., Painter, S., Leary, R. F., & Allendorf, F. W. (2009). Hybridization rapidly reduces fitness of a native trout in the wild. Biology Letters, 5(3), 328-331. doi:http://dx.doi.org/10.1098/rsbl.2009.0033

Muhlfeld, C. C., Kovach, R. P., Jones, L. A., Al-Chokhachy, R., Boyer, M. C., Leary, R. F., Allendorf, F. W. (2014). Invasive hybridization in a threatened species is accelerated by climate change. *Nature Climate Change*, *4*(7), 620-624. doi:http://dx.doi.org/10.1038/nclimate2252

Murphy, D. D., and S. B. Weiss. 1992. Effects of climate change on biological diversity in Western North America: Species losses and mechanisms. Chapter 26 in Global Warming and biological diversity, ed. R. L. Peters and T. E. Lovejoy. Castleton, New York: Hamilton Printing.

Nelson, L., P. Clancey, T. Horton, T. Humphrey, T. Lohrenz, D. Moser, J. Olsen, D. Oswald, E. Roberts, B. Shepard, R. Spoon, M. Vaughn, S. Barndt, J. Brammer, L. Burns, D. Downing, A. Harper, S. Kujala, C. Riley, B. Roberts, C. Sestrich, L. Walch, D. Watschke, P. Hutchinson, S. Franklin and S. LaMarr, T. Koel and M. Ruhl. 2011. Draft Status and Conservation Needs for Westslope Cutthroat Trout in Southwest Montana. Montana Fish, Wildlife & Parks, Beaverhead – Deerlodge, Helena and Gallatin National Forests, Bureau of Land Management, Dillon and Butte Field Offices, Yellowstone National Park

Nelson, L., Clancy, P., Horton, T., Humphrey, T., Lohrenz, T., Moser, D., Vaughn, M. (2011). *Status and conservation needs for westslope cutthroat trout in southwest montana*.

Nelson, M. D., Johnson, D. H., Linkhart, B. D., & Miles, P. D. (2009). *Flammulated owl (otus flammeolus) breeding habitat abundance in ponderosa pine forests of the united states.* Paper presented at the Fourth International Partners in Flight Conference: Tundra to Tropics, McAllen, Texas.

North, M. P., & Hurteau, M. D. (2011). High-severity wildfire effects on carbon stocks and emissions in fuel treted and untreated forest. *Forest Ecology and Management*, *261*, 1115-1120. doi:http://dx.doi.org/10.1016/j.foreco.2010.12.039

Noss, R. F., Franklin, J. F., Baker, W., Schoennagel, T., & Moyle, P. B. (2006). *Ecological science relevant to management poilicies for fire-prone forests of the western united states*. Retrieved from Arlington, VA:

O'Brien, Renee A., Curtis M. Johnson, Andrea M. Wilson, and Van C. Elsbernd. 2003. Indicators of Rangeland Health and Functionality in the Intermountain West. USDA Forest Service, Rocky Mountain Research Station. General Technical Report RMRS-GTR-104. June 2003.

Pan, Y. (2011). A large and persistent carbon sink in the world's forests. *Science, 333*, 988-993.

Pardee, J. T., & Schrader, F. C. (1933). *Metalliferous deposits of the greater helena mining region montana*.

Parks, C. G., Radosevich, S. E., Endress, B. A., Naylor, B. J., Anzinger, D., Rew, L. J., . . . Dwire, K. A. (2005). Natural and land-use history of the northwest mountain ecoregions (USA) in relation to patterns of plant invasions. *Perspectives in Plant Ecology, Evolution and Systematics, 7*, 137-158.

Parks Sean A., Miller Carol, Holsinger Lisa M., Baggett L. Scott, Bird Benjamin J. (2016) Wildland fire limits subsequent fire occurrence. International Journal of Wildland Fire 25, 182-190. https://doi.org/10.1071/WF15107

Pauchard, A., Kueffer, C., Dietz, H., Daehler, C. C., Alexander, J., Edwards, P. J., Seipel, T. (2009). Ain't no mountain high enough: Plant invasions reaching new elevations. *Frontiers in Ecology and the Environment, 7*(9), 479-486. doi:http://dx.doi.org/10.1890/080072

Peck, C. P., F. T. van Manen, C. M. Costello, M. A. Haroldson, L. A. Landenburger, L. L. Roberts, D. D. Bjornlie, and R. D. Mace. 2017. Potential paths for male-mediated gene flow to and from an isolated grizzly bear population. Ecosphere 8(10):e01969. 10.1002/ecs2.1969.

Pederson, G. T., Graumlich, L. J., Fagre, D. B., Kipfer, T., & Muhlfeld, C. C. (2010). A century of climate and ecosystem change in western montana: What do temperature trends portend? *Climatic Change*, *98*(1-2), 133-154. doi:http://dx.doi.org/10.1007/s10584-009-9642-y

Pellant, M., Abbey, B., & Karl, S. (2004). Restoring the great basin desert, u.S.A.: Integrating science, management, and people. *Environmental Monitoring and Assessment, 99*, 169-179.

Pellant, M., P. Shaver, D.A. Pyke, and J.E. Herrick. 2005. Interpreting indicators of rangeland health, version 4. Technical Reference 1734-6. U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center, Denver, CO. BLM/WO/ST-00/001+1734/REV05. 122 pp.

Perry, C. and R. Overly. 1976. Impact of roads on big game distribution in portions of the Blue Mountains. P. 62-68 in Proc. Elk-Logging-Roads Symp., Univ. Idaho.

Peterson, D. L., Agee, J. K., Aplet, G. H., Dykstra, D. P., Graham, R. T., Lehmkuhl, J. F., . . . Stuart, J. D. (2009). *Effects of timber harvest following wildfire in western north america* (General Technical Report PNW-GTR-776). Retrieved from Portland, OR:

Pfankuch, D. J. (1975). *Stream reach inventory and channel stability evaluation: A watershed management procedure* (R1-75-002). Retrieved from St. Paul, MN:

Pickett, S.T.A. and White, P.S. (1985). Patch Dynamics: a synthesis. The ecology of natural disturbance and patch dynamics, pp. 371-384.

Pierce, R., & Podner, C. (2006). *The big blackfoot river fisheries restoration report for 2004 and 2005*. Retrieved from Missoula:

Platt, W. S. (1991). Livestock grazing. In W. R. Meehan (Ed.), *Influences of forest and rangeland management on salmonid fishes and their habitats* (pp. 389-423). Bethesda, MD: American Fisheries Society.

Poff, B., Koestner, K. A., Neary, D. G., & Henderson, V. (2011). Threats to riparian ecosystems in western north america: An analysis of existing literature. *Journal of the American Water Resources Association, 47*(6), 1241-1254. doi:http://dx.doi.org/10.1111/j.1752-1688.2011.00571.x

Polfus, J. (2011). *Literature review and synthesis on the effects of residential development on ungulate winter range in the rocky mountain west*. Retrieved from Helena, MT:

Pollet, J., & Omi, P. N. (2002). Effect of thinning and prescribed burning on crown fire severity in ponderosa pine forests. *International Journal of Wildland Fire, 11*, 1-10.

Potyondy, J. P., & Geier, T. W. (2011). *Watershed condition classification technical guide*. Retrieved from https://www.fs.fed.us/biology/resources/pubs/watershed/maps/watershed_classification_guide2011FS978.pdf

Pregitzer, K. S., & Euskirchen, E. S. (2004). Carbon cycling and storage in world forests: Biome patterns related to forest age. *Global Change Biology, 10*(10), 2052–2077.

Preisler, H. K., Ager, A. A., & Wisdom, M. J. (2006). Statistical methods for analysing responses of wildlife to human disturbance. *Journal of Applied Ecology, 43*, 164-172. doi:http://dx.doi.org/10.1111/j.1365-2664.2005.01123.x

Proffitt, K. M., Gude, J. A., Hamlin, K. L., & Messer, M. A. (2013). Effects of hunter access and habitat security on elk habitat selection in landscapes with a public and private land matrix. *Journal of Wildlife Management, 77*(3), 514-524. doi:http://dx.doi.org/10.1002/jwmg.491

Proffitt, K. M., Hebblewhite, M., Peters, W., Hupp, N., & Shamhart, J. (2016). Linking landscape-scale differences in forage to ungulate nutritional ecology. *Ecological Applications, 26*(7), 2156-2174. doi:http://dx.doi.org/10.1002/eap.1370

Randall, C., & Bush, R. (2010). *R1 forest insect hazard rating system user guide for use with inventory data stored in fsveg and/or analyzed with the forest vegetation simulator* (Report 10-05).

Ranglack, D., Garrott, B., Rotella, J., Proffitt, K., Gude, J., & Canfield, J. (2014). *Evaluating elk summer resource selection and applications to summer range habitat management*.

Ranglack, D.H., K.M. Proffitt, J.E. Canfield, J.A. Gude, J. Rotella, and R.A. Garrott. 2017. Security Areas for Elk During Archery and Rifle Hunting Seasons. 81: 778–791. doi:10.1002/jwmg.21258

Rasch, Rebecca and Beth Hahn. (2018). A Spatial Demographic Approach to Wilderness Management. International Journal of Wilderness (Forthcoming).

Reeves, G. H., Benda, L. E., Burnett, K. M., Bisson, P. A., & Sedell, J. R. (1995). *A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of evolutionarily significant units of anadromous salmonids in the pacific northwest.* Paper presented at the American Fisheries Society Symposium.

Regier, H. A. (1993). The notion of natural and cultural integrity. In S. Woodley, J. Kay, & G. Francis (Eds.), *Ecological integrity and the management of ecosystems* (pp. 3-18). Delray Beach, FL: St. Lucie Press.

Reinhardt, E., & Holsinger, L. (2010). Effects of fuel treatments on carbon-disturbance relationships in forests of the northern rocky mountains. *Forest Ecology and Management, 259*(8), 1427-1435. doi:http://dx.doi.org/10.1016/j.foreco.2010.01.015

Reinhardt, E. D., Keane, R. E., Calkin, D. E., & Cohen, J. D. (2008). Objectives and considerations for wildland fuel treatment in forested ecosystems of the interior western united states. *Forest and Ecology Management, 256*(12), 1997-2006. doi:http://dx.doi.org/10.1016/j.foreco.2008.09.016

Rhodes, J., McCullough, D. A., & Espinosa, F. A., Jr. (1994). *A course screening process for evaluation of the effects of land management activities on salmon spawning and rearing habitat in esa consultations* (Technical Report 94-4). Retrieved from Portland, OR:

Rieman, B. E., Isaak, D., Adams, S., Horan, D., Nagel, D., Luce, C., & Myers, D. (2007). Anticipated climate warming effects on bull trout habitats and populations across the interior columbia river basin. *Transactions of the American Fisheries Society, 136*, 1552-1565. doi:http://dx.doi.org/10.1577/T07-028.1

Rimbey, N., & Torell, L. A. (2011). *Grazing costs: What's the current situation?* Retrieved from Moscow, ID: https://www.google.com/#q=rimbey+torell+2011+grazing+costs

Ritchie, M. W., Wing, B. M., & Hamilton, T. A. (2008). Stability of the large tree component in treated and untreated late-seral interior ponderosa pine stands. *Canadian Journal of Forest Research, 38*(5), 919-923. doi:http://dx.doi.org/10.1139/X07-242

Robichaud, P. R., Beyers, J. L., & Neary, D. G. (2000). *Evaluating the effectiveness of postfire rehabilitation treatments*. Retrieved from Fort Collins, CO: https://www.fs.fed.us/psw/publications/robichaud/psw_2000_robichaud000.pdf

Ruby, Mark, "Evaluation of grizzly bear (ursus arctos) movement and habitat use in relationship to human development in the Swan-Clearwater Valleys, Montana" (2014). Graduate Student Theses, Dissertations, & Professional Papers. 4344. https://scholarworks.umt.edu/etd/4344.

Ruddell, S., Walsh, M. J., & Kanakasabai, M. (2006). *Forest carbon trading and marketing in the united states*.

Ruediger, B., Claar, J., Gniadek, S., Holt, B., Lewis, L., Mighton, S., . . . Williamson, A. (2000). Lynx geographic areas: Descriptions and risk factors *Canada lynx conservation assessment and strategy (r1-00-53*. Missoula, MT: U.S. Department of Agriculture, Forest Service and U.S. Department of Interior Fish and Wildlife Service, Bureau of Land Management, and National Park Service.

Russell, R. E., Saab, V. A., Dudley, J. G., & Rotella, J. J. (2006). Snag longevity in relation to wildfire and postfire salvage logging. *Forest Ecology and Management, 232*(1–3), 179-187. doi:http://dx.doi.org/10.1016/j.foreco.2006.05.068

Ryan, M. G., Harmon, M. E., Birdsey, R. A., Giardina, C. P., Heath, L. S., Houghton, R. A., . . . Skog, K. E. (2010). A synthesis of the science on forests and carbon for u.S. Forests. *Issues in Ecology, 13*, 1-16.

Saab, V., & Dudley, J. G. (1998). *Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/douglas-fir forests of southwestern idaho* (RMRS-RP-11). Retrieved from Ogden, UT:

Salwasser, H. (2009). Regional conservation of old-growth forest in a changing world: A global and temporal perspective. In T. A. Spies & S. L. Duncan (Eds.), *Old growth in a new world: A pacific northwest icon reexamined* (pp. 222-232). Washington, DC: Island Press.

Samson, F. B. (2006). *Habitat estimates for maintaining viable populations of the northern goshawk, black-backed woodpecker, flammulated owl, pileated woodpecker, american marten, and fisher*.

Schaedel, M. S., Larson, A. J., Affleck, D. L. R., Belote, R. T., Goodburn, J. M., & Page-Dumroese, D. S. (2017). Early forest thinning changes aboveground carbon distribution among pools, but not total amount. *Forest Ecology and Management, 389*, 187-198. doi:http://dx.doi.org/10.1016/j.foreco.2016.12.018

Scott, G., Mahalovich, M. F., Rinehart, S., & Krueger, J. (2013). *Reforestation-revegetation climate change primer: Incorporating climate change impacts into reforestation and revegetation prescriptions*. Retrieved from Missoula, MT: http://fsweb.r1.fs.fed.us/forest/silv/RefRevegPrimer06252013_web.pdf

Servheen, C., Waller, J. S., & Sandstrom, P. (2001). *Identification and management of linkage zones for grizzly bears between the large blocks of public land in the northern rocky mountains*. Retrieved from Missoula, MT:

Shepard, B. B., May, B. E., & Urie, W. (2005). Status and conservation of westslope cutthroat trout within the western united states. *North American Journal of Fisheries Management, 25*(4), 1426-1440. doi:http://dx.doi.org/10.1577/m05-004.1

Shepperd, W. D. (1990). *Initial growth, development, and clonal dynamics of regenerated aspen in the rocky mountains* (Research Paper RM-312). Retrieved from Fort Collins, CO:

Shepperd, W. D., Bartos, D. L., & Mata, S. A. (2001). Above- and below-ground effects of aspen clonal regeneration and succession to conifers. *Canadian Journal of Forest Research, 31*(5), 739-745. doi:http://dx.doi.org/10.1139/x01-001

Skovlin, J. M., Zager, p., & Johnson, B. K. (2002). Elk habitat selection and evaluation. In D. E. Toweill & J. W. Thomas (Eds.), *North american elk: Ecology and management* (pp. 531-555). Washington, DC: Smithsonian Institution Scholarly Press.

Smith, H. Y., & Arno, S. F. (1999). *Eighty-eight years of chance in a managed ponderosa pine forest* (RMRS-GTR-23).

Spies, T. A., Hemstrom, M. A., Youngblood, A., & Hummel, S. (2006). Conserving old-growth forest diversity in disturbance-prone landscapes. *Conservation Biology, 20*(2), 351-362. doi:http://dx.doi.org/10.1111/j.1523-1739.2006.00389.x

Spracklen, D.V., L.J. Mickley, J.A. Logan, R.C. Hudman, R. Yevich, M.D. Flannigan, A.L. Westerling. 2009. “Impacts of climate change from 2000 to 2050 on wildfire activity and carbonaceous aerosol concentrations in the western United States.” Journal of Geophysical Research 114: D203

Spreitzer, P. N. (1985). Transitory range: A new frontier. *Rangelands, 7*(1), 33-34.

Squires, J. R., Copeland, J. P., Schwartz, M. K., & Ruggiero, L. F. (2007). Sources and patterns of wolverine mortality in western montana. *Journal of Wildlife Management, 71*(7), 2213-2220. doi:http://dx.doi.org/10.2193/2007-053

Squires, J. R., Decesare, N. J., Kolbe, J. A., & Ruggiero, L. F. (2010). Seasonal resource selection of canada lynx in managed forests of the northern rocky mountains. *The Journal of Wildlife Management, 74*(8), 1648-1660. doi:http://dx.doi.org/10.2193/2009-184

Squires, J. R., Olson, L. E., Turner, D. L., DeCesare, N. J., & Kolbe, J. A. (2012). Estimating detection probability for canada lynx *lynx canadensis* using snow-track surveys in the northern rocky mountains, montana, USA. *Wildlife Biology, 18*, 215-224.

Steeger, C., & Quesnel, H. (2003). *Impacts of partial cutting on old-growth forests in the rocky mountain trench, british columbia*. Retrieved from Cranbrook, BC:

Steelman, T.A., and S. McCaffrey. 2013. “Best practices in risk and crisis communication: Implications for natural hazards management.” Natural Hazards 65 (1): 683-705.

Stephens, S. L. (1998). Evaluation of the effects of silvicultural and fuels treatments on potential fire behaviour in sierra nevada mixed-conifer forests. *Forest Ecology and Management, 105*(1-3), 21-35. doi:http://dx.doi.org/10.1016/S0378-1127(97)00293-4

Stephens, S. L., & Moghaddas, J. J. (2005). Fuel treatment effects on snags and coarse woody debris in a sierra nevada mixed conifer forest. *Forest Ecology and Management, 214*, 53-64.

Steventon, J. D., MacKenzie, K. L., & Mahon, T. E. (1998). Response of small mammals and birds to partial cutting and clearcutting in northwest British Columbia. *Forestry Chronicle, 74*(5), 703-713.

Stewart, K. M., Bowyer, R. T., Dick, B. L., Johnson, B. K., & Kie, J. G. (2005). Density-dependent effects on physical condition and reproduction in north american elk: An experimental test. *Oecologia*, *143*(1), 85-93. doi:http://dx.doi.org/10.1007/s00442-004-1785-y

Sugden, B. D., & Woods, S. W. (2007). Sediment production from forest roads in western montana. *Journal of the American Water Resources Association, 43*(1), 193-206. doi:10.1111/j.1752-1688.2007.00016.x

Swetnam, T. W., Allen, C. D., & Betancourt, J. L. (1999). Applied historical ecology: Using the past to manage for the future. *Ecological Applications, 9*(4), 1189-1206.

Taylor, K., Brummer, T., Taper, M. L., Wing, A., & Rew, L. J. (2012). Human-mediated long-distance dispersal: An empirical evaluation of seed dispersal by vehicles. *Diversity and Distributions, 18*(9), 942-951. doi:http://dx.doi.org/10.1111/j.1472-4642.2012.00926.x

Thomas, J. W. (1979). *Wildlife habitats in managed forests: The blue mountains of oregon and washington*. Washington, DC: USDA Forest Service.

Thompson, M. Baty R and L Marcum. (2005). Elk Use of Forage and Cover in response to wildfire and severe snow conditions. Missoula, MontanaThompson and others (2005)

Tomback, D. F., Arno, S. F., & Keane, R. E. (2001). The compelling case for management intervention. In D. F. Tomback, S. F. Arno, & R. E. Keane (Eds.), *Whitebark pine communities: Ecology and restoration* (pp. 3-25). Washington DC: Island Press.

Toney, J. Christopher; Peter M Rice; and Frank Forcella (1998). Exotic plant records in the Northwest United States 1950-1996: an ecological assessment. Northwest Science, Vol. 72, No. 3, 1998.

Turner, M. G., Donato, D. C., & Romme, W. H. (2012). Consequences of spatial heterogeneity for ecosystem services in changing forest landscapes: Priorities for future research. *Landscape Ecology*, *28*(6), 1081-1097. doi:http://dx.doi.org/10.1007/s10980-012-9741-4

Turner, M. G., Gardner, R. H., & O'Neill, R. V. (2001). *Landscape ecology in theory and practice: Pattern and process*. New York, NY: Springer Science+Business Media, Inc.

Tysdal, R.G., S. Ludington, and A.E. McCafferty. 1996. Mineral and Energy Resource Assessment of the Helena National Forest, West-Central Montana, U.S. Geological Survey Open File Report 96-683-A.

U.S. Department of Agriculture, Forest Service. (1981). *The northern regional plan*.

U.S. Department of Agriculture, Forest Service. 1981 b. Final Report on the Elkhorn Wilderness Study Area.

United States Department of Agriculture. United States Forest Service-Northern Region. (1981). Montana Cooperative Elk-Logging Study. Missoula, Montana

U.S. Department of Agriculture, Forest Service, Helena National Forest. (1986). Record of decision, environmental impact statement, and forest plan for the Helena National Forest.

U.S. Department of Agriculture, Forest Service, Northern Region. (1990). The management of lodgepole pine in region one. Committee report, september 1990. Retrieved from Missoula, MT:

U.S. Department of Agriculture, Forest Service. 1994. Lewis and Clark Noxious Weed Control FEIS and ROD

U.S. Department of Agriculture, Forest Service, Intermountain, Northern, and Pacific Northwest Regions. (1995). Decision notice and finding of no significant impact (M4-37). Retrieved from Couer D'Alene, ID:

U.S. Department of Agriculture, Forest Service. 1995. Noxious Weed Treatment Project Lewis and Clark National Forest. Record of Decision.

U.S. Department of Agriculture, Forest Service. 1996. Range Vegetation Classification for the Lewis and Clark National Forest.

U. S. Department of Agriculture, Forest Service. 1998. Record of Decision, Oil and Gas Leasing Helena and Elkhorns portion of the Deerlodge National Forest.

U.S. Department of Agriculture, Forest Service. 2000. Survivability and deterioration of fire-injured trees in the northern rocky mountains; a review of the literature. USDA Forest Service Northern Region Forest Health Protection Report 2000-13.

U.S. Department of Agriculture, Forest Service. (2001). Special areas; roadless area conservation. *Federal Register, 66*(9), 3244-3273.

U.S. Department of Agriculture, Forest Service. 2003b. An assessment of ecosystem components in the Upper Missouri River Basin.

U.S. Department of Agriculture, Forest Sevice. (2006). Record of Decision, Noxious Weed Treatment Project Helena National Forest. May 2006.

U.S. Department of Agriculture, Forest Service. (2006b). *Occupied mapped lynx habitat amendment to the canada lynx conservation agreement*.

U.S. Department of Agriculture, Forest Service. (2007a). *Northern rockies lynx management direction final environmental impact statement*. Retrieved from Missoula, MT:

U.S. Department of Agriculture, Forest Service. (2007b). *Northern rockies lynx management direction record of decision*.

U.S. Department of Agriculture, Forest Service (2007c). Technical Guide to Managing Ground Water Resources. Minerals and Geology Management, FS-881.

U.S. Department of Agriculture, Forest Service. (2007d). Biological Assessment (Revised) of the Northern Rockies Lynx Amendment on Threatened, Endangered and Proposed Vertebrate and Invertebrate Species (Revision of Biological Assessment dated Nov. 18, 2005). Missoula, Montana. United States Department of Agriculture.

U.S. Department of Agriculture, Forest Service. 2011a. Helena National Forest May 2011. Hazard Assessment for Developed Recreation Sites.

U.S. Department of Agriculture, Forest Service. 2011b. Lewis and Clark National Forest May 2011, Hazard Assessment for Developed Recreation Sites.

U.S. Department of Agriculture, Forest Service. 2011d. Lewis and Clark National Forest Evaluation and Compliance with National Forest Management Act Requirements to Provide for Viability and Diversity of Animal Communities. Northern Region, Lewis and Clark National Forest, unpublished report. 182 pp.

U.S. Department of Agriculture, Forest Service. 2011e. Helena National Forest May 2011. Hazard Assessment for Developed Recreation Sites.

U.S. Department of Agriculture, Forest Service. 2011f. Lewis and Clark National Forest May 2011, Hazard Assessment for Developed Recreation Sites.

U.S. Department of Agriculture, Forest Service. (2012). National forest system land management planning final rule and record of decision. *Federal Register, 77*(68), 21162-21276.

U.S. Department of Agriculture, Forest Service. (2013a). *Custer, gallatin, helena, and lewis and clark national forests. Framework for project-level effects analysis on elk*.

U.S. Department of Agriculture, Forest Service. (2013b). *National visitor use monitoring results: Usda forest service national summary report - data collected fy 2008 through fy 2012*. Retrieved from

U.S. Department of Agriculture, Forest Service. (2013c). *Ncde grizzly bear conservation strategy-draft*.

U.S. Department of Agriculture, Forest Service. 2015. Baseline Estimates of Carbon Stocks in Forests and Harvested Wood Products for National Forest System Units; Northern Region. 43 pp. Whitepaper. O:\OfficeOfTheChief\ClimateChange\Program\Carbon\CarbonAssessmentsNFS

U.S. Department of Agriculture, Forest Service, Northern Region. (2015b). Assessment of the helena and lewis & clark national forests. Retrieved from Helena, MT:

U.S. Department of Agriculture, Forest Service. 2016 - Regional Forester habitat clarification memo (lynx), Sept 6 2016

U.S. Department of Agriculture, Forest Service. 2016. National Visitor Use Monitoring Survey (NVUM). (Wilderness. USDA Forest Service. Retrieved from http://apps.fs.fed.us/nfs/nrm/nvum/results/A01002-A01003-A01005-A01008-A01018-A01010-A01011-A01012-A01004-A01014-A01015-A01016-A01017.aspx/FY2013.

U.S. Department of Agriculture, Forest Service. 2017a. National Visitor Use Monitoring Survey (NVUM). Helena National Forest and Lewis and Clark National Forest 2011-2015. USDA Forest Service. Retrieved from http://apps.fs.fed.us/nfs/nrm/nvum/results/A01012-A01015.aspx/FY2015.

U. S. Department of Agriculture, Forest Service. (2017b). Volume 3- Final Environmental Impact Statement for the Forest Plan Amendments: Incorporating Habitat Management Direction for the Northern Continental Divide Ecosystem Grizzly Bear Population. (Volume 3). Missoula, Montana. United States Department of Agriculture.

U. S. Department of Agriculture, Forest Service. (2017c). Draft Record of Decision for the Final Environmental Impact Statement and the Forest Plan Amendments to Incorporating Habitat Management Direction for the Northern Continental Divide Ecosystem Grizzly Bear Population. Missoula, Montana. United States Department of Agriculture.

U.S. Department of Agriculture, Forest Service. (2017d). Biological Assessment for Canada Lynx Designated Critical Habitat for Northern Rockies Lynx Management Decision. Missoula, Montana. United States Department of Agriculture.

U.S. Department of Agriculture, Forest Service. 2017e [Draft] – Assessment of Disturbance, Management Activities, and Environmental Factors on Carbon Stocks, Northern Region.

U.S. Department of Agriculture, Forest Service and Montana Department of Fish, Wildlife, and Parks. (2013). *Collaborative overview and recommendations for elk habitat management on the custer, gallatin, helena, and lewis and clark national forests*.

U.S. Department of Agriculture, Forest Service and U.S. Department of the Interior, Fish and Wildlife Service. (2005). *Canada lynx conservation agreement* (USFS Agreement #00-MU-11015600-013).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2017, USDA-NRCS Soil Survey of Lew and Clark National Forest. 2017. Unpublished.

U. S. Department of Agriculture, Office of Inspector General. (2011). Forest Service Administration of Special Use Program. (Audit Report 08601-55-SF). Washington, D.C. United States Forest Service.

U.S. Department of Agriculture, Soil Conservation Service. 1994. 59 Federal Register 35680, 7/13/94, https://www.gpo.gov/fdsys/pkg/FR-1994-07-13/html/94-16835.htm

U.S. Department of Commerce. Census Bureau. 2017. County Business Patterns, Washington D.C. (federal data repository)

U. S. Department of Energy, National Renewable Energy Lab. 2005. Assessing the Potential for Renewable Energy on National Forest System Lands. NREL/BK-710-36759.

U.S. Department of the Interior, Fish and Wildlife Service. (2000). Endangered and threatened wildlife and plants; determination of threatened status for the contiguous u.S. Distinct population segment of the canada lynx and related rule. *Federal Register, 65*(58), 16052-16086.

U.S. Department of the Interior, Fish and Wildlife Service. 2003. Endangered and Threatened Wildlife and Plants; Notice of Remanded Determination of Status for the Contiguous United States Distinct Population Segment of the Canada Lynx; Clarification of Findings; Final Rule. 50 CFR Part 17. Federal Register. Volume 68, No. 128

U.S. Department of the Interior, Fish and Wildlife Service. (2005a). Endangered and threatened wildlife and plants; proposed designation of critical habitat for the contiguous united states distinct population segment of the canada lynx. *Federal Register, 70*(216), 68294-68328.

U.S. Department of the Interior, Fish and Wildlife Service. (2005b). *Recovery outline: Contiguous united states distinct population segment of canada lynx*. Retrieved from Helena, MT:

U.S. Department of the Interior, Fish and Wildlife Service. 2006. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; Final Rule. 50 CFR Part 17. Federal Register. Volume 71, No. 217

U.S. Department of the Interior, Fish and Wildlife Service. 2009. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; Final Rule. 50 CFR Part 17. Federal Register. Volume 74, No. 36.

U.S. Department of the Interior, Fish and Wildlife Service. (2011). Endangered and threatened wildlife and plants; 12-month finding on a petition to list *pinus albicaulis* as endangered or threatened with critical habitat. *Federal Register, 76*(138), 42631-42654.

U.S. Department of the Interior, Fish and Wildlife Service. (2013). Endangered and threatened wildlife and plants; threatened status for the distinct population segment of the north american wolverine occurring in the contiguous united states. *Federal Register*, *78*(23), 7864-7890.

U.S. Department of the Interior, Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx and Revised Distinct Population Segment Boundary; Final Rule. 50 CFR Part 17. Federal Register. Volume 79, No. 177

U.S. Department of Interior, Fish and Wildlife Service. (2015). Recovery plan for the coterminous united states population of bull trout (salvelinus confluentus). Retrieved from Portland, Oregon:

U.S. Department of the Interior, Fish and Wildlife Service. 2016. 50 CFR Part 17, Federal Register Vol. 81, No. 201, Tuesday, October 18, 2016, Proposed Rules, p. 71670-71671

U. S. Department of the Interior, Fish and Wildlife Services. (2017). Endangered Species Act Section 7 Consultation Biological Opinion on the Effects of the Northern Rockies Lynx Management Direction on Designated Critical Habitat for Canada Lynx. Helena, Montana. United States

U. S. Department of the Interior and U. S. Department of Agriculture. 2008. Final Programmatic Environmental Impact Statement and Record of Decision for Geothermal Leasing in the Western United States.

U.S. Department of the Interior, Geologic Survey. 2000. A Tapestry of Time and Terrain, A Union of Two Maps, Geology and Topography.

U.S. Department of the Interior, Geologic Survey. 2015. Rocky Mountain regional snowpack chemistry monitoring study area. Accessed February 20, 2015, and November 8 2017, <http://co.water.usgs.gov/projects/RM_snowpack/index.html>

Unsworth, J. W., & Kuck, L. (1991). Bull elk vulnerability in the clearwater drainage of north-central idaho. In A. G. Christensen, L. J. Lyon, & T. N. Lonner (Eds.), *Proceedings of elk vulnerability: A symposium*. Bozeman, MT: Montana Department of Fish, Wildlife and Parks.

U.S. Department of Agriculture, Forest Service. (1986a). *Helena national forest plan*. Retrieved from Helena, MT: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5352772.pdf

U.S. Department of Agriculture, Forest Service. (1986b). *Lewis and clark national forest plan*. Retrieved from https://www.fs.usda.gov/detail/lcnf/landmanagement/?cid=stelprdb5409100

U.S. Department of Agriculture, Forest Service. (1995a). *Inland native fish strategy: Decision notice and finding of no significant impact and environmental assessment*. Retrieved from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_033158.pdf

U.S. Department of Agriculture, Forest Service. (1995b). *Inland native fish strategy: Environmental assessment*. Retrieved from Coeur d' Alene, ID:

U.S. Department of Agriculture, Forest Service. (1995c). *Inland native fish strategy: Environmental assessment--decision notice and finding of no significant impact*. Retrieved from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_033158.pdf

U.S. Department of Agriculture, Forest Service. (2001). *36 cfr part 294 - special areas, roadless area conservation rule*. Washington, DC: USDA Forest Service Retrieved from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5050459.pdf.

U.S. Department of Agriculture, Forest Service. (2007). Biological Assessment (Revised) of the Northern Rockies Lynx Amendment on Threatened, Endangered and Proposed Vertebrate and Invertebrate Species (Revision of Biological Assessment dated Nov. 18, 2005). Missoula, Montana.

U.S. Department of Agriculture, Forest Service. (2007a). *Northern rockies lynx management direction record of decision, national forests in montana, and parts of idaho, wyoming, and utah*. Retrieved from Missoula, MT:

U.S. Department of Agriculture, Forest Service. (2007b). *Northern rockies lynx management direction: Final environmental impact statement (vols. 1 and 2)*. Retrieved from Missoula, MT: https://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPwhQoY6IeDdGCqCPOBqwDLG-AAjgb6fh75uan6BdnZaY6OiooA1tkqlQ!!/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZfMjAwMDAwMDBBODBPSEhWTjJNMDAwMDAwMDA!/?navtype=BROWSEBYSUBJECT&cid=stelprdb5160650&navid=160120000000000&pnavid=160000000000000&ss=1101&position=Not%20Yet%20Determined.Html&ttype=detail&pname=Region%201-%20Resource%20Management

U.S. Department of Agriculture, Forest Service. (2011a). *Sensitive species list: Forest service, region 1, february 2011*. Retrieved from

U.S. Department of Agriculture, Forest Service. (2011b). *Watershed condition framework: A framework for assessing and tracking changes to watershed condition*.

U.S. Department of Agriculture, Forest Service. 2011d. Lewis and Clark National Forest Evaluation and Compliance with National Forest Management Act Requirements to Provide for Viability and Diversity of Animal Communities. Northern Region, Lewis and Clark National Forest, unpublished report. 182 pp.

U.S. Department of Agriculture, Forest Service. (2012a). *36 cfr part 219, planning*. Washington, DC: USDA Forest Service.

U.S. Department of Agriculture, Forest Service. (2012b). *2012 planning rule*. Retrieved from https://www.fs.usda.gov/detail/planningrule/home/?cid=stelprd3828310

U.S. Department of Agriculture, Forest Service. (2012c). *Future of america's forests and rangelands: Forest service 2010 resources planning act assessment*. (WO-87). Washington, DC: USDA Forest Service Retrieved from https://www.treesearch.fs.fed.us/pubs/41976.

U.S. Department of Agriculture, Forest Service. (2012d). *National best management practices for water quality management on national forest system lands, volume 1: National core bmp technical guide*. Retrieved from Washington, DC: https://www.fs.fed.us/sites/default/files/FS_National_Core_BMPs_April2012_sb.pdf

U.S. Department of Agriculture, Forest Service. (2013). *Decision notice and finding of no significant impact: Blackfoot-north divide winter travel plan, helena national forest*.

U.S. Department of Agriculture, Forest Service. (2013). Notes for assessment field trip iii: Terrestrial and aquatic habitats, threatened and endangered species, species of conservation concern, and invasive species, swan lake ranger district. USDA Forest Service, Flathead National Forest.

U.S. Department of Agriculture, Forest Service. (2014). *An assessment of fisher (pekania pennanti) habitat in the u.S. Forest service northern region*. Retrieved from Missoula, MT:

U.S. Department of Agriculture, Forest Service. (2015). *Forest service handbook (fsh) 1909.12, land management planning handbook*. Retrieved from Washington, DC: https://www.fs.fed.us/im/directives/

U.S. Department of Agriculture, Forest Service, U.S. Department of the Interior, Fish and WIldlife Service. (2008). Memorandum of understanding between the u.S. Department of agriculture, forest service and the u.S. Fish and wildlife service to promote the conservation of migratory birds (fs agreement# 08-mu-1113-2400-264).

U.S. Department of the Interior, Fish and Wildlife Service. (1993). *Grizzly bear recovery plan*. Retrieved from Missoula, MT: https://www.fws.gov/mountain-prairie/es/species/mammals/grizzly/Grizzly_bear_recovery_plan.pdf

U.S. Department of the Interior, Fish and Wildlife Service. (1999). *50 cfr part 17, federal register /vol. 64, no. 210 / monday, november 1, 1999 / proposed rules. Endangered and threatened wildlife and plants; determination of threatened status for bull trout in the coterminous united states, pages 58910-58933*.

U.S. Department of the Interior, Fish and Wildlife Service. (2007). *Biological opinion on the northern rockies lynx management decision*. Retrieved from Helena, MT:

U.S. Department of the Interior, Fish and Wildlife Service. (2011). *Grizzly bear (ursus arctos horribilis) 5-year review: Summary and evaluation*. Retrieved from Missoula, MT: https://ecos.fws.gov/docs/five_year_review/doc3847.pdf

U.S. Department of the Interior, Fish and Wildlife Service. (2013a). *Endangered and threatened wildlife and plants; draft conservation strategy for the northern continental divide ecosystem grizzly bear. Federal register / vol. 78, no. 86 / friday, may 3, 2013 / notices/ page 26064*. U.S. Fish and Wildlife Service Retrieved from http://www.fws.gov/endangered/species/recovery-plans.html.

U.S. Department of the Interior, Fish and Wildlife Service. (2013b). *Northern continental divide ecosystem grizzly bear conservation strategy draft*. Retrieved from http://www.fws.gov/mountain-prairie/species/mammals/grizzly/NCDE_Draft_CS_Apr2013_Final_Version_corrected_headers.pdf

U.S. Department of the Interior, Fish and Wildlife Service. (2014). *Final environmental assessment: Revised designation of critical habitat for the contiguous united states distinct population segment of the canada lynx*. Retrieved from Denver, CO: http://www.fws.gov/mountain-prairie/species/mammals/lynx/

U.S. Department of the Interior, Fish and Wildlife Service. (2015a). *Columbia headwaters recovery unit implementation plan for bull trout (salvelinus confluentus)*. Retrieved from Kalispell, MT: https://www.fws.gov/pacific/bulltrout/pdf/Final_Columbia_Headwaters_RUIP_092915.pdf

U.S. Department of the Interior, Fish and Wildlife Service. (2015b). *Recovery plan for the coterminous united states population of bull trout (salvelinus confluentus)*. Retrieved from Portland, OR:

U.S. Department of the Interior. 2016. Endangered and Threatened Wildlife and Plants; Proposed Rule for the North American Wolverine. 50 CFR Part 17. Federal Register. Volume 81, No, 201

U.S. Department of Interior, Fish and Wildlife Service. (2017). Endangered Species Act Section 7 Consultation Biological Opinion on the Effects of the Northern Rockies Lynx Management Direction on Designated Critical Habitat for Canada Lynx. Helena, Montana. United States Department of Interior.

U.S. Environmental Protection Agency. 2003. "Particle pollution and your health." EPA-452-/F-03-001. Accessed December 3, 2014, <http://www.epa.gov/airquality/particlepollution/pdfs/pm-color.pdf>

U.S. Environmental Protection Agency. 2014a. U 2014. EPA Air Emission Sources. Accessed December 3, 2014, <http://www.epa.gov/cgi-bin/broker?_service=data&_debug=0&_program=dataprog.state_1.sas&pol=PM25_PRI&stfips=30>

Varhola, A., Coops, N. C., Weiler, M., & Moore, R. D. (2010). Forest canopy effects on snow accumulation and ablation: An integrative review of empirical results. *Journal of Hydrology, 392*(3-4), 219-233. doi:10.1016/j.jhydrol.2010.08.009

Vose, J. M., Peterson, D. L., & Patel-Weynand, T. E. (2012). *Effects of climatic variability and change on forest ecosystems: A comprehensive science synthesis for the u.S. Forest sector* (General Technical Report PNW-GTR-870). Retrieved from Portland, OR: https://www.srs.fs.usda.gov/pubs/42610

Wallmo, O. C., Gill, R. B., Carpenter, L. H., & Reichert, D. W. (1973). Accuracy of field estimates of deer food-habits. *Journal of Wildlife Management, 37*(4), 556-562. doi:http://dx.doi.org/10.2307/3800322

Walthall, C. L., Hatfield, J., Backlund, P., Lengnick, L., Marshall, E., Waslh, M., . . . Ziska, L. H. (2012). *Climate change and agriculture in the united states: Effects and adaptation*. Retrieved from Washington, DC: http://www.usda.gov/oce/climate_change/effects_2012/CC%20and%20Agriculture%20Report%20(02-04-2013)b.pdf

Ward Thomas, J., Black, H., Jr., Scherzinger, R. J., & Pedersen, R. J. (1979). Deer and elk. In J. W. Thomas (Ed.), *Wildlife habitats in managed forests: The blue mountains of oregon and washington. Usda forest service agriculture handbook no. 533* (pp. 104-127). Washington, D.C.: Government Printing Office.

Wear, D.N., R. Huggett, R. Li, B. Perryman, S.Liu. 2013. Forecasts of forest conditions in regions of the United States under future scenarios: A technical document supporting the Forest Service 2012 RPA Assessment. Gen. Tech. Rep. SRS-GTR-170. Asheville, NC: USDA Forest Service, Southern Research Station.

Weed, W. H. 1900. "Geology of the Little Belt Mountains, Montana", U. S. Geological Survey, 20th Ann. Report, Pt. 3

Wehausen, J. D., Kelley, S. T., & Ramey, R. R., II. (2011). Domestic sheep, bighorn sheep, and respiratory disease: A review of the experimental evidence. *California Fish and Game, 97*(1), 7-24.

Westerling, A. L., Hidalgo, H. G., Cayan, D. R., & Swetnam, T. W. (2006). Warming and earlier spring increase western u.S. Forest wildfire activity. *Science, 313*(5789), 940-943. doi:http://dx.doi.org/10.1126/science.1128834

Whitlock, C., Marlon, J., Briles, C., Brunelle, A., Long, C., & Bartlein, P. (2008). Long-term relations among fire, fuel, and climate in the northwestern u.S. Based on lake-sediment studies. *International Journal of Wildland Fire, 17*(1), 72-83. doi:http://dx.doi.org/10.1071/Wf07025

Wiedinmyer, C., & Hurteau, M. D. (2010). Prescribed fire as a means of reducing forest carbon emissions in the western united states. *Environmental Science and Technology, 44*, 1926-1932.

Wilderness act - public law 88-577 (16 u.S. C. 1131-1136), (1964).

Wilson, S. M., Madel, M. J., Mattson, D. J., Graham, J. M., Burchfiled, J. A., & Belsky, J. M. (2005). Natural landscape features, human-related attractants, and conflict hotspots: A spatial analysis of human-grizzly bear conflicts. *Ursus, 16*(1), 117-129. doi:http://dx.doi.org/10.2192/1537-6176(2005)016[0117:NLFHAA]2.0.CO;2

Wisdom, M.J., editor. 2005. The Starkey Project: a Synthesis of Long Term Studies of Elk and Mule Deer. Alliance Communications Group, Lawrence, KS, USA

Wisdom, M. J., & Bate, L. J. (2008). Snag density varies with intensity of timber harvest and human access. *Forest Ecology and Management, 255*(7), 2085-2093. doi:http://dx.doi.org/10.1016/j.foreco.2007.12.027

Wisdom, M. J., Johnson, B. K., Vavra, M., Boyd, J. M., Coe, P. K., Kie, J. G., . . . Cimon, N. J. (2005). Cattle and elk responses to intensive timber harvest. In M. J. Wisdom (Ed.), *The starkey project: A synthesis of long-term studies of elk and mule deer* (pp. 197-216). Lawrence, Kansas: Alliance Communications Group.

Wondzell, S. M. (2001). The influence of forest health and protection treatments on erosion and stream sedimentation in forested watersheds of eastern oregon and washington. *Northwest Science, 75*, 128-140.

Wood, F. L., Heathwaite, A. L., & Haygarth, P. M. (2005). Evaluating diffuse and point phosphorus contributions to river transfers at different scales in the taw catchment, devon, uk. *Journal of Hydrology, 304*(1-4), 118-138. doi:http://dx.doi.org/10.1016/j.jhydrol.2004.07.026

Woodall, C., Smith, J., & Nichols, M. (2013). *Data sources and estimation/modeling procedures for national forest system carbon stocks and stock change estimates derived from the us national greenhouse gas inventory*. Retrieved from https://www.fs.fed.us/climatechange/documents/NFSCarbonMethodology.pdf

World Bank. (2009). Public attitudes toward climate change: findings from a multi-country poll. World Development Report. Washington, D.C. Retrieved from http://siteresources.worldbank.org/INTWDR2010/Resources/Background-report.pdf.

WSWG. (2012). *Recommendations for domestic sheep and goat management in wild sheep habitat*. Retrieved from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5385708.pdf

Young, Michael K.; Isaak, Daniel J.; McKelvey, Kevin S.; Schwartz, Michael K.; Carim, Kellie J.; Fredenberg, Wade; Wilcox, Taylor M.; Franklin, Thomas W.; Chandler, Gwynne L.; Nagel, David E.; Parkes-Payne, Sharon L.; Horan, Dona L.; Wollrab, Sherry P. 2017. Species occurrence data from the Range-Wide Bull Trout eDNA Project. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2017-0038.

Youngblood, A., Metlen, K. L., & Coe, K. (2006). Changes in stand structure and composition after restoration treatments in low elevation dry forests of northeastern oregon. *Forest Ecology and Management, 234*, 143-163. doi:http://dx.doi.org/10.1016/j.foreco.2006.06.033

Yount, J. D., & Niemi, G. J. (1990). Recovery of lotic communities and ecosystems from disturbance: A narrative review of case studies. *Environmental Management*, *14*(5), 547-569. doi:10.1007/Bf02394709

Zelenski, John M., and Elizabeth K. Nisbet. 2014. Happiness and Feeling Connected: the Distinct Role of Nature Relatedness. Environment and Behavior 46(1): 3–23.

Zhang, Yuan, John M. Wallace, and David S. Battisti. 1997. ENSO-like Interdecadal Variability: 1900-93. Journal of Climate vol, 10, pp. 1004-1020.

Zhang, J. W., Ritchie, M. W., & Oliver, W. W. (2008). Vegetation responses to stand structure and prescribed fire in an interior ponderosa pine ecosystem. *Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 38*(5), 909-918. doi:http://dx.doi.org/10.1139/X07-230

Ziesak, R. (2015). *Montana forestry best management practices monitoring: 2014 forestry bmp field review report*. Retrieved from Missoula, MT: http://dnrc.mt.gov/divisions/forestry/docs/assistance/practices/2012bmplongrpt.pdf

Ziska, L. H., Faulkner, S., & Lydon, J. (2004). Changes in biomass and root:Shoot ratio of field-grown canada thistle (*cirsium arvense*), a noxious, invasive weed, with elevated co_2: Implications for control with glyphosate. *Weed Science, 52*, 584-588.

Ziska, L. H., & R., T. J. (2000). Sustained growth and increased tolerance to glyphosate observed in a c3 perennial weed, quackgrass (elytrigia repens), grown at elevated carbon dioxide. *Australian Jounral of Plant Physiology, 27*, 159-166.

Zouhar, K., Kapler Smith, J., Sutherland, S., & Brooks, M. L. (2008). *Wildland fire in ecosystems: Fire and nonnative invasive plants*. Retrieved from Fort Collins, CO: https://www.fs.fed.us/rm/pubs/rmrs_gtr042_6.pdf