United States Department of Agriculture

Telegraph Vegetation Project

Draft Environmental Impact Statement

Volume I. Summary, Chapters 1, 2, and Part 1 of Chapter 3

Forest Service Helena National Forest Helena Ranger District July 2015

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TELEGRAPH VEGETATION PROJECT

Draft Environmental Impact Statement – Volume I

Powell County, Montana

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Helena Ranger District

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Abstract: This draft environmental impact statement (EIS) considers three alternatives in detail. Alternative 1 is the no action alternative, which provides a baseline for comparing the magnitude of environmental effects of the action alternatives. Alternative 2 would treat approximately 6,754 acres in the project area with a combination of intermediate harvest (434 acres), precommercial thinning (1,786 acres), regeneration harvest (3,484 acres), and prescribed fire (1,050 acres). Connected actions for alternative 2 would include 8.5 miles of temporary road construction (followed by full obliteration), 43.1 miles of road maintenance, 32.6 miles road reconstruction, and improvement of 6 road/stream crossings. Alternative 3 would treat approximately 4,185 acres in the project area with a combination of intermediate harvest (434 acres), precommercial thinning (1,289 acres), regeneration harvest (1,856 acres), and prescribed fire (606 acres). Connected actions for alternative 3 would include 3.4 miles of temporary road construction (followed by full obliteration), 42.9 miles of road maintenance, 28.3 miles road reconstruction, 30 miles of road decommissioning, and improvement of 9 road/stream crossings.

It is important that reviewers provide their comments at such times and in such a way that they are useful to the Agency's preparation of the EIS. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. The submission of timely and specific comments can affect a reviewer's ability to participate in subsequent administrative review or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. 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.

Summary

Introduction

The Helena Ranger District of the Helena National Forest (HNF) is proposing the Telegraph Vegetation Project. This project is intended to move the resource area toward desired conditions and designed to respond to the goals and objectives outlined in the Helena National Forest Plan (USDA, Forest Service 1986).

Specifically, uniform forest conditions dominated by dense even-aged stands of mature lodgepole pine were established in the Telegraph landscape by extensive clearing in the early part of the century. This was followed by cool, moist growing conditions and exclusion of wildfire which caused forests to become highly susceptible to the MPB. The result has been wide-scale tree mortality in the past few years. Among many other ecosystem effects, this tree mortality will likely reduce fire suppression effectiveness.

Treatment is needed to meet Forest Plan goals and direction, ensure diverse and sustainable forest stands and wildlife habitat in the future, improve conditions for fire suppression, recover economic value of dead and dying trees, and maintain and improve watershed values. This translates in a general sense to providing multiple ecosystem services related to sustainable forest cover. This suite of values would best be provided by a landscape that is resilient with respect to natural disturbance regimes.

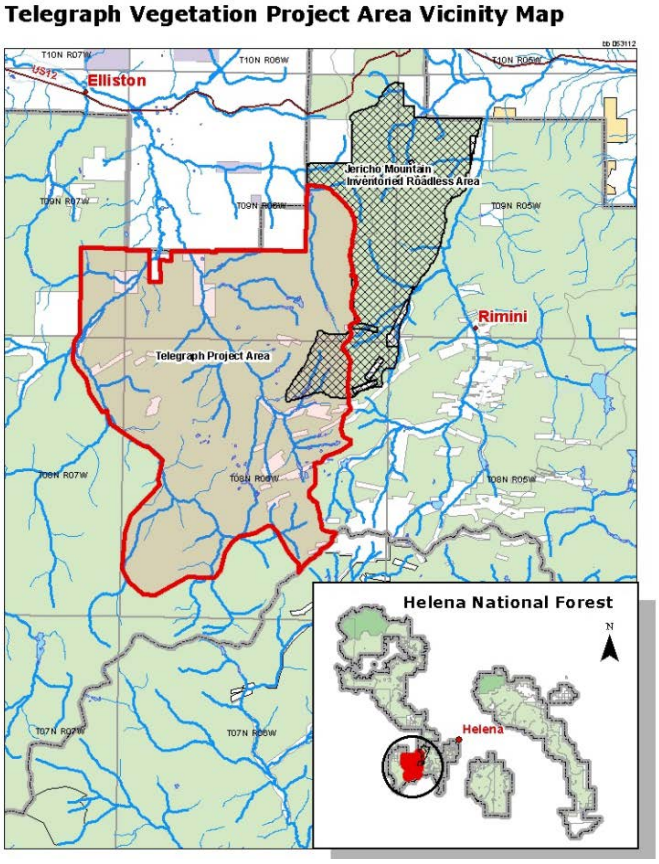

Figure S- 1. Telegraph Vegetation Project area vicinity map

The Telegraph Project area is approximately 23,669 acres (Figure S-1) in size and is located roughly 15 miles southwest of Helena, and 5 miles south from Elliston, MT, in the Little Blackfoot drainage west of the Continental Divide. The project is located within all or part of Sections 14, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 and 36 of T9N, R6W; Sections 25 and 36 of T9N, R7W; Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33 and 34; Sections 1 and 12 of T8N, R7W; and Sections 4, 5, and 6 of T7N, R6W; Powell County, MT; PMM.

Project History

As a result of the MPB epidemic, in 2008, the Forest Service initiated the planning process for the Telegraph Vegetation project with reviews of database information and ground conditions within the watershed. Public involvement for the Telegraph project started in fall of 2009. Scoping was used to help the Forest Service develop the proposed action alternatives. Site-specific public comments were requested through a letter that was mailed to potentially interested or affected members of the public on November 05, 2009. This letter included maps and a description of the proposed action as developed at the time. The letter included a comment form so interested people could provide input on the proposal and submit their

comments about proposed activities in the area. A legal notice briefly describing the project and requesting public comment was published in the Helena Independent Record (the newspaper of record) on November, 13 2009. A Notice of Intent (NOI) was prepared and printed in the Federal Register on November 12, 2009. An open house was held on December 3, 2009. The comments from the initial scoping were considered when later analyzing issues and developing alternatives. Comments to the scoping document were received and are included as part of the project record.

The project was then re-scoped in July 2012 as a result of comments received and additional site specific field information to incorporate 449 acres of slashing generally small diameter trees, followed by prescribed burning within the Jericho Mountain Inventoried Roadless Area in addition to changes in the location and acreages of treatments. A corrected NOI was submitted to the Federal Register and was published on July 20, 2012. An open-house meeting was held at the Elliston School House on July 10, 2012 to share information and hear from interested citizens. Maps of the action alternatives, photos of existing vegetation conditions, and examples of what treatment areas may look like post-harvest and/or post burning were posted for viewing. Copies of the scoping letter (describing the proposed action) were made available. An estimated 25 people from the surrounding communities that were interested in this proposal attended the meeting. Input was received on how interested parties viewed the management proposal for the area as described in the scoping notice.

Regulatory Framework

Several important laws, executive orders and policies form the regulatory framework applicable to managing the HNF, a partial list follows. While most pertain to all Federal lands, some of the laws are specific to Montana. This framework is also an integral part of the purpose and need for action. In addition to the following laws and documents, each specialist report identifies the regulatory framework that is applicable to their analysis. Disclosures and findings required by these laws and orders are contained within each resource specialist report and in the project file.

The National Forest Management Act (NFMA) of 1976 governs vegetation management on national forest lands. Several sections in the act, and its accompanying regulations (USDA Forest Service, 1982), specifically address terms and conditions relevant to the vegetation resource. These include sections on timber suitability and management requirements for vegetative manipulation, including tree regeneration timeframes and opening size limits.

The size of harvest openings created by even-aged silvicultural systems will normally be 40 acres or less, and the creation of larger openings requires 60-day public review and Regional Forester approval. However, where natural catastrophic events such as fire, windstorms, or insect attacks have occurred, 40 acres may be exceeded without 60-day public review and Regional Forester approval, provided the public is notified and the environmental analysis supports the decision (USDA 2002). Many proposed treatments in the Action Alternatives would exceed 40 acres due to extensive MPB-caused mortality and a desired to emulate natural disturbance patch sizes, as supported by this analysis. The public is hereby notified of these areas (Forested Vegetation Specialist Report). In these units and contiguous groups, prescriptions would include varying amounts of tree retention in surviving components, potentially buffering openings, leaving individuals and clumps throughout units, and including patches of inoperable areas. However, because the overstory is largely dead and reforestation is required, these are considered openings.

The National Environmental Policy Act (NEPA 1969). The Forest Service has prepared this environmental impact statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

As required under the **Federal Land Assistance, Management, and Enhancement (FLAME) Act** of 2009 the Secretaries of Interior and Agriculture are required to submit a report to Congress on their efforts in producing an integrated wildfire management strategy. The Wildland Fire Leadership Council

guided the development of the National Cohesive Wildland Fire Management Strategy, known as the Cohesive Strategy (USDA/DOI 2011), that provides consistent interagency direction.

Powell County prepared a **Community Wildfire Protection Plan (CWPP)** for the county in 2005 in conjunction with the concern Powell County Stakeholders. This project also considers the CWPP for Lewis & Clark, Broadwater and Jefferson Counties called the Tri-County CWPP which was developed for the three counties in 2005 thru the Tri – County Fire Safe Working Group. The CWPP recommends treatment options be proposed on a landscape scale. These treatments should reduce hazardous fuels and reduce risks to values that are important to communities, people, and natural resources. These treatments include hazardous fuels reduction treatments that remove or modify wildland fuels, lessen post-fire damage, and limit the spread or proliferation of invasive species and diseases. Activities to accomplish these objectives include prescribed fire, mechanical thinning, grazing, or combinations of these and other methods.

The Northern Region Overview (1998) sets priorities for ecosystem restoration and focuses the Forest Service Natural Resource Agenda for the National Forest lands of the Northern Region. For forest vegetation, the overview establishes indicators of risk to the proper functioning conditions of this ecosystem. Risk indicators include: (1) the loss of species composition at the cover type level, (2) the change in landscape level fragmentation, and (3) stand level structure as measured by density and seral stage/size class distribution. The overview also describes the importance of restoring ponderosa pine, western larch, and whitebark pine (USDA, 1998). The overview identifies aspen, whitebark pine, ponderosa pine, sagebrush, and grasslands among the areas of concern currently at risk in the Northern Region. The agents of change listed for these areas of concern include mountain pine beetle (MPB), fire (including suppression), blister rust, root disease, noxious weeds/exotic species, grazing, and timber harvest.

The Helena National Forest Plan (1986a) (FP), as amended, provides detailed direction and guidance for managing public lands on the HNF. The FP embodies the provisions of NFMA, its implementing regulations, and other guiding documents. Guidance from the Record of Decision for Amendments to the Forest Plan (1986) is incorporated in the Forest Plan. Forest Service Manuals (FSM) and Forest Service Handbooks (FSH) provide direction and were applied to the development of this project. This plan also identifies Management Areas (MAs) and provides direction for each. The actions proposed in this project are designed to be consistent with the Forest Plan, including all plan amendments currently in effect, to the extent possible given the existing conditions. Where Forest Plan direction may not be met, a site-specific Forest Plan amendment would be proposed.

The Forest Plan provides two types of management direction, forestwide direction and management area (MA) direction. forestwide direction, which applies to all MAs, is located on pages II/14 through II/36 of the Forest Plan. Table S-1 displays the management areas within the project area and the following table lists the acres of each MA found within the project boundary, and relevant goals by MAs as described in the Forest Plan. The project area overlaps and includes treatments within the Jericho Mountain Roadless Area.

Helena National Forest Management Areas T-1, T-5, L-1, M-1, P-3, W-1, and private lands are included in the Telegraph project area. The forestwide management direction in Chapter II of the Forest Plan applies to all management areas (Forest Plan III/1). For additional information on the MA goals, resource potentials, and limitations, see the Helena Forest Plan on pages III/1 to III/92.

The following table is a list of MAs and a summary of the goals relevant to this proposal of the management areas within the project area.

Table S- 1. Management areas and associated acres within the Telegraph Vegetation Project area

Management Area (Acres)	Pages In Forest Plan	Goals Relevant To This Proposal
T1 (17,588 acres)	T-1 III/30-III/33	Provide healthy timber stands and optimize timber growing potential over the planning horizon. Emphasize cost-effective timber production, while protecting the soil productivity. Maintain water quality and stream bank stability. Provide for dispersed recreation opportunities, wildlife habitat, and livestock use, when consistent with the timber management goals.
M1 (3,299 acres)	M-1 III/5-III/7	Maintain the present condition with minimal investment for resource activities, while protecting the basic soil, water, and wildlife resources.
L1 (343 acres)	L1- III/11-III/13	Maintain or improve vegetative conditions and livestock forage productivity
T5 (321 acres)	T-5 III/46-III/49	Increase production and quality of forage. Manage timber sites cost-effectively, by selecting the most economical harvest system and managing for natural regeneration. Provide for healthy stands of timber and timber products consistent with increasing quality and quantity of forage. Emphasize cost- effective timber production, while protecting the soil productivity. Maintain water quality and stream bank stability. Provide for other resource uses that are compatible with the other goals.
P3 (51 acres)	P-3 III/73-III/77	Manage the recommended wilderness additions to protect the wilderness Characteristics and to the extent possible allow existing uses, pending Congressional classification.
W1 (455 acres)	W1 III/50-III/52	Optimize wildlife habitat potential, including old growth, over the long term. Provide for other resource uses, if they are compatible with wildlife management goals.

In addition, a description of each management area and pertinent goals are provided in Appendix B of this document. This appendix summarizes the Forest Plan Standards and Goals as well as the applicable management area direction. It also provides a synopsis of how the project responds to the standards and guidelines for the Forest Plan and by each management area.

Treatments using harvest may occur in several MAs. Some of these MAs are suitable for timber production, and include goals of managing for healthy stands of timber and optimizing growing potential. Other MAs are considered unsuitable for timber, but harvest may be used as a tool to meet the other objectives of the MA.

Forest Management must also consider direction in the Inland Native Fish Strategy (INFISH 1995) which provides direction to protect habitat and populations of resident native fish outside of anadromous fish habitat. Other pertinent direction including the Northern Rockies Lynx Management Direction is also considered.

Northern Region Integrated Restoration and Protection Strategy. The Northern Region Integrated Restoration and Protection Strategy provides information to help local Forest Service units identify and prioritize potential areas for accomplishing Forest and Grassland Plan goals and objectives, and thus, meeting this mission. This strategy focuses on restoration and maintenance of watersheds, wildlife habitats (including more resilient vegetation conditions), and the protection of people, structures, and community infra-structure in and associated with the wildland-urban interface. Values in these focus areas may be threatened by large scale fires, drought, insects and disease, invasive plants and animals, forest

encroachment into grasslands, dense vegetation that create hazardous fuel conditions, erosion, sedimentation, and toxic chemicals.

The Endangered Species Act of 1973, as amended (ESA 1973, 16 U.S.C. 1531) provides direction to the Forest Service to establish objectives for habitat management and recovery through the Forest Plan for the conservation and protection of endangered and threatened species. This project is consistent with the Forest Plan for listed species and is therefore consistent with these guidelines. The U.S. Fish and Wildlife Service was consulted to determine which species required evaluating for the project. An analysis of effects on listed species was conducted and documented in a Biological Evaluation. Consultation is ongoing and will be completed prior to issuing a decision on this project.

The Migratory Bird Treaty Act, Presidential Executive Order 13186 10 January 2001. Migratory birds are included under the Migratory Bird Treaty Act (MBTA) and incorporate most species of birds present in the project area. In December 2008, the Forest Service entered into a memorandum of understanding (MOU) with the United States Department of Interior (USDI) Fish and Wildlife Service on the Migratory Bird Treaty Act to further clarify agency responsibilities (USDA Forest Service and USDI Fish and Wildlife Service 2008). Four key principles embodied in the MOU direct the Forest Service to (1) focus on bird populations; (2) focus on habitat restoration and enhancement where actions can benefit specific ecosystems and migratory birds dependent on them; (3) recognize that actions taken to benefit some migratory bird populations may adversely affect other migratory bird populations; and (4) recognize that actions that may provide long-term benefits to migratory birds may have short-term impacts on individual birds. The parties agreed that through the NEPA process, the Forest Service would evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors.

Executive Order 13186 directs departments and agencies to take certain actions to further implement the MBTA. Specifically, the Order directs Federal agencies, whose direct activities will likely result in the "take" of migratory birds, to develop and implement a memorandum of understanding with the USFWS that shall promote the conservation of bird populations. Under Executive Order 13186 the USFWS is responsible to ensure that environmental analyses of Federal actions evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.

In 1963 Congress passed the **Federal Clean Air Act** and amended the act in 1970, 1977, and 1990. The purpose of the act is to protect and enhance air quality while ensuring the protection of public health and welfare. The 1970 amendments established National Ambient Air Quality Standards (NAAQS), which must be met by most state and federal agencies, including the Forest Service.

States are given the primary responsibility for air quality management. Section 110 of the Clean Air Act requires states to develop State Implementation Plans (SIPs) that identify how the state will attain and maintain NAAQS. **The Montana Clean Air Act** (MCAA)(1967) promulgates the SIP and created the Montana Air Quality Bureau (now under the Montana Department of Environmental Quality-MDEQ). The Clean Air Act also allows states, and some counties, to adopt unique permitting procedures and to apply more stringent standards.

The Federal Clean Water Act, as amended, is commonly referred to as the Clean Water Act (CWA). This required each state to develop its own water quality standards, subject to the approval of the Environmental Protection Agency (EPA). Section 303(d) of the CWA required each state to assess all water bodies within its borders in order to identify water quality impairments that exceeded state standards. Under the CWA, water bodies identified as impaired generally require the development of a "Total Maximum Daily Load" (TMDL—a water quality restoration plan). The state is required to systematically develop these plans in collaboration with the EPA. A water body's status on Montana's 303(d) list dictates, to a certain extent, the water quality standards under state law. The Little Blackfoot River, Telegraph Creek, and Ontario Creek are on the Montana 303(d) list of water-quality impaired streams not fully supporting all listed beneficial uses. Listed impairments include alteration in stream-side

or littoral vegetative covers, arsenic, cyanide and sedimentation/siltation. This project will have a long-term beneficial effect to the Little Blackfoot River by reducing the anthropogenic sediment load to these streams, as well as reduce the likelihood of culvert failure where culverts are upgraded. The resource protection measures identified will minimize the short-term negative effects to project-area streams and riparian areas. Any permits needed for implementation would be obtain before operations were initiated.

National Historic Preservation Act, **Section 106 (1966 as amended)** provides direction for Federal agencies to establish a program for preservation of historic properties. In compliance with this ac, a review was conducted to determine if cultural resources surveys had been conducted with in the project area, and if cultural resources sites had been record. Potential impacts to sites eligible for the National Register of Historic Places (NRHP), as well as for those not yet evaluated, were considered in this analysis. In accord with 36 CFR 800, Protection of Historic Properties, it is the policy of the Forest Service to protect those sites determined NRHP eligible, as well as those sites not yet formally evaluated. The result of the Heritage Resource analysis conducted is in the specialist report in the project record. Project design features developed to protect heritage resources are listed in chapter 2. Consultation with the State Historic Preservation Office for concurrence will be completed prior to issuing a decision on this project.

Species Designation for Whitebark Pine R1 Regional Forester Letter (2011)

This letter specifies that whitebark pine is designated as a sensitive species in Region 1 because of the U.S. Fish and Wildlife Service finding that the listing of whitebark pine under the Endangered Species Act (ESA) was warranted but precluded, making it a candidate species for listing. The letter notes that the designation should not change our approach to restoration of whitebark pine, and in fact hopefully accelerate actions to restore whitebark pine (USDA 2011b).

Purpose and Need for Action

Uniform forest conditions dominated by dense even-aged stands of mature lodgepole pine were established in the Telegraph landscape by extensive clearing in the early part of the century. This was followed by cool, moist growing conditions and exclusion of wildfire which caused forests to become highly susceptible to the MPB. The result has been wide-scale tree mortality in the past few years. Among many other ecosystem effects, this tree mortality will likely reduce fire suppression effectiveness.

Treatment is needed to meet Forest Plan goals and direction, ensure diverse and sustainable forest stands and wildlife habitat in the future, improve conditions for fire suppression, recover economic value of dead and dying trees, and maintain and improve watershed values. This translates in a general sense to providing multiple ecosystem services related to sustainable forest cover. This suite of values would best be provided by a landscape that is resilient with respect to natural disturbance regimes.

Based upon the existing condition and consistent with the Forest Plan direction and its goals, the Helena National Forest IDT identified the Purpose and Needs for the project area.

1. Resiliency, Diversity and Reforestation

    - Develop forest conditions across the landscape by improving resiliency to disturbances such as to insects, disease, fire, and drought through maintaining existing long-lived early seral species and increasing their overall representation across the landscape.

    - Enhance species, age class diversity and density to provide opportunity for future diversification thus helping the landscape to be more resilient.

    - Establish diverse and robust reforestation on suitable timber acres killed by MPB.

- Manage previously harvested stands to ensure vigorous growth and high resilience.

2. Hazardous Fuels Reduction

    - Improve conditions for fire suppression as well as public and firefighter safety in the area in the event of a wildfire.

3. Provide Wood Products for Local Economies

    - Utilize dead and dying trees to provide forest products to the local timber industry, contributing to short term forest products and providing for long-term sustainability of timber on National Forest System lands.

4. Maintain and Improve Watershed Values

    - Improve water quality through reduction of sediment delivery by conducting various road treatments and stream crossings improvements.

The following sections discuss in greater detail the goals and objectives related to these needs.

Resiliency, Diversity and Reforestation

Forested environments within the Telegraph Landscape are influenced by climate, topography, fire, and human activity. Over time, past harvesting practices, exclusion of wildfire, insects and diseases, and other factors have changed the species composition in the resource area from that which existed prior to European settlement. The species composition that now exists contains many short-lived and fire-intolerant tree species. As a result, the landscape has become less resilient to insects, disease, fire and drought.

A primary goal of this project is to maintain and increase diversity in species and density to enhance resilience across the landscape. The vigor, abundance, and distribution of special habitat features (whitebark pine, ponderosa pine, aspen, old growth, and snags) would be maintained and/or enhanced as appropriate for site conditions, short and long term. Increasing the abundance of these species would contribute to improving resiliency to disturbances such as fire, insects, and disease. Although, all seral species (aspen, ponderosa pine and whitebark pine) currently exist in the Telegraph Landscape, this action is needed because, they occur in lower quantities than they did historically due to selective harvesting, fire exclusion, insects and disease. These past activities created a more uniform landscape comprised of dense forests (Douglas-fir and lodgepole pine) susceptible to insect and wildfire mortality. In addition, a large-scale MPB epidemic has killed most of the mature lodgepole pine and ponderosa pine.

Simply put, a resilient landscape is diverse so that not all areas are equally susceptible to the same disturbances at the same time. Although even-aged stands and stand replacement mortality are a natural part of lodgepole pine ecology, this landscape was likely more homogeneous than it would have been historically.

While lodgepole pine forests are emphasized because of their extent, the resiliency of other types (Douglas-fir, whitebark pine, subalpine fir, Engelmann spruce, and aspen) is also important. Drier Douglas-fir forests may have been influenced more profoundly by fire suppression due to a naturally more frequent fire return interval. These forests are dominated by relatively densely stocked mature Douglas-fir with varying amounts of ladder fuel development, increasingly susceptible to Douglas-fir beetle (DFB) and western spruce budworm (WSB). Natural fire would have created more of a mosaic of open stands at multiple seral stages. Subalpine fir and Engelmann spruce dominate some of the highest elevation and/or moist sites; persist as fine-scale refugia in riparian or rocky areas; and are minor components in some lodgepole and Douglas-fir forests. These late-seral, shade-tolerant trees have been favored by fire exclusion and MPB.

Thinning some of the stands established after past harvest could promote resilience, individual tree growth, and density diversity of these younger forests that provide the primary green forests on a regenerating landscape. Encouraging a mosaic of reforestation and downed-fuel conditions would increase the potential that natural wildfires would burn at sizes and intensities more consistent with historic regimes. Salvage logging of gray phase, beetle-killed lodgepole stands would alter the behavior and severity of potential future wildfires (Collins et al. 2012). This would help ensure that a full range of ecological and social values are provided through time. Throughout the century following MPB infestation, fire behavior will be influenced by changes in canopy and surface fuel loads, species composition, and stand structure (Collins et al. 2012). Untreated areas in all alternatives would remain unchanged in the short term, and generally over time develop into denser forests with higher components of shade tolerant species. Over the course of decades, windthrow beetle-killed trees will contribute large surface fuels and may increase the potential for severe soil heating in the case of a wildfire in untreated areas (Collins et al. 2012). Treated and untreated areas together would provide a mix of forest and habitat conditions.

Hazardous Fuels Reduction

Approximately half of the Telegraph Project area is designated as wildland-urban interface (WUI) in the Powell County Community Wildfire Protection Plan. The community of Elliston, private land, homes, recreational use, and the Highway 12 corridor are major infrastructures or values at risk that influence WUI designation.

There is a need for hazardous fuel reduction in the Telegraph Landscape because the increase in fuels increases the potential of wildfire to threaten life, property, resource values and infrastructure. This project proposes to strategically locate treatments along ridgelines, along valley bottoms, in conjunction with natural openings/barriers, and along roads/trails which would allow for safer, more efficient and direct initial attack of unwanted fires by fire suppression forces. Removal of the dead overstory would alleviate the risk of increased future fuel loadings and improve safety conditions for firefighters/forest workers from falling dead trees.

Provide Wood Products for Local Economies

There is also a need to meet Forest Plan objectives and goals as they relate to timber management. The availability of timber products for local and regional markets has been reduced in recent years. This caused a loss of job opportunities, evidenced by recent mill closings. To support a viable wood products industry, wood products from a variety of sources should be available. Forestwide objectives in the Forest Plan for the timber resource include managing suitable acres with stocking control techniques, such as pre-commercial and commercial thinning, and successfully managing any insect or disease outbreaks (Forest Plan II/4). With approximately 75 percent of the project area being lands allocated for a timber management emphasis, this project is responsive to the Forest Plan direction.

Dead and dying trees from this project would be utilized to provide forest products to the local timber industry that contribute to short-term forest products and provide for long-term sustainability of timber on National Forest system lands. The revenue generated from forest products from this project has the potential to affect local economies. People and economies are an important part of the ecosystem. The use of renewable resources generates employment and income in the surrounding communities and counties, and generates revenues returned to the Federal Treasury or used to fund additional on-the-ground activities to accomplish resource management objectives. These trees have been dead and/or dying since 2009, to be responsive to the deterioration of product and its value it is important to be quick to respond and remove this material urgently while it still has product value.

The proposed action would increase timber productivity on the affected suitable timber land. It would help by managing suitable acres using stocking control techniques, such as pre-commercial and commercial thinning.

Maintain and Improve Watershed Values

The Telegraph project area encompasses portions of four 6th-order hydrologic unit codes (6th-HUC) drainages. These include: Ontario Creek, Telegraph Creek, Mike Renig Gulch, and Little Blackfoot River-Hat Creek. There are impaired stream reaches as identified on the State of Montana Clean Water Act section 303(d) list adjacent to and immediately downstream of the project area. Stream impairments in the project area are primarily a result of past mining activity, forest roads, and livestock activities.

A goal of this project is to improve water quality. Therefore, there is a need to reduce sediment delivery to streams by conducting various road treatments and stream crossing improvements.

Forest roads have the potential to negatively affect watershed values. The impact of a road is generally continuous whether the road is open or closed to public use, although unused roads are often partially stabilized by vegetation over time. However, without de-compaction of road surfaces, top soil may remain unavailable to plant roots, preventing the road prism from re-vegetating to a point that sufficiently decreases concentrated runoff. Additionally, subsurface hydraulic connectivity would continue to be impaired on roads with cut-fill construction without de-compaction and re-contouring of the road (Gucinski et al., 2001). Further, undersized culverts or improperly designed road-stream crossings on closed, but not decommissioned roads, could continue to be a source of road sediment without restoration and stabilization of the stream channel (Madej, 2000).

This project is designed to specifically address the Helena National Forest Plan forestwide management direction on page II/1 states in goal 10, “Maintain high quality water to protect fisheries habitat, water based recreation opportunities, and municipal water supplies and to meet or exceed state and Federal water quality standards.” Also, the general watershed guidance under the forestwide standards, page II/25, guides the forest in correcting problems with soil erosion (item #3); mitigating adverse effects on water-related beneficial uses (item #4); and controlling non-point pollution sources (item #5).

Vegetation Conditions

The Project Area is characterized by productive lodgepole pine growing on Douglas-fir and subalpine fir habitat types that were initiated by wildfire prior to 1900. Over the last century the homogeneity of the forest was fragmented by modern timber harvest from the 1960s to 1990s, which predominantly consisted of clearcutting patches usually (but not always) less than 40 acres where it was feasible to build roads. This occurred on roughly 16 percent of the Project Area. While the result was to diversify age classes, the patch size and pattern is not necessarily consistent with what would have been created by natural disturbance.

In the case of historic fire occurrences, while stand replacement effects would have been typical, there would also have been mixed and low severity fires that left remnant components. Aside from the patchwork of past harvest, forests were relatively uniform and characterized by densely growing mature lodgepole pine trees. As a result, the recent Mountain Pine Beetle (MPB) outbreak caused extensive mortality peaking in 2009; affecting over 94 percent of the Project Area at intensities greater than 90 percent pine mortality in some stands. While many forests contained little diversity, there are stands mixed with Douglas-fir, subalpine fir, Engelmann spruce, aspen, and/or whitebark pine. Additionally, there are areas dominated by these species and natural meadows.

The Divide landscape historically burned an average of 39,124 to 170,242 acres per decade (Hollingsworth 2004), but no large fires have occurred in the last century. Although we will never know site-specifically what the results would have been without fire suppression, it is reasonable to conclude that to some extent the lack of fire has altered vegetation. This would have occurred even in forests with naturally long fire return intervals because not every stand would have been starting at a theoretical year “0” for fire return when suppression began. Further, although large stand replacing events play a major role in lodgepole types, less severe intervening disturbances would also have occurred. The crown fire cycle is 110-170 years on these types (USDA 1990); however the interval between any two fires in one

area might be only a few years (Fischer and Clayton 1983). Fire suppression has decreased acreage burned in normal fire seasons, reducing the natural variability in landscape patterns that would otherwise be created by small fires (USDA 1990). Historically, a 5-year crown fire event could be expected to impact roughly 1 percent of the lodgepole type, in patches of an average 100 acres; while a 30-year event would impact 10 percent with an average of 10,000 acre size (USDA 1990).

While fire suppression was successful, the other primary disturbance agent in lodgepole types—MPB—could not be suppressed. Historic evidence shows that outbreaks were often spatially concentrated and severity mixed; the severity and magnitude of the recent outbreak is likely a result of high levels of susceptible pine forest, wildfire suppression, and recent warming climate conditions (Lewis 2008). The recent outbreak of MPB resulted in a mix of effects, commonly stand-replacing but also mixed severity in less susceptible stands (younger, smaller trees, and/or mixed species). Quantity and types of biological legacies differ greatly among disturbances leading, in turn, to widely varying starting points for stand structural development (Franklin et al. 2002). Some of the differences between MPB and fire include residual vegetation and downed woody debris which influence forest development.

Ecosystem response following MPB outbreak seems to be slower than to fire, with seedlings establishing over several decades following a MPB outbreak (Axelson et al. 2009). Low or moderate intensity MPB mortality do not result in significant increases in light to the forest floor, favoring regeneration of shade tolerant species; on the other hand, intense MPB infestation which removes the majority of the overstory will favor regeneration of shade intolerant species (Axelson et al. 2009). Both of these trends would occur in the Telegraph area depending on stand-level MPB mortality intensity. Without fire, reforestation may take longer and/or be less dominated by lodgepole because this seral species regenerates best in sunny conditions with mineral soil exposure via serotinous cones opened by fire. Even so, as the dead and dying stands “unravel,” if a shade tolerant understory is not present lodgepole would still regenerate in many areas from the sun heating the cones.

With MPB, all of the trees killed remain onsite and become downed fuels over time, while with a fire some of this material would be consumed. The extent of downed fuels expected in the near future on this landscape will be quite continuous across a large extent. This condition could result in large scale, severe fire behavior if a wildfire were to occur, not in terms of crown fire, but rather long-duration surface fire in the woody debris. It would also directly increase the potential of wildfire to threaten life, property, and resource values.

Summary of Proposed Action

The proposed action was designed to meet the purpose and need, forest plan management area objectives, and to be responsive to issues raised by Forest specialists. The proposed action treatment summary table including a unit-by-unit treatment description can be found in Appendix A of this DEIS.

Implementation of proposed treatments would include the use of ground-based logging equipment, cable systems, and hand and/or fire treatments. Approximately 8.5 miles of temporary road construction, 43.1 miles of road maintenance, and 32.6 miles of road reconstruction would be needed to implement the proposed action. There would be an estimated total of 84.2 miles of haul route needed. All temporary roads would be obliterated after project activities have been completed. Post treatment activities could include approximately 4,329 acres of underburning, site prep burning, broadcast burning, jackpot burning, and handpiling/burning. Approximately 537 acres of slashing generally small diameter trees and broadcast burning would occur within the Jericho Mountain Inventoried Roadless Area.

A site-specific amendment may be needed related to thermal cover on winter range in the Jericho herd unit (Big Game Standard 3, Forest Plan page II/17). This site-specific amendment would also exempt the Project from winter range restrictions in order to proceed with winter logging in select units and from limitations on the size of openings associated with clearcuts. Any site-specific amendments to the Helena National Forest Plan would follow the transition language found in the 2012 Planning Rule (16 U.S.C. 1604 (i)).

Scope of Analysis

The proposed action is limited to the specific fuels, vegetation, road management, and stream crossing improvement activities proposed on National Forest System (NFS) land in the Telegraph Vegetation project area. That said, the geographic extent of some areas used to analyze different resource components (watershed, fuels, and wildlife home ranges) may extend beyond the project area. The analysis of effects disclosed in this document includes those occurring from the entire "scope" of the decision. Scope is defined in 40 CFR 1508.25 as the range of actions, alternatives, and impacts to be considered in an EIS. Any new information that develops after the decision of this analysis would be considered prior to implementation.

Decisions to Be Made

The Responsible Official for this proposal is the Forest Supervisor of the HNF. The Forest Supervisor will make the following decisions and document them in a Record of Decision (ROD) following the completion of the final environmental impact statement (FEIS).

- Whether to implement the proposed action or an alternative to the proposed action;
- What monitoring requirements are appropriate to evaluate implementation of this project, and;
- Whether a forest plan amendment is necessary.

Issues

The comments received were separated into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explains this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review" (Sec. 1506.3).

As for significance, the IDT for the Telegraph Project identified the following issues during scoping:

Lynx and Lynx Habitat

Several commenters were concerned about proposed treatment effects on lynx and lynx habitat. Alternative 2, the Proposed Action, was developed with treatments occurring in lynx habitat that lies within the WUI, as allowed under the *Northern Rockies Lynx Management Direction.* Alternative 3 has been developed by reducing the acres of treatments within lynx habitat especially within early stand imitation, stand initiation, and multistory habitat.

Measures to Evaluate: Treatment and remaining acres occurring within early stand initiation, stand initiation, and multistory habitat that lies in the WUI.

Elk Security and Cover

Several commenters had concerns about possible treatment effects on elk security and elk hiding cover. Alternative 3 features a reduction in the amount of hiding cover treated within security and intermittent refuge areas as well as within the elk herd unit as a whole.

Measures to Evaluate: Treatment acres occurring within mapped security areas.

Road Construction

Several commenters were concerned about new road construction, along with re-construction of existing roads. Concerns with road building included weed introduction/spread, illegal motorized use, habitat

security, and sedimentation. Alternative 3 was designed to address wildlife concerns and minimize new temporary road construction, while still being able to meet overall project objectives.

Measures to Evaluate: Miles of temporary road construction followed by full obliteration, miles of road maintenance, miles of road reconstruction, and miles of haul routes

Jericho Inventoried Roadless Area (IRA)

One commenter was concerned about thinning and prescribed burning activities proposed within the Jericho Mtn. IRA, especially when coupled with the harvest and new roads proposed around the IRA. Another commenter questioned how treatment within the IRA would benefit lynx. After consultation with HNF wildlife and fire specialists, significant portions of planned treatments within Jericho IRA were dropped from alternatives 2. Additionally, under alternative 3, many of the treatment units and temporary roads surrounding the IRA are proposed to be dropped from treatment.

Measures to Evaluate: Acres of prescribed burning.

In addition to significant issues, the ID team evaluated other concerns that helped frame the scope of the analysis during the scoping process. These resource related concerns were not considered major issues because they were resolved through project design and therefore were not used to develop alternatives analyzed in detail. These concerns are addressed within the effects analysis by resource in Chapter 3.

Alternatives

Section 102(2)(3) of the NEPA states that all Federal agencies shall “study, develop, and describe appropriated alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.”

The range of alternatives may extend beyond the limits set by Forest Plan goals and objectives under the NEPA; however, the NFMA requires that the selected alternative fully comply with the Forest Plan, unless the plan is amended in accordance with 36 CFR 219.10(F).

The range of alternatives developed and presented in this chapter was based on preliminary evaluation of the information gathered from public and internal comments during scoping activities and the purpose and need for the project. This project is intended to meet the Purpose and Need while maintaining resource conditions which are consistent with the HNF Forest Plan. Other influences included Forest Plan goals, objectives, standards and guidelines; and federal laws, regulations and policies. Within these parameters, the alternatives display a range of outputs, treatments, management requirements, design elements, and effects on resources.

In addition to the alternatives considered in detail, the interdisciplinary team (IDT) considered a number of other alternatives. Although these alternatives contributed to the range of alternatives, they were eliminated from detailed study for the reasons briefly described below.

Alternatives Considered But Not Given Detailed Study

Federal agencies are required by the Council on Environmental Quality (CEQ) to rigorously explore and objectively evaluate reasonable alternatives and 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. Therefore, a number of alternatives were considered but dismissed from detailed study for reasons summarized below.

The proposed action is limited to the specific fuel and vegetation treatment activities proposed on National Forest System (NFS) land in the Telegraph Vegetation Project area. That said, the geographic extent of some areas used to analyze different resource components (watershed, fuels and wildlife home ranges) may extend beyond the project area. The analysis of effects disclosed in this document includes those occurring from the entire "scope" of the decision. Scope is defined in 40 CFR 1508.25 as the range of actions, alternatives, and impacts to be considered in an EIS. Any new information that develops after the decision of this analysis would be considered prior to implementation.

Area Treatment with Verbenone

It was suggested by one commenter that the FS should treat the area with Verbenone. Verbenone is a MPB anti-aggregate pouch that is manually placed on trees to try to keep flying MPB away from a particular area. Since the MPB epidemic is largely over in the Telegraph project area and due to the large existing mortality that makes the area at low risk for future infestations for the immediate future, it was decided that this alternative did not need to be carried forward.

No Logging

It was suggested by one commenter that we should analyze a “no logging alternative.” For the EIS we will be analyzing a no action alternative that will display the effects of no treatment within the project area. The possibility of a prescribed burn only alternative was discussed within the IDT but was decided to be largely unfeasible and not likely to meet the project objectives stated in the project purpose and need.

Treat South and West of Elliston

One commenter suggested that we should look to treat the area directly south and west of the town of Elliston. This area does not lie within the Telegraph project boundary. Portions of this area were considered for treatment under the Elliston Face project. Because this area lies outside of the established project boundary it will not be considered in detail under the Telegraph Vegetation project.

Eliminate Units (with roads and noxious weeds present) from Fire Management Proposals

One commenter asked for an alternative to be developed “that eliminates units that have noxious weeds present on roads within units from fire management proposals.” The IDT interpreted this to mean eliminating any unit that has roads and weeds present from fire management proposals. Because some level of weeds are present along almost all roads within the project area this would essentially eliminate fire management from all units in which it is proposed. Eliminating all fire treatments from the project would not meet fuels and site preparation objectives and also would not meet purpose and need objectives.

Make Temp Roads Permanent, Create New OHV Routes, and Open Existing Closed Routes

Several commenters stated that they use the project are for motorized recreation and would like to see new temporary roads left in place, and old road closures opened back up. Other commenters asked for new OHV routes to be developed, including a motorized historic mine tour route. Since the Divide Travel process is ongoing and addresses most of these issues for now we won’t be addressing travel management decisions through the Telegraph Vegetation Project.

Alternatives Considered in Detail

The following section describes the No Action alternative and two action alternatives considered in detail. All alternatives are subject to compliance with all valid statutes on NFS lands. Impacts to resources are considered through the National Environmental Policy Act (NEPA) of 1969.

For an alternative to be analyzed and considered in detail, it must respond to the purpose and need for action and significant issues. This document has three alternatives that were analyzed in detail.

Alternative 1 is the No Action alternative. Alternative 2 is the Proposed Action as described on 23 and 24. Alternative 3 was developed based upon the significant issues that were identified during the scoping process (lynx/lynx habitat, elk cover and security, road construction, Jericho IRA, and wildlife movement/corridor). Maps of the action alternatives are located in appendix E of the DEIS.

Alternatives at a Glance

Table S- 2. Treatment summary by alternative

Treatment Type	Prescription	Alt. 1 Acres	Alt. 2 Acres	Alt. 3 Acres
Intermediate Harvest Acres Total	Improvement Cut, Slashing, Jackpot Burn	0	434	434
Precommercial thinning Acres Total	Precommercial Thin	0	1,758	1,261
	Pre-commercial Thin, Underburn	0	28	28
Prescribed Fire Acres Total	Slashing, Broadcast Burn	0	1,039	595
	Slashing, Handpiling, Burning Piles	0	11	11
Regeneration Harvest Acres Total	2-Aged Seedtree with Reserves	0	16	16
	2-Aged Seedtree with Reserves, Site Prep Burn	0	166	29
	2-Aged Shelterwood with Reserves, Site Prep Burn	0	155	132
	Clearcut with Leave Trees	0	651	288
	Clearcut with Leave Trees, Jackpot Burn	0	1,046	547
	Clearcut with Leave Trees, Site Prep Burn	0	1,355	838
	Clearcut with Reserves, Site Prep Burn	0	95	6
Grand Total		**0**	**6,754**	**4,185**

Logging system	**Alt. 1 Acres**	**Alt. 2 Acres**	**Alt. 3 Acres**
Ground-Based	0	3,450	2,052
Cable	0	468	237
Hand and/or fire treatment only	0	2,441	1,543
Mechanical pre-commercial thinning	0	394	352

Road Activity	Alt. 1 Miles	Alt. 2 Miles	Alt. 3 Miles
Temp Road Construction, followed by Full Obliteration	0	8.5	3.4
Road Maintenance	0	43.1	42.9
Road Reconstruction	0	32.6	28.3
Road Decommissioning	0	0.0	30.0
Total Haul Route Miles	0	84.2	74.6
Burning Activity	**Alt. 1 Acres**	**Alt. 2 Acres**	**Alt. 3 Acres**
RX Fire – hand treatment followed by burning	0	1,049	605
Pre-commercial thinning followed by burning	0	28	28
Harvest followed by burning	0	3,251	1,552
Total acres with burning activity	0	4,328	2,185

Stream Crossing Improvements

Road	Stream	Existing Structure	Summary of Work	Alt. 1	Alt. 2	
NFSR 123	Mary Ann Creek	1.8-foot X 2.5-foot metal pipe arch (28-foot length)	Replace culvert. Surface roadway above structure.	No	Yes	Yes
NFSR 123	Little Blackfoot River tributary	4-foot circular metal culvert (41-foot length)	Armor roadway with riprap along upstream fill slope between culvert and Little Blackfoot River bridge. Armor inlet and outlet w/ riprap.	No	Yes	Yes
NFSR 1801	Monarch Creek	6-foot X 4.7-foot metal pipe arch	Replace culvert with new structure to accommodate aquatic organism passage.	No	No	Yes
NFSR 1856	Mike Renig Gulch tributary (southern site)	1.5-foot circular metal pipe (23-foot length)	Remove damaged culvert; replace with rock ford.	No	Yes	Yes
NFSR 1856	Mike Renig Gulch tributary (northern site)	1.5-foot circular metal pipe (25-foot length)	Remove non-functional culvert; replace with rock ford.	No	Yes	Yes
NFSR 495	Clemmer Gulch (lower crossing)	1.5-foot circular metal culvert (25-foot length)	Replace culvert.	No	Yes	Yes

Road	Stream	Existing Structure	Summary of Work	Alt. 1	Alt. 2	Alt.3
NFSR 495	Clemmer Gulch (upper crossing)	2-foot circular metal culvert (41-foot length)	Replace culvert.	No	Yes	Yes
NFSR 4100	Little Blackfoot River	Ford	Upgrade crossing to bridge. Relocate a segment of NFSR 123 to utilize this improved crossing, and reconnect with the existing NFSR 123 alignment east of the existing Ontario Creek bridge.	No	No	Yes
NFSR 4104	Monarch Creek	4-foot X 5.5-foot metal pipe arch	Replace culvert with new structure to accommodate aquatic organism passage.	No	No	Yes
Total Number of Stream Crossing Improvements By Alternative				**0**	**6**	**9**

Alternative 1, No Action

Alternative 1 is the No Action alternative and describes the existing condition. Alternative 1 provides the baseline for a comparison of the environmental effects of the action alternatives.

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 1. The current situation as described by each resource in Chapter 3 would continue. Under the no-action alternative current management plans would continue to guide management of the project area. Ongoing work or work previously planned and approved, such as, but not limited to, routine road maintenance, weed spraying, trail maintenance, and firewood gathering would still occur. None of the actions proposed in any of the other alternatives would occur. Natural processes would continue.

Alternative 2

Alternative 2 is designed to be responsive to the Mountain Pine Beetle (MPB) outbreak in the area. The project area has experienced wide-scale tree mortality in the past few years. Treatments are needed to meet forest plan goals and direction, ensure diverse and sustainable forest stands and wildlife habitat in the future, improve conditions for fire suppression, recover economic value of dead and dying trees and to maintain and improve watershed conditions.

Establishing a greater diversity in species, age, size class and density can help the landscape to be more resilient. This project will also encourage aspen stand health and size and promote the reproduction of whitebark pine as well as provide opportunities for the local forest products industry.

This alternative was designed with publics within the local community and through the expertise of resource specialists on an interdisciplinary team. Unit treatments are designed to reduce ladder fuels and fine woody debris, create more heterogeneous stands, increase structural diversity, and restore the fire adapted ecosystem in the area by moving the landscape towards the desired conditions. This alternative meets the purpose and need to a much greater degree than any of the other alternatives as displayed in the Comparison of Alternatives Section and in Chapter 3. Appendix A displays a unit-by-unit table of all the proposed vegetative treatments within each alternative (see Proposed Alternative Map in Appendix E of the DEIS).

The following detailed features are included in alternative 2:

- To facilitate removal of timber products, approximately 8.5 miles of temporary road construction, and approximately 400 ground based landings are proposed. All road and landing construction would be decommissioned after harvest.
- Approximately 20.9 million board feet (or 20,888 MBF) of commercial timber would be harvested over approximately 3,918 acres.
- Approximately 1,050 acres are designated for prescribed fire and may include treatment with chainsaws prior to fire application if necessary. Approximately 537 acres are within the Jericho Mountain Roadless Area and are designed to keep fire in the Telegraph Watershed.
- Approximately 1,786 acres are identified for pre-commercial thinning to improve overall stand vigor, resiliency and species diversity.
- To improve watershed conditions, reduce sedimentation, increase sizing to accommodate 100-year flow events, and/or provide for aquatic organism passage, six road stream crossings would be improved.
- To meet BMP standards, approximately 84.2 miles of road will be maintained during the life of the project.

Alternative 3

This alternative was designed to address the following significant issues identified in scoping: elk security and hiding cover, lynx and lynx habitat, road construction and Jericho Mountain Inventoried Roadless area. To address concerns treatments were modified within elk security areas and other wildlife use areas, especially where some green stands still exist, pre-commercial thinning densities were increased to retain more elk hiding cover, treatments were dropped within some units in the WUI that met lynx habitat guidelines and temporary road construction was minimized. To address these concerns, this alternative treats approximately 2,569 less acres than the proposed action and leaves three percent more hiding cover for big game than the proposed action In addition; to improve watershed conditions, reduce sedimentation, increase sizing to accommodate 100-year flow events, and/or provide for aquatic organism passage, additional road stream crossings would be improved and non-system roads would be decommissioned in the project area to achieve water quality and big game security objectives (see Alternative 3 Map in Appendix E of the DEIS).

The following detailed features are included in alternative 3:

- To facilitate removal of timber products, approximately 3.4 miles of temporary road construction, and approximately 265 ground based landings are proposed. All road and landing construction would be decommissioned after harvest.
- Approximately 12.0 million board feet (or 12,022 MBF) of commercial timber would be harvested over approximately 2,642 acres.
- Approximately 606 acres are designated for prescribed fire and may include treatment with chainsaws prior to fire application if necessary. Approximately 418 acres are within the Jericho Mountain Roadless Area and are designed to keep fire in the Telegraph Watershed.
- Approximately 1,289 acres are identified for pre-commercial thinning to improve overall stand vigor and species diversity.
- To improve watershed conditions, reduce sedimentation, increase sizing to accommodate 100-year flow events, and/or provide for aquatic organism passage, nine road stream crossings would be improved and approximately 30.0 miles of non-system roads will be decommissioned in the project area.

- Associated with replacing individual crossing structures, more substantial road reconstruction would also occur near the west end of NFSR 123. An existing ford located where NFSR 4100 crosses the Little Blackfoot River would be replaced with a bridge, and then NFSR 123 would be relocated to use this crossing and follow a newly constructed roadway along the east side of the Little Blackfoot River and Ontario Creek, rejoining the current alignment east of the existing Ontario Creek crossing. From the intersection with NFSR 227, the first 0.6 miles of NFSR 123 would be decommissioned – including crossing removal and roadway rehabilitation. To meet BMP standards, approximately 74.6 miles of road will be maintained during the life of the project.

Terminology

To help our readers better understand the treatment descriptions included within the action alternatives, we are providing this section on commonly-used terminology. More definitions can be found in the glossary of the DEIS.

Silviculture

Intermediate Harvest: Harvest designed to enhance growth, quality, vigor, and composition of a stand after establishment. Density, structure, and/or composition of the stand are altered, and the stand maintains a forested appearance. A final harvest may or may not be conducted in the future depending on management goals. In Telegraph, these treatments result in 2-aged or even-aged stands.

Improvement Harvest: Harvest in a stand pole-sized or larger, to improve composition and quality by removing less desirable trees. In Telegraph, treatment would be some group selection to remove conifers in and near aspen, and also thinning conifers where no aspen is present, to leave behind a more open aspen/conifer matrix with some patches of regeneration. This treatment is proposed in mature stands dominated by or containing a mix of healthy Douglas-fir and/or aspen along with varying amounts of mostly dead lodgepole pine, where an increase in tree quality and an open structure would be emphasized. Diameters cut would generally range from 7 to 20 inches dbhand rare seral species such as ponderosa pine, whitebark pine, and aspen would be favored where they occur.

Precommercial Thinning: Young plantations established from past harvest. These stands range from 15 to 40 years old, and contain roughly 400 to 1,700 trees per acre and trees 2 to 7 inches in diameter. Some of the larger pine trees in these stands have mortality associated with the MPB infestation. Treatment would be pre-commercial thinning to leave behind more open, vigorous trees so that the individual stand is healthy and contributes to landscape diversity in species composition and density. Species such as ponderosa pine, whitebark pine, and aspen would be favored where they occur. After treatment, a target tree per acre (TPA) would be generally 150 to 400 depending on species and site conditions.

Regeneration Harvest: Harvesting to create a new age class, resulting in uneven-aged, 2-aged, or even-aged stands. These harvests could include clearcutting, seed/shelterwood cutting, and single or group tree selection depending on the tree species and desired regeneration. For 1- or 2-aged systems, most of the overstory is removed and the stand is dominated by new regeneration. For 3-aged systems, only single trees or small groups are removed, with regeneration established in gaps.

Clearcut: Most overstory trees are removed. *Leave trees* may be retained for snags or structure; leave trees are defined site specifically with prescriptions. Target density is minimal and the resulting stand is even-aged. In Telegraph, this is proposed in lodgepole stands that have been killed by beetle with few to no living trees of other species present. Generally live trees such as Douglas-fir would be retained. Lodgepole pine and/or whitebark pine natural regeneration is expected.

Seedtree: Most trees are removed except those needed to provide seed for regeneration. Seed trees may be retained as *reserves* to create a 2-aged stand or removed after seedling establishment to maintain an even-aged stand. In Telegraph, this is proposed in lodgepole pine dominated stands killed by beetle that have enough healthy trees (generally Douglas-fir or Engelmann spruce) to provide seed. A mix of

lodgepole pine, Douglas-fir, Engelmann spruce, and/or whitebark pine regeneration is expected that contributes to landscape diversity in species composition and density. The seed trees would be left as reserves.

Shelterwood: All trees are removed except those needed to provide seed and shelter for regeneration. A *group shelterwood* is left in a clumpy distribution. Shelter trees may be retained as *reserves* to create a 2-aged stand or removed after seedling establishment for an even-aged stand. In Telegraph, this is proposed in lodgepole stands killed by beetles that have a heavier mix of Douglas-fir and/or spruce to provide both seed and shelter. Douglas-fir and spruce dominated natural regeneration is expected. Most live trees would be retained. Shelter trees would be left as reserves.

Prescribed Burning is where fire is used as a treatment tool to accomplish a variety of goals, primarily fuels reduction and vegetation restoration. This category includes necessary slash preparation work. No ignition buffers would be required adjacent to stream courses. Hand firelines would be constructed as needed.

The following burning activities are proposed throughout the Telegraph Project area.

Slashing: Cutting small diameter trees (generally less than 6 inches dbh) mechanically or with chainsaws. Slashing is used to reduce ladder fuels to lower crown fire potential; to create a sufficient surface fuels to carry a prescribed fire; and/or to add fuels to meet woody debris goals for nutrient cycling. Prescriptions may call for the retention of certain species (such as ponderosa or limber pine), or a desired spacing in order to meet target stand conditions.

Pile/Burn: Hand or mechanical piling of fuels, generally follows slashing or harvest where slash disposal is needed but broadcast burning is not feasible or desirable. Slash would generally be burned when conditions are favorable, after curing. Target amounts of slash may be left to meet woody debris and nutrient cycling goals.

Jackpot Burn: Burning focused on concentrations of natural fuels accumulations and/or slash, generally after harvest or slashing. May involve burning loose piles or areas of slash where fuels are not generally continuous and/or overstory mortality not a concern (as in a natural opening). A minimal amount of mortality may occur in nearby trees greater than 6 inches dbh.

Site Prep burn: Burning following harvest where the bulk of the canopy was removed. The goal is to reduce logging slash and prepare the site for regeneration. It is a low to moderate intensity fire where direct and indirect mortality of leave trees is less than 5 percent (reserve, shelter, or seed trees left are minimal and a high priority to protect). The goals are to reduce fine woody debris (less than 3 inches diameter), reduce duff fuel loadings, expose 5 to 25 percent mineral soil, and retain most coarse woody debris (greater than 3 inches diameter) for nutrient cycling, seedling microsites, and wildlife habitat. Burning would be designed to target the low end of mixed severity to ensure adequate soil cover is retained. Additional objectives include generating heat to open serotinous cones and reduce competing vegetation. Units targeting whitebark pine regeneration will have mixed severity effects; units targeting other species will have low severity effects.

Broadcast Burning: This is ecosystem burning with goals of reducing hazardous fuels and restoring appropriate fire regimes to the landscape. These may include areas of:

Low Severity Burn: The purpose is to reduce ladder fuels and reduce overstory tree density to a minor extent. Slashing as needed would occur to create the desired fuelbed and fire intensity needed to accomplish objectives. An additional purpose is the re-introduction of fire to the ecosystem. Direct mortality less than 5 percent, indirect mortality less than 10 percent, and less than 1 acre mortality patches may occur in the overstory. Objectives include reducing fine woody debris (less than 3 inches diameter), reducing duff fuel loading while minimizing exposure of soil (less than 10 percent), and retaining most coarse woody debris (greater than3” diameter) for nutrient cycling and wildlife habitat.

Mixed Severity: Fire is used as a tool to achieve stand objectives with mixed severity. The purpose is to reduce ladder fuels and overstory tree density—heterogeneity in structure is desired. Overall mature tree mortality is generally 30 to 50 percent, occurring in patches. Mortality patch size and distribution are dictated by stand and burning conditions. Patches will generally not exceed 5 to 10 acres in large units (greater than 50 acres) or 20 percent of the unit size in units less than 50 acres. Slashing would occur as needed to create a fuelbed for burning and reduce ladder fuels. Natural openings would be favored by eliminating small tree encroachment. Other objectives include reduction of fine woody debris (less than 3 inches diameter) and duff fuel loadings. Limited amounts of mineral soil would be exposed (5 to 25 percent). Up to 30 percent of coarse woody debris (greater than 3 inches diameter) may be consumed but the remainder would be retained for nutrient cycling and wildlife habitat. Burning would be designed to target the low end of mixed severity to ensure adequate soil cover is retained.

Roads

Road Maintenance: The intention of road maintenance is to keep the road at an acceptable level that meets Best Management Practices (BMP) standards and allows for safe timber haul. Road maintenance activities would include surface blading, vegetation removal, minor slump repair, and drainage structure cleaning and/or installation.

Road Reconstruction: The intention of road reconstruction is to bring the road up to an acceptable level, in order to meet BMP standards and allow for safe timber haul. In addition to basic maintenance activities (listed above), reconstruction would also involve more significant roadway improvements, realignment, curve widening, or subgrade boulder or cobble excavation and removal.

Temporary Road: Temporary roads for the Telegraph Vegetation Project will be improved or constructed to a minimal standard in order to provide access for harvesting equipment and log trucks. These roads would be decommissioned following use. Telegraph Vegetation Project temporary roads will be decommissioned by obliteration, including: re-contouring (returning the prism to natural contour), removing culverts, replacing topsoil, placing woody debris upon the disturbed area to provide stability, and seeding the disturbed area.

Haul Road: Road used during project implementation to haul wood products on.

Road Decommissioning: For the Telegraph Vegetation Project decommissioning refers to full obliteration of the road: re-contouring (returning the road prism to natural contour), removing culverts, replacing topsoil, placing woody debris upon the disturbed area to provide stability, and seeding the disturbed area.

Design Feature Common to All Action Alternatives

Design features were developed to avoid or reduce potential adverse environmental impacts, as well as to respond to concerns expressed during the scoping process. Design features and mitigation measures are an integral part of each action alternative. Design features are described in chapter 2 and in the specialist reports in the project record.

Forest Plan Amendment

Implementation of any of the action alternatives would require a site specific amendment to the 1986 Helena National Forest Plan (Forest Plan) for lands encompassed by the Telegraph Vegetation Treatment Project. This site-specific amendment would exempt the Telegraph Vegetation Project from the Forest Plan forestwide standard for thermal cover on winter range in the Jericho herd unit (Big Game Standard 3, Forest Plan page II/17). The site-specific amendment would also exempt the Project from winter range restrictions in order to proceed with winter logging in select units and from limitations on the size of openings associated with clearcuts. forestwide Big Game Standard 6 (Forest Plan page II/19) directs that the Montana Cooperative Elk-Logging Study Recommendations in Appendix C of the Forest Plan will be followed during timber sale and road construction projects. Those recommendations include scheduling

logging outside of the winter period on winter range (Forest Plan page C/10) and limiting the size of clearcuts to 100 acres or less. The need for this amendment is predicated on winter range validation with Montana Department of Fish, Wildlife, and Parks (MFWP). Winter range in the Telegraph Vegetation Project is based on coarse distribution maps created by MFWP. These winter range maps represent general species distribution at a one square mile Section level. This amendment would be applicable only to implementation of the decision for the Telegraph Vegetation Project.

Monitoring

Monitoring and evaluation compares the end results being achieved to those projected in the Forest Plan. Monitoring is conducted on a sample basis to evaluate the overall progress in implementation of the Forest Plan, the assumption on which the Forest Plan is based, and to provide a feedback loop for determining the effectiveness of project and mitigation implementation. Monitoring and evaluation would be conducted as described in the Forest Plan and individual specialist reports. The monitoring plan for the Telegraph Vegetation Project will be included in the Record of Decision.

Comparison of Alternatives

This section provides a tabular summary of the effects of implementing each alternative. The tables display Purpose and Need, Key Issues, Harvest Systems, and Resource Measurement Indicators by alternative. The action alternatives address key issues to varying degrees, dependent upon specific alternative design elements.

Table S- 3. Purpose and need indicators by alternative

Purpose and Need Indicators	Alt 1	Alt 2	Alt 3
Habitat Resiliency, Diversity and Reforestation			
Acres of **aspen** promoted by treatment type	0	705	705
Acres of **whitebark pine** promoted by treatment type	0	781	366
Forest Vegetation Simulator estimated % **WBP** composition in example stand (stand 1 - TPA/%Total TPA – 5 years)	0	70/44%	70/44%
% project area treated			
• Regeneration Harvest	0	15	8
• Intermediate Harvest	0	2	2
• Pre-commercial Thinning	0	8	5
• RX Fire	0	4	3
• Cumulative (w/past act)	16	37	29
Acres of old growth adjacent to treatment units	0	669	456
Hazardous Fuels Reduction			
Acres of treatments that reduce surface fuel loading levels, remove vertical standing dead, and break up contiguous dead and down vegetation that would alter fire spread and provide for firefighter and public safety.	0	4,996	2,924
Provide Wood Products for Local Economies			
Volume production (MBF)	0	20,888	12,022
Watershed Values			
Miles of Road Decommissioned	0	0	30

Purpose and Need Indicators	Alt 1	Alt 2	Alt 3
Stream Crossing Improvements	0	6	9

Table S- 4. Significant issues by alternative

Issues	Alt 1	Alt 2	Alt 3
Lynx and lynx habitat			
Acres of multistory snowshoe hare habitat in the WUI within the project boundary	4.472	3,277	3,897
Acres of stand initiation snowshoe hare habitat in the WUI within the project boundary	1,455	781	1,086
Acres of early stand initiation habitat in the WUI within the project boundary	535	1,312	900
Elk security and hiding cover			
Acres of hiding cover			
Jericho Elk Herd Unit	25,810	23,423	24,454
Spotted Dog/Little Blackfoot Elk Herd Unit	53,149	49,328	50,801
Acres of hiding cover in security areas			
Jericho Elk Herd Unit	3,139	2,821	3,074
Spotted Dog/Little Blackfoot Elk Herd Unit	17,196	16,770	16,873
Acres of hiding cover in intermittent refuge areas			
Jericho Elk Herd Unit	863	765	854
Spotted Dog/Little Blackfoot Elk Herd Unit	1,957	1,678	1,869
Road Activity (miles)			
Temporary Road Construction followed by full obliteration	0	8.5	3.4
Road maintenance	0	43.1	42.9
Road reconstruction	0	32.6	28.3
Haul routes	0	84.2	74.6
Jericho Inventoried Roadless Area			
Acres of Prescribed burning	0	537	418

Table S- 5. Harvest systems and acres by alternative

Harvest Systems Used	Alternative 1	Alternative 2	Alternative 3
Ground based	NA	3,845	2,405
Cable	NA	468	237
Hand and/or fire treatment only	NA	2,441	1,543
Total	**NA**	**6,754**	**4,185**

Table S- 6. Resource measurement indicators by alternative

Resource (measurement indicator)	Alt 1	Alt 2	Alt 3
Hydrology/Aquatic Organisms			
Water Quantity Cumulative Effects (percent water yield increase over undisturbed forest)			
Little Blackfoot –Hat Creek	8%	9%	9%
Mike Renig Gulch	8%	10%	9%
Ontario Creek	10%	12%	11%
Telegraph Creek	12%	14%	13%
Sedimentation from treatment units (tons, probability of sedimentation in the first year after treatment)			
Little Blackfoot -Hat Creek	N/A	0.01 (16%)	0.01 (16%)
Mike Renig Gulch	N/A	0.10 (18%)	0.06 (18%)
Ontario Creek	N/A	0.13 (13%)	0.04 (13%)
Telegraph Creek	N/A	0.23 (12%)	0.16 (12%)
Sedimentation from Roads (average tons/year)			
Little Blackfoot -Hat Creek	4.3	0.1	0.1
Mike Renig Gulch	11.2	1.1	1.1
Ontario Creek	2.6	0.4	0.4
Telegraph Creek	3.5	0.6	0.6
Road Decommissioning (miles decommissioned within 150 ft. of a stream)			
Little Blackfoot -Hat Creek	0	0	0.7
Mike Renig Gulch	0	0	0.5
Ontario Creek	0	0	0.5
Telegraph Creek	0	0	3.9
Vegetation			
Snags/ac in Third Order Drainages (post treatment)			
Drainage 1106B	33	20	27

Resource (measurement indicator)	Alt 1	Alt 2	Alt 3
Drainage 1107	37	26	30
Drainage 1108-1	32	26	28
Fuels			
Acres treated with in Wildland Urban Interface (WUI)	0	6,753	4,184
Soils			
Acres of predicted detrimental soil disturbance – short term	0	575	339
Wildlife			
Elk			
% Elk habitat effectiveness on summer range			
Jericho Herd Unit	56%	56%	56%
Spotted Dog/Little Blackfoot Herd Unit	56%	56%	56%
% Elk hiding cover by elk herd unit on summer range			
Jericho Herd Unit	73%	66%	69%
Spotted Dog/Little Blackfoot Herd Unit	65%	60%	62%
% Hiding cover /open road density mi/mi^2 by elk herd unit			
Jericho Herd Unit	73%/1.27	66%/1.27	69%/1.27
Spotted Dog/Little Blackfoot Herd Unit	65%/1.06	60%/1.06	62%/1.06
% Elk security habitat by elk herd unit			
Jericho Herd Unit	12%	12%	12%
Spotted Dog/Little Blackfoot Herd Unit	30%	30%	30%
% Elk Intermittent Refuge Areas by elk herd unit			
Jericho Herd Unit	3%	3%	3%
Spotted Dog/Little Blackfoot Herd Unit	4%	4%	4%
% Elk thermal cover by elk herd unit on winter range			
Jericho Herd Unit	5%	5%	5%
Spotted Dog/Little Blackfoot Herd Unit	3%	3%	3%
Lynx			
% Lynx Analysis Unit (LAU) in an early stand initiation structural stage			
di-03	1.3%	1.4%	1.4%
di-04	3.3%	9.2%	6.5%
di-05	2.5%	2.5%	2.5%
% LAU regenerated by timber harvest on NFS land in a 10-year period			

Resource (measurement indicator)	Alt 1	Alt 2	Alt 3
di-03	0.03%	0.54%	0.40%
di-04	0.07%	13.09%	6.64%
di-05	0.95%	0.95%	0.95%
Other wildlife resources			
Acres of potential Flammulated Owl habitat in the project area	6,688	5,077	5,506
Acres of potential Northern Goshawk habitat (Nesting) in the project area	9,524	7,057	7,919
Acres of potential Northern Goshawk habitat (Foraging) in the project area	17,709	12,172	14,320
Acres of potential Pileated Woodpecker Habitat in the project area	7,643	5,926	6,364
Acres of potential Hairy Woodpecker Habitat in the project area	7,746	5,930	6,368
Acres of potential American Marten habitat in the project area	12,036	8,855	10,069
Acres of potential Fisher habitat (Summer) in the project area	4,857	3,500	4,119
Acres of potential Fisher habitat (Winter) in the project area	20,103	14,111	16,483
Noxious Weeds			
Predicted acres of noxious weed infestation due to proposed activities	0	575	339

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Chapter 1. Purpose of and Need for Action

Document Structure

The Telegraph Vegetation Project Draft Environmental Impact Statement (DEIS) is a site-specific effects analysis of management activities proposed in the Telegraph Landscape. The Forest Service has prepared this DEIS in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This DEIS discloses the direct, indirect, and cumulative environmental impacts that would potentially result from proposed activities under each alternative in addition to determining any irreversible and irretrievable commitment of resources that would result from the actions proposed to address forest health, watershed rehabilitation, fuels management, and timber production goals of the Helena National Forest Plan, as amended (1986a). This DEIS is prepared according to the format established by Council on Environmental Quality (CEQ) regulations to implement the NEPA found in 40 CFR 1500-1508.

This DEIS herby incorporates by reference the project record (40 CFR 1502.21) and the Helena National Forest Plan, as amended; and the Forest Plan Final Environmental Impact Statement (FEIS) and Appendices. The project record contains specialist reports and other technical documentation used to support the analysis and conclusions in this DEIS. These multiple specialist reports were developed specifically for the Telegraph Vegetation Project.

The Forest Service uses the most current and complete data available. GIS data and product accuracy may vary. They may be: developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation, incomplete while being created or revised, etc. Due to rounding, acre totals are approximate. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The Forest Service reserves the right to correct, update, modify, or replace GIS products without notification.

This document is organized into four chapters:

- ***Chapter 1. Purpose and Need for Action***

The chapter includes introductory information on the background and history, the purpose of and need for management, and the agency's proposal for achieving the purpose and need in the Telegraph Landscape. This section also details the regulatory framework for this project, Helena National Forest Plan direction, decisions to be made, how the Forest Service informed and involved the public in the development of the proposal and how the public responded.

- ***Chapter 2. Alternatives Considered***

This chapter provides a detailed description of the alternative methods developed for achieving the stated Purpose and Need of the project (including the no action alternative). These alternatives were based on key issues raised by the Interdisciplinary Team (IDT), other agencies, and/or the public during scoping. This section provides a summary of the past, present, and reasonably foreseeable activities in the resource area. This chapter also includes Design Criteria intended to reduce potential impacts to specified resource areas identified. Finally, this section provides summary comparison tables of the alternatives and their effects.

- ***Chapter 3. Affected Environment & Environmental Consequences***

This chapter describes the natural and human environments potentially affected by the proposed action and alternatives, and discloses anticipated potential effects of these actions. This chapter is organized by resource area followed by an index of key terms used throughout chapter 3.

- ***Chapter 4. Consultation and Coordination***

This chapter provides a glossary, literature cited throughout the DEIS, list of preparers and agencies consulted during the development of the environmental impact statement.

- ***Appendices***

The Appendices provide more detailed information to support the analyses presented in the draft EIS. Appended materials in this document include a unit by unit treatment summary (Appendix A), a Forest Plan consistency table (Appendix B), cumulative effects information (Appendix C), the appendices for the wildlife section (Appendix D), and a map section (Appendix E).

Additional documentation, including more detailed analyses of the resources in the area, is found in the project record, located at the Helena Ranger District, 2880 Skyway Drive, Helena, Montana 59602. Project record documents are available for review by contacting the project leader (contact information for the project leader is provided in the abstract of this document).

Introduction and Background

The Telegraph Vegetation Project area is approximately 23,669 acres (figure 1) in size and is located roughly 15 miles southwest of Helena, and 5 miles south from Elliston, MT, in the Little Blackfoot drainage west of the Continental Divide. The project is located within all or part of Sections 14, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 and 36 of T9N, R6W; Sections 25 and 36 of T9N, R7W; Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 26, 27, 28, 29, 30, 31, 32, 33 and 34; Sections 1 and 12 of T8N, R7W; and Sections 4, 5, and 6 of T7N, R6W; Powell County, MT; PMM.

This project is intended to move the resource area toward desired conditions and designed to respond to the goals and objectives outlined in the Helena National Forest Plan (USDA Forest Service 1986). The Forest Plan defines the general management direction for all Helena National Forest (HNF) resource areas. It provides both forestwide and area-specific goals, standards, and guidelines. This DEIS documents the analysis of effects of the proposed activities on the Telegraph Vegetation Project area.

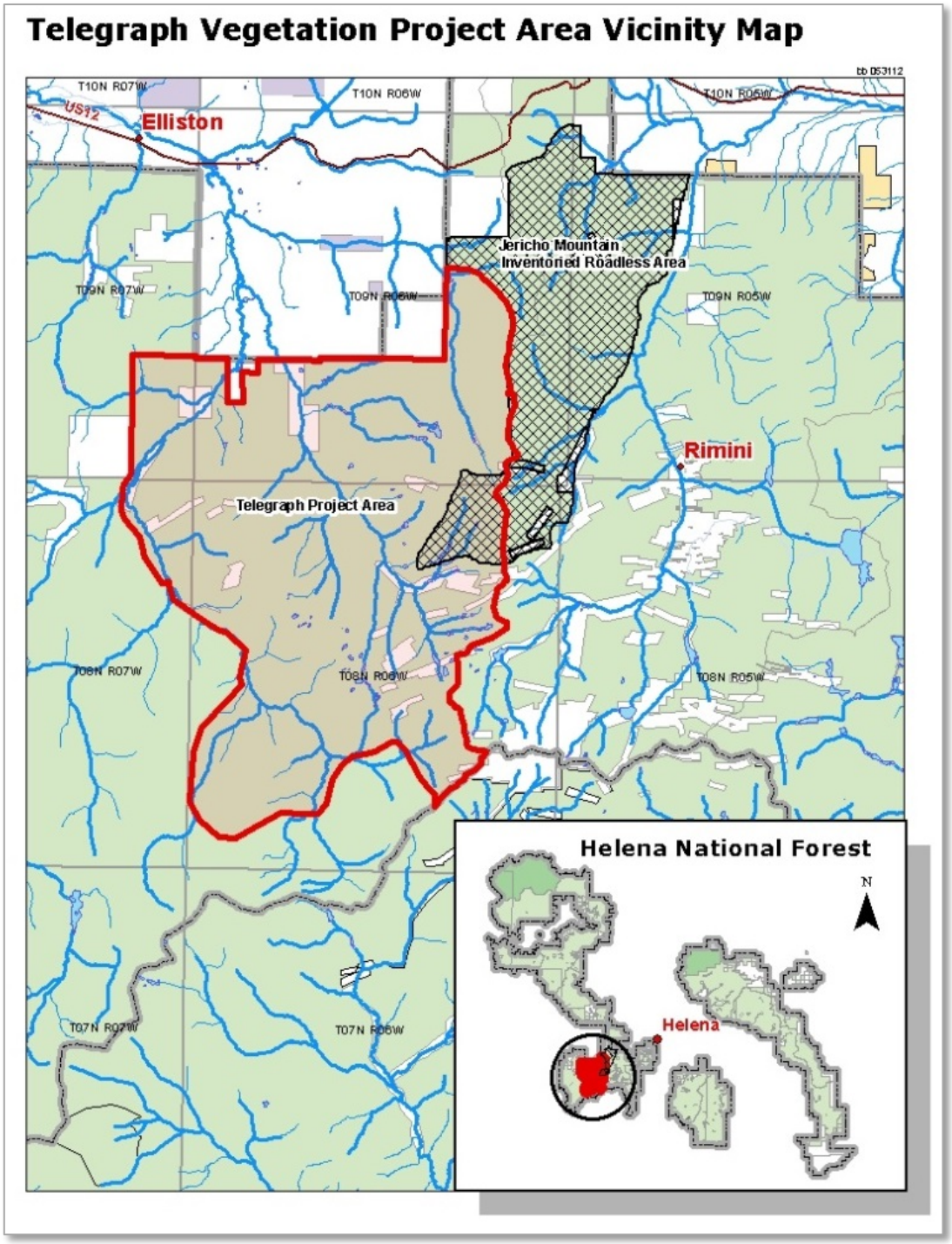


Figure 1. Telegraph Vegetation Project vicinity map

The Project Area is characterized by productive lodgepole pine growing on Douglas-fir and subalpine fir habitat types that were initiated by wildfire prior to 1900. Over the last century the homogeneity of the forest was fragmented by modern timber harvest from the 1960s to 1990s, which predominantly consisted of clearcutting patches usually (but not always) less than 40 acres where it was feasible to build roads. This occurred on roughly 16 percent of the Project Area. While the result was to diversify age classes, the patch size and pattern is not necessarily consistent with what would have been created by natural disturbance.

In the case of historic fire occurrences, while stand replacement effects would have been typical, there would also have been mixed and low severity fires that left remnant components. Aside from the patchwork of past harvest, forests were relatively uniform and characterized by densely growing mature lodgepole pine trees. As a result, the recent Mountain Pine Beetle (MPB) outbreak caused extensive mortality peaking in 2009; affecting over 94 percent of the Project Area at intensities greater than 90 percent pine mortality in some stands (figure 2). While many forests contained little diversity, there are stands mixed with Douglas-fir, subalpine fir, Engelmann spruce, aspen, and/or whitebark pine. Additionally, there are areas dominated by these species and natural meadows.

The Divide landscape historically burned an average of 39,124 to 170,242 acres per decade (Hollingsworth 2004), but no large fires have occurred in the last century. Although we will never know site-specifically what the results would have been without fire suppression, it is reasonable to conclude that to some extent the lack of fire has altered vegetation. This would have occurred even in forests with naturally long fire return intervals because not every stand would have been starting at a theoretical year “0” for fire return when suppression began. Further, although large stand-replacing events play a major role in lodgepole types, less severe intervening disturbances would also have occurred. The crown fire cycle is 110 to 170 years on these types (USDA 1990); however, the interval between any two fires in one area might be only a few years (Fischer and Clayton 1983). Fire suppression has decreased acreage burned in normal fire seasons, reducing the natural variability in landscape patterns that would otherwise be created by small fires (USDA 1990). Historically, a 5-year crown fire event could be expected to impact roughly 1 percent of the lodgepole type, in patches of an average 100 acres; while a 30-year event would impact 10 percent with an average of 10,000-acre size (USDA 1990).

While fire suppression was successful, the other primary disturbance agent in lodgepole types—MPB—could not be suppressed. Historic evidence shows that outbreaks were often spatially concentrated and severity mixed; the severity and magnitude of the recent outbreak is likely a result of high levels of susceptible pine forest, wildfire suppression, and recent warming climate conditions (Lewis 2008). The recent outbreak of MPB resulted in a mix of effects, commonly stand-replacing but also mixed severity in less susceptible stands (younger, smaller trees, and/or mixed species). Quantity and types of biological legacies differ greatly among disturbances leading, in turn, to widely varying starting points for stand structural development (Franklin et al. 2002). Some of the differences between MPB and fire include residual vegetation and downed woody debris which influence forest development.

Ecosystem response following MPB outbreak seems to be slower than to fire, with seedlings establishing over several decades following a MPB outbreak (Axelson et al. 2009). Low or moderate intensity MPB mortality do not result in significant increases in light to the forest floor, favoring regeneration of shade tolerant species; on the other hand, intense MPB infestation which removes the majority of the overstory will favor regeneration of shade intolerant species (Axelson et al. 2009). Both of these trends would occur in the Telegraph area depending on stand-level MPB mortality intensity. Without fire, reforestation may take longer and/or be less dominated by lodgepole because this seral species regenerates best in sunny conditions with mineral soil exposure via serotinous

cones opened by fire. Even so, as the dead and dying stands "unravel," if a shade tolerant understory is not present lodgepole would still regenerate in many areas from the sun heating the cones.

Figure 2. Forested stand of Lodgepole Pine with greater than 90 percent mortality caused by MPB

With MPB, all of the trees killed remain onsite and become downed fuels over time, while with a fire some of this material would be consumed. The extent of downed fuels expected in the near future on this landscape will be quite continuous across a large extent. This condition could result in large scale, severe fire behavior if a wildfire were to occur, not in terms of crown fire, but rather long-duration surface fire in the woody debris. It would also directly increase the potential of wildfire to threaten life, property, and resource values.

Purpose and Need for Action

Uniform forest conditions dominated by dense even-aged stands of mature lodgepole pine were established in the Telegraph landscape by extensive clearing in the early part of the century. This was followed by cool, moist growing conditions and exclusion of wildfire which caused forests to become highly susceptible to the MPB. The result has been wide-scale tree mortality in the past few years. Among many other ecosystem effects, this tree mortality will likely reduce fire suppression effectiveness.

Treatment is needed to meet Forest Plan goals and direction, ensure diverse and sustainable forest stands and wildlife habitat in the future, improve conditions for fire suppression, recover economic value of dead and dying trees, and maintain and improve watershed values. This translates in a general sense to providing multiple ecosystem services related to sustainable forest cover. This suite of values would best be provided by a landscape that is resilient with respect to natural disturbance regimes.

Based upon the existing condition and consistent with the Forest Plan direction and its goals, the Helena National Forest IDT identified the Purpose and Needs for the project area.

1. Resiliency, Diversity and Reforestation

    - Develop forest conditions across the landscape by improving resiliency to disturbances such as to insects, disease, fire, and drought through maintaining existing long-lived early seral species and increasing their overall representation across the landscape.

    - Enhance species, age class diversity and density to provide opportunity for future diversification thus helping the landscape to be more resilient.

- Establish diverse and robust reforestation on suitable timber acres killed by MPB.
- Manage previously harvested stands to ensure vigorous growth and high resilience.

2. Hazardous Fuels Reduction
   - Improve conditions for fire suppression as well as public and firefighter safety in the area in the event of a wildfire.
3. Provide Wood Products for Local Economies
   - Utilize dead and dying trees to provide forest products to the local timber industry, contributing to short term forest products and providing for long-term sustainability of timber on National Forest System lands.
4. Maintain and Improve Watershed Values
   - Improve water quality through reduction of sediment delivery by conducting various road treatments and stream crossings improvements.

The following sections discuss in greater detail the goals and objectives related to these needs.

Resiliency, Diversity and Reforestation

Forested environments within the Telegraph Landscape are influenced by climate, topography, fire, and human activity. Over time, past harvesting practices, exclusion of wildfire, insects and diseases, and other factors have changed the species composition in the resource area from that which existed prior to European settlement. The species composition that now exists contains many short-lived and fire-intolerant tree species. As a result, the landscape has become less resilient to insects, disease, fire and drought.

A primary goal of this project is to maintain and increase diversity in species and density to enhance resilience across the landscape. The vigor, abundance, and distribution of special habitat features (whitebark pine, ponderosa pine, aspen, old growth, and snags) would be maintained and/or enhanced as appropriate for site conditions, short and long term. Increasing the abundance of these species would contribute to improving resiliency to disturbances such as fire, insects, and disease. Although, all seral species (aspen, ponderosa pine and whitebark pine) currently exist in the Telegraph Landscape, this action is needed because, they occur in lower quantities than they did historically due to selective harvesting, fire exclusion, insects and disease. These past activities created a more uniform landscape comprised of dense forests (Douglas-fir and lodgepole pine) susceptible to insect and wildfire mortality. In addition, a large-scale MPB epidemic has killed most of the mature lodgepole pine and ponderosa pine (see figure 4).

Simply put, a resilient landscape is diverse so that not all areas are equally susceptible to the same disturbances at the same time. Although even-aged stands and stand replacement mortality are a natural part of lodgepole pine ecology, this landscape was likely more homogeneous than it would have been historically.

While lodgepole pine forests are emphasized because of their extent, the resiliency of other types (Douglas-fir, whitebark pine, subalpine fir, Engelmann spruce, and aspen) is also important. Drier Douglas-fir forests may have been influenced more profoundly by fire suppression due to a naturally

more frequent fire return interval. These forests are dominated by relatively densely stocked mature Douglas-fir with varying amounts of ladder fuel development, increasingly susceptible to Douglas-fir beetle (DFB) and western spruce budworm (WSB). Natural fire would have created more of a mosaic of open stands at multiple seral stages. Subalpine fir and Engelmann spruce dominate some of the highest elevation and/or moist sites; persist as fine-scale refugia in riparian or rocky areas; and are minor components in some lodgepole and Douglas-fir forests. These late-seral, shade-tolerant trees have been favored by fire exclusion and MPB.

Figure 3. Existing condition in the project area

Thinning some of the stands established after past harvest could promote resilience, individual tree growth, and density diversity of these younger forests that provide the primary green forests on a regenerating landscape. Encouraging a mosaic of reforestation and downed-fuel conditions would increase the potential that natural wildfires would burn at sizes and intensities more consistent with historic regimes. Salvage logging of gray phase, beetle killed lodgepole stands would alter the behavior and severity of potential future wildfires (Collins et al. 2012). This would help ensure that a full range of ecological and social values are provided through time. Throughout the century following MPB infestation, fire behavior will be influenced by changes in canopy and surface fuel loads, species composition, and stand structure (Collins et al. 2012). Untreated areas in all alternatives would remain unchanged in the short term, and generally over time develop into denser forests with higher components of shade tolerant species. Over the course of decades, windthrow beetle-killed trees will contribute large surface fuels and may increase the potential for severe soil heating in the case of a wildfire in untreated areas (Collins et al. 2012). Treated and untreated areas together would provide a mix of forest and habitat conditions.

Figure 4. Past harvest units

Hazardous Fuels Reduction

Approximately half of the Telegraph Project area is designated as wildland-urban interface (WUI) in the Powell County Community Wildfire Protection Plan. The community of Elliston, private land, homes, recreational use, and the Highway 12 corridor are major infrastructures or values at risk that influence WUI designation (see figure 5).

There is a need for hazardous fuel reduction in the Telegraph Landscape because the increase in fuels increases the potential of wildfire to threaten life, property, resource values and infrastructure. This project proposes to strategically locate treatments along ridgelines, along valley bottoms, in conjunction with natural openings/barriers, and along roads/trails which would allow for safer, more efficient and direct initial attack of unwanted fires by fire suppression forces. Removal of the dead overstory would alleviate the risk of increased future fuel loadings and improve safety conditions for firefighters/forest workers from falling dead trees.

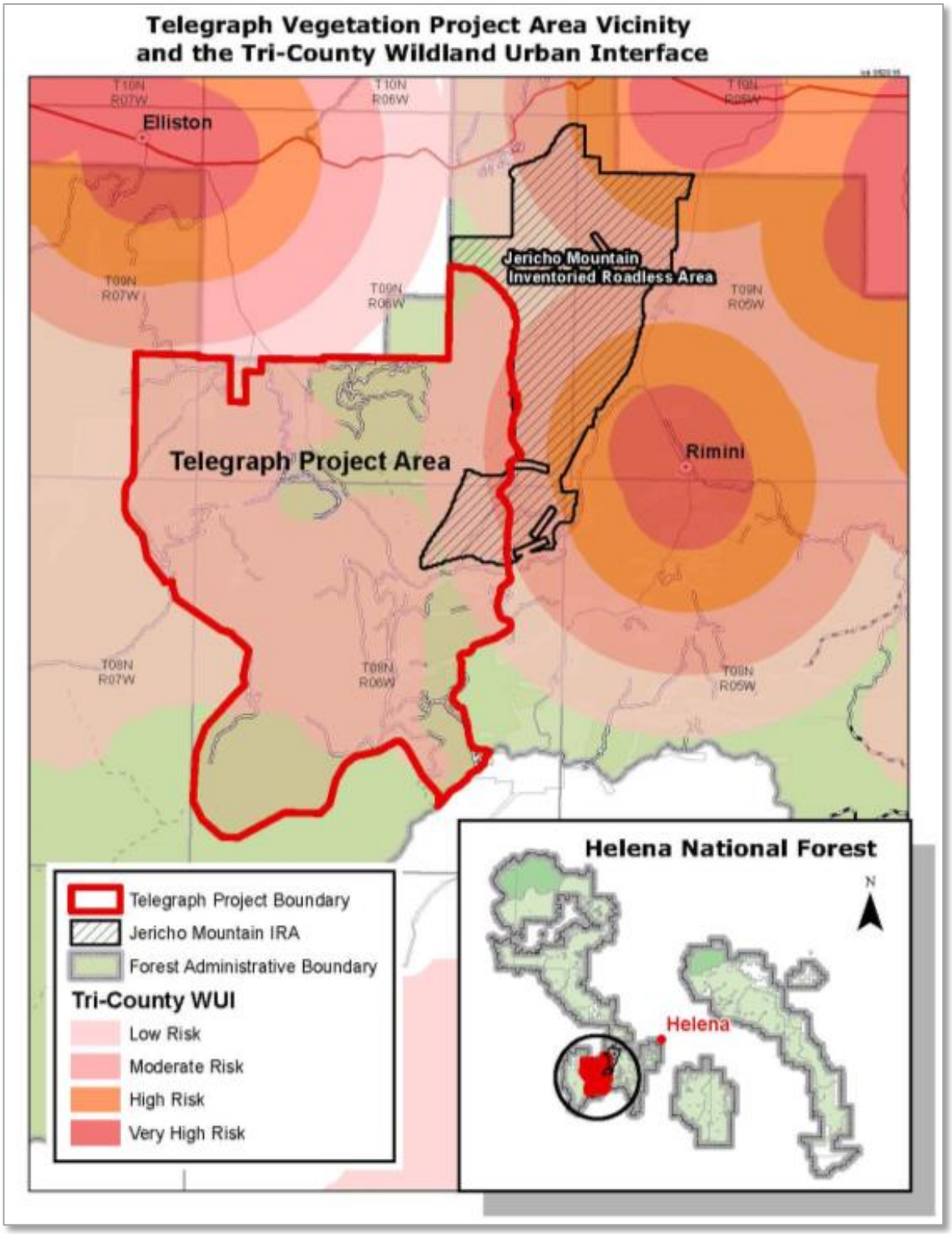


Figure 5. Telegraph Vegetation Project - Wildland Urban Interface

Provide Wood Products for Local Economies

There is also a need to meet Forest Plan objectives and goals as they relate to timber management. The availability of timber products for local and regional markets has been reduced in recent years. This caused a loss of job opportunities, evidenced by recent mill closings. To support a viable wood products industry, wood products from a variety of sources should be available. Forestwide objectives in the Forest Plan for the timber resource include managing suitable acres with stocking control techniques, such as pre-commercial and commercial thinning, and successfully managing any insect or disease outbreaks (Forest Plan II/4). With approximately 75 percent of the project area being lands allocated for a timber management emphasis, this project is responsive to the Forest Plan direction.

Dead and dying trees from this project would be utilized to provide forest products to the local timber industry that contribute to short-term forest products and provide for long-term sustainability of timber on National Forest system lands. The revenue generated from forest products from this project has the potential to affect local economies. People and economies are an important part of the ecosystem. The use of renewable resources generates employment and income in the surrounding communities and counties, and generates revenues returned to the Federal Treasury or used to fund additional on-the-ground activities to accomplish resource management objectives. These trees have been dead and/or dying since 2009, to be responsive to the deterioration of product and its value it is important to be quick to respond and remove this material urgently while it still has product value.

The proposed action would increase timber productivity on the affected suitable timber land. It would help by managing suitable acres using stocking control techniques, such as pre-commercial and commercial thinning.

Maintain and Improve Watershed Values

The Telegraph project area encompasses portions of four 6th-order hydrologic unit codes (6th-HUC) drainages. These include: Ontario Creek, Telegraph Creek, Mike Renig Gulch, and Little Blackfoot River-Hat Creek. There are impaired stream reaches as identified on the State of Montana Clean Water Act section 303(d) list adjacent to and immediately downstream of the project area. Stream impairments in the project area are primarily a result of past mining activity, forest roads, and livestock activities.

A goal of this project is to improve water quality. Therefore, there is a need to reduce sediment delivery to streams by conducting various road treatments and stream crossing improvements.

Forest roads have the potential to negatively affect watershed values. The impact of a road is generally continuous whether the road is open or closed to public use, although unused roads are often partially stabilized by vegetation over time. However, without de-compaction of road surfaces, top soil may remain unavailable to plant roots, preventing the road prism from re-vegetating to a point that sufficiently decreases concentrated runoff. Additionally, subsurface hydraulic connectivity would continue to be impaired on roads with cut-fill construction without de-compaction and re-contouring of the road (Gucinski et al. 2001). Further, undersized culverts or improperly designed road-stream crossings on closed, but not decommissioned roads, could continue to be a source of road sediment without restoration and stabilization of the stream channel (Madej 2000).

This project is designed to specifically address the Helena National Forest Plan forestwide management direction on page II/1 states in goal 10, “Maintain high quality water to protect fisheries habitat, water based recreation opportunities, and municipal water supplies and to meet or exceed state and Federal water quality standards.” Also, the general watershed guidance under the forestwide standards, page II/25, guides the forest in correcting problems with soil erosion (item #3);

mitigating adverse effects on water-related beneficial uses (item #4); and controlling non-point pollution sources (item #5).

Proposed Action

The proposed action was designed to meet the purpose and need, forest plan management area objectives, and to be responsive to issues raised by Forest specialists. The proposed action treatment summary table including a unit-by-unit treatment description can be found in Appendix A of this DEIS.

Implementation of proposed treatments would (Maps - Appendix E) include the use of ground-based logging equipment, cable systems, and hand and/or fire treatments. Approximately 8.5 miles of temporary road construction, 43.1 miles of road maintenance, and 32.6 miles of road reconstruction would be needed to implement the proposed action. There would be an estimated total of 84.2 miles of haul route needed. All temporary roads would be obliterated after project activities have been completed. Post treatment activities could include approximately 4,329 acres of underburning, site prep burning, broadcast burning, jackpot burning, and handpiling/burning. Approximately 537 acres of slashing generally small diameter trees and broadcast burning would occur within the Jericho Mountain Inventoried Roadless Area.

A site-specific amendment may be needed related to thermal cover on winter range in the Jericho herd unit (Big Game Standard 3, Forest Plan page II/17). This site-specific amendment would also exempt the Project from winter range restrictions in order to proceed with winter logging in select units and from limitations on the size of openings associated with clearcuts. Any site-specific amendments to the Helena National Forest Plan would follow the transition language found in the 2012 Planning Rule (16 U.S.C. 1604 (i)).

Regulatory Framework

Several important laws, executive orders and policies form the regulatory framework applicable to managing the HNF, a partial list follows. While most pertain to all Federal lands, some of the laws are specific to Montana. This framework is also an integral part of the purpose and need for action. In addition to the following laws and documents, each specialist report identifies the regulatory framework that is applicable to their analysis. Disclosures and findings required by these laws and orders are contained within each resource specialist report and in the project file.

The National Forest Management Act (NFMA) of 1976 governs vegetation management on national forest lands. Several sections in the act, and its accompanying regulations (USDA Forest Service, 1982), specifically address terms and conditions relevant to the vegetation resource. These include sections on timber suitability and management requirements for vegetative manipulation, including tree regeneration timeframes and opening size limits.

The size of harvest openings created by even-aged silvicultural systems will normally be 40 acres or less, and the creation of larger openings requires 60-day public review and Regional Forester approval. However, where natural catastrophic events such as fire, windstorms, or insect attacks have occurred, 40 acres may be exceeded without 60-day public review and Regional Forester approval, provided the public is notified and the environmental analysis supports the decision (USDA 2002). Many proposed treatments in the Action Alternatives would exceed 40 acres due to extensive MPB-caused mortality and a desired to emulate natural disturbance patch sizes, as supported by this analysis. The public is hereby notified of these areas (Forested Vegetation Specialist Report). In these units and contiguous groups, prescriptions would include varying amounts of tree retention in surviving components, potentially buffering openings, leaving individuals and clumps throughout

units, and including patches of inoperable areas. However, because the overstory is largely dead and reforestation is required, these are considered openings.

The National Environmental Policy Act (NEPA 1969). The Forest Service has prepared this environmental impact statement (EIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EIS discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

As required under the **Federal Land Assistance, Management, and Enhancement (FLAME) Act** of 2009 the Secretaries of Interior and Agriculture are required to submit a report to Congress on their efforts in producing an integrated wildfire management strategy. The Wildland Fire Leadership Council guided the development of the National Cohesive Wildland Fire Management Strategy, known as the Cohesive Strategy (USDA/DOI 2011), that provides consistent interagency direction.

Powell County prepared a **Community Wildfire Protection Plan (CWPP)** for the county in 2005 in conjunction with the concern Powell County Stakeholders. This project also considers the CWPP for Lewis & Clark, Broadwater and Jefferson Counties called the Tri-County CWPP which was developed for the three counties in 2005 thru the Tri – County Fire Safe Working Group. The CWPP recommends treatment options be proposed on a landscape scale. These treatments should reduce hazardous fuels and reduce risks to values that are important to communities, people, and natural resources. These treatments include hazardous fuels reduction treatments that remove or modify wildland fuels, lessen post-fire damage, and limit the spread or proliferation of invasive species and diseases. Activities to accomplish these objectives include prescribed fire, mechanical thinning, grazing, or combinations of these and other methods.

The Northern Region Overview (1998) sets priorities for ecosystem restoration and focuses the Forest Service Natural Resource Agenda for the National Forest lands of the Northern Region. For forest vegetation, the overview establishes indicators of risk to the proper functioning conditions of this ecosystem. Risk indicators include: (1) the loss of species composition at the cover type level, (2) the change in landscape level fragmentation, and (3) stand level structure as measured by density and seral stage/size class distribution. The overview also describes the importance of restoring ponderosa pine, western larch, and whitebark pine (USDA, 1998). The overview identifies aspen, whitebark pine, ponderosa pine, sagebrush, and grasslands among the areas of concern currently at risk in the Northern Region. The agents of change listed for these areas of concern include mountain pine beetle (MPB), fire (including suppression), blister rust, root disease, noxious weeds/exotic species, grazing, and timber harvest.

The Helena National Forest Plan (1986a) (FP), as amended, provides detailed direction and guidance for managing public lands on the HNF. The FP embodies the provisions of NFMA, its implementing regulations, and other guiding documents. Guidance from the Record of Decision for Amendments to the Forest Plan (1986) is incorporated in the Forest Plan. Forest Service Manuals (FSM) and Forest Service Handbooks (FSH) provide direction and were applied to the development of this project. This plan also identifies Management Areas (MAs) and provides direction for each. The actions proposed in this project are designed to be consistent with the Forest Plan, including all plan amendments currently in effect, to the extent possible given the existing conditions. Where Forest Plan direction may not be met, a site-specific Forest Plan amendment would be proposed.

The Forest Plan provides two types of management direction, forestwide direction and management area (MA) direction. forestwide direction, which applies to all MAs, is located on pages II/14 through II/36 of the Forest Plan. Table 1 displays the management areas within the project area and the following table lists the acres of each MA found within the project boundary, and relevant goals

by MAs as described in the Forest Plan. The project area overlaps and includes treatments within the Jericho Mountain Roadless Area.

Helena National Forest Management Areas T-1, T-5, L-1, M-1, P-3, W-1, and private lands are included in the Telegraph project area. The forestwide management direction in Chapter II of the Forest Plan applies to all management areas (Forest Plan III/1). For additional information on the MA goals, resource potentials, and limitations, see the Helena Forest Plan on pages III/1 to III/92.

The following table is a list of MAs and a summary of the goals relevant to this proposal of the management areas within the project area.

Table 1. Management Areas and associated acres within the Telegraph Vegetation Project area

Management Area (Acres)	Pages In Forest Plan	Goals Relevant To This Proposal
T1 (17,588 acres)	T-1 III/30-III/33	Provide healthy timber stands and optimize timber growing potential over the planning horizon. Emphasize cost-effective timber production, while protecting the soil productivity. Maintain water quality and stream bank stability. Provide for dispersed recreation opportunities, wildlife habitat, and livestock use, when consistent with the timber management goals.
M1 (3,299 acres)	M-1 III/5-III/7	Maintain the present condition with minimal investment for resource activities, while protecting the basic soil, water, and wildlife resources.
L1 (343 acres)	L1- III/11-III/13	Maintain or improve vegetative conditions and livestock forage productivity
T5 (321 acres)	T-5 III/46-III/49	Increase production and quality of forage. Manage timber sites cost-effectively, by selecting the most economical harvest system and managing for natural regeneration. Provide for healthy stands of timber and timber products consistent with increasing quality and quantity of forage. Emphasize cost- effective timber production, while protecting the soil productivity. Maintain water quality and stream bank stability. Provide for other resource uses that are compatible with the other goals.
P3 (51 acres)	P-3 III/73-III/77	Manage the recommended wilderness additions to protect the wilderness Characteristics and to the extent possible allow existing uses, pending Congressional classification.
W1 (455 acres)	W1 III/50-III/52	Optimize wildlife habitat potential, including old growth, over the long term. Provide for other resource uses, if they are compatible with wildlife management goals.

In addition, a description of each management area and pertinent goals are provided in appendix B of this document. This appendix summarizes the Forest Plan Standards and Goals as well as the applicable management area direction. It also provides a synopsis of how the project responds to the standards and guidelines for the Forest Plan and by each management area.

Treatments using harvest may occur in several MAs. Some of these MAs are suitable for timber production, and include goals of managing for healthy stands of timber and optimizing growing potential. Other MAs are considered unsuitable for timber, but harvest may be used as a tool to meet the other objectives of the MA.

Forest Management must also consider direction in the Inland Native Fish Strategy (INFISH 1995) which provides direction to protect habitat and populations of resident native fish outside of anadromous fish habitat. Other pertinent direction including the Northern Rockies Lynx Management Direction is also considered.

Forest Service Manual (FSM) and Forest Service Handbook (FSH): The Forest Service Manuals and Handbooks provide management direction and guidance for Forest Service analysis and activities. See the individual specialist reports for the applicable sections.

Northern Region Integrated Restoration and Protection Strategy. The Northern Region Integrated Restoration and Protection Strategy provides information to help local Forest Service units identify and prioritize potential areas for accomplishing Forest and Grassland Plan goals and objectives, and thus meeting this mission. This strategy focuses on restoration and maintenance of watersheds, wildlife habitats (including more resilient vegetation conditions), and the protection of people, structures, and community infrastructure in and associated with the wildland-urban interface. Values in these focus areas may be threatened by large scale fires, drought, insects and disease, invasive plants and animals, forest encroachment into grasslands, dense vegetation that create hazardous fuel conditions, erosion, sedimentation, and toxic chemicals.

The Endangered Species Act of 1973, as amended (ESA 1973, 16 U.S.C. 1531) provides direction to the Forest Service to establish objectives for habitat management and recovery through the Forest Plan for the conservation and protection of endangered and threatened species. This project is consistent with the Forest Plan for listed species and is therefore consistent with these guidelines. The U.S. Fish and Wildlife Service was consulted to determine which species required evaluating for the project. An analysis of effects on listed species was conducted and documented in a Biological Evaluation. Consultation is ongoing and will be completed prior to issuing a decision on this project.

The Migratory Bird Treaty Act, Presidential Executive Order 13186 10 January 2001. Migratory birds are included under the Migratory Bird Treaty Act (MBTA) and incorporate most species of birds present in the project area. In December 2008, the Forest Service entered into a memorandum of understanding (MOU) with the United States Department of Interior (USDI) Fish and Wildlife Service on the Migratory Bird Treaty Act to further clarify agency responsibilities (USDA Forest Service and USDI Fish and Wildlife Service 2008). Four key principles embodied in the MOU direct the Forest Service to (1) focus on bird populations; (2) focus on habitat restoration and enhancement where actions can benefit specific ecosystems and migratory birds dependent on them; (3) recognize that actions taken to benefit some migratory bird populations may adversely affect other migratory bird populations; and (4) recognize that actions that may provide long-term benefits to migratory birds may have short-term impacts on individual birds. The parties agreed that through the NEPA process, the Forest Service would evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors.

Executive Order 13186 directs departments and agencies to take certain actions to further implement the MBTA. Specifically, the Order directs Federal agencies, whose direct activities will likely result in the “take” of migratory birds, to develop and implement a memorandum of understanding with the USFWS that shall promote the conservation of bird populations. Under Executive Order 13186 the USFWS is responsible to ensure that environmental analyses of Federal actions evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.

In 1963, Congress passed the **Federal Clean Air Act** and amended the act in 1970, 1977, and 1990. The purpose of the act is to protect and enhance air quality while ensuring the protection of public

health and welfare. The 1970 amendments established National Ambient Air Quality Standards (NAAQS), which must be met by most state and federal agencies, including the Forest Service.

States are given the primary responsibility for air quality management. Section 110 of the Clean Air Act requires states to develop State Implementation Plans (SIPs) that identify how the state will attain and maintain NAAQS. **The Montana Clean Air Act** (MCAA)(1967) promulgates the SIP and created the Montana Air Quality Bureau (now under the Montana Department of Environmental Quality-MDEQ). The Clean Air Act also allows states, and some counties, to adopt unique permitting procedures and to apply more stringent standards.

The Federal Clean Water Act, as amended, is commonly referred to as the Clean Water Act (CWA). This required each state to develop its own water quality standards, subject to the approval of the Environmental Protection Agency (EPA). Section 303(d) of the CWA required each state to assess all water bodies within its borders in order to identify water quality impairments that exceeded state standards. Under the CWA, water bodies identified as impaired generally require the development of a "Total Maximum Daily Load" (TMDL—a water quality restoration plan). The state is required to systematically develop these plans in collaboration with the EPA. A water body's status on Montana's 303(d) list dictates, to a certain extent, the water quality standards under state law. The Little Blackfoot River, Telegraph Creek, and Ontario Creek are on the Montana 303(d) list of water-quality impaired streams not fully supporting all listed beneficial uses. Listed impairments include alteration in stream-side or littoral vegetative covers, arsenic, cyanide and sedimentation/siltation. This project will have a long-term beneficial effect to the Little Blackfoot River by reducing the anthropogenic sediment load to these streams, as well as reduce the likelihood of culvert failure where culverts are upgraded. The resource protection measures identified will minimize the short-term negative effects to project-area streams and riparian areas. Any permits needed for implementation would be obtain before operations were initiated.

National Historic Preservation Act, **Section 106 (1966 as amended)** provides direction for Federal agencies to establish a program for preservation of historic properties. In compliance with this ac, a review was conducted to determine if cultural resources surveys had been conducted with in the project area, and if cultural resources sites had been record. Potential impacts to sites eligible for the National Register of Historic Places (NRHP), as well as for those not yet evaluated, were considered in this analysis. In accord with 36 CFR 800, Protection of Historic Properties, it is the policy of the Forest Service to protect those sites determined NRHP eligible, as well as those sites not yet formally evaluated. The result of the Heritage Resource analysis conducted is in the specialist report in the project record. Project design features developed to protect heritage resources are listed in chapter 2. Consultation with the State Historic Preservation Office for concurrence will be completed prior to issuing a decision on this project.

The Native American Graves Protection and Repatriation Act, and the **American Indian Religious Freedom Act** of 1978 require Federal agencies to consult with culturally affiliated tribes and determine possible effects to sites and other culturally significant resources resulting from activities within a proposed project area.

Species Designation for Whitebark Pine R1 Regional Forester Letter (2011)

This letter specifies that whitebark pine is designated as a sensitive species in Region 1 because of the U.S. Fish and Wildlife Service finding that the listing of whitebark pine under the Endangered Species Act (ESA) was warranted but precluded, making it a candidate species for listing. The letter notes that the designation should not change our approach to restoration of whitebark pine, and in fact hopefully accelerate actions to restore whitebark pine (USDA 2011b).

Scoping

As a result of the MPB epidemic, in 2008, the Forest Service initiated the planning process for the Telegraph Vegetation Project with reviews of database information and ground conditions within the watershed. Public involvement for the Telegraph Project started in fall of 2009. Scoping was used to help the Forest Service develop the proposed action alternatives. Site-specific public comments were requested through a letter that was mailed to potentially interested or affected members of the public on November 5, 2009. This letter included maps and a description of the proposed action as developed at the time. The letter included a comment form so interested people could provide input on the proposal and submit their comments about proposed activities in the area. A legal notice briefly describing the project and requesting public comment was published in the *Helena Independent Record* (the newspaper of record) on November 13, 2009. A Notice of Intent (NOI) was prepared and printed in the Federal Register on November 12, 2009. An open house was held on December 3, 2009. The comments from the initial scoping were considered when later analyzing issues and developing alternatives. Comments to the scoping document were received and are included as part of the project record.

The project was then re-scoped in July 2012, as a result of comments received and additional site-specific field information to incorporate 449 acres of slashing generally small-diameter trees, followed by prescribed burning within the Jericho Mountain Inventoried Roadless Area, in addition to changes in the location and acreages of treatments. A corrected NOI was submitted to the Federal Register and was published on July 20, 2012. An open-house meeting was held at the Elliston School House on July 10, 2012, to share information and hear from interested citizens. Maps of the action alternatives, photos of existing vegetation conditions, and examples of what treatment areas may look like post-harvest and/or post burning were posted for viewing. Copies of the scoping letter (describing the proposed action) were made available. An estimated 25 people from the surrounding communities who were interested in this proposal attended the meeting. Input was received on how interested parties viewed the management proposal for the area as described in the scoping notice.

Issues

Comments received were separated into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: (1) outside the scope of the proposed action; (2) already decided by law, regulation, Forest Plan, or other higher level decision; (3) irrelevant to the decision to be made; or (4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explains this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review" (Sec. 1506.3).

As for significance, the IDT for the Telegraph Project identified the following issues during scoping:

Lynx and Lynx Habitat

Several commenters were concerned about proposed treatment effects on lynx and lynx habitat. alternative 2, the Proposed Action, was developed with treatments occurring in lynx habitat that lies within the WUI, as allowed under the *Northern Rockies Lynx Management Direction.* Alternative 3 has been developed by reducing the acres of treatments within lynx habitat especially within early stand imitation, stand initiation, and multistory habitat.

Measures to Evaluate: Treatment and remaining acres occurring within early stand initiation, stand initiation, and multistory habitat that lies in the WUI.

Elk Security and Cover

Several commenters had concerns about possible treatment effects on elk security and elk hiding cover. Alternative 3 features a reduction in the amount of hiding cover treated within security and intermittent refuge areas as well as within the elk herd unit as a whole.

Measures to Evaluate: Treatment acres occurring within mapped security areas.

Road Construction

Several commenters were concerned about new road construction, along with re-construction of existing roads. Concerns with road building included weed introduction/spread, illegal motorized use, habitat security, and sedimentation. Alternative 3 was designed to address wildlife concerns and minimize new temporary road construction, while still being able to meet overall project objectives.

Measures to Evaluate: Miles of temporary road construction followed by full obliteration, miles of road maintenance, miles of road reconstruction, and miles of haul routes

Jericho Inventoried Roadless Area

One commenter was concerned about thinning and prescribed burning activities proposed within the Jericho Mountain Inventoried Roadles Area (IRA), especially when coupled with the harvest and new roads proposed around the IRA. Another commenter questioned how treatment within the IRA would benefit lynx. After consultation with HNF wildlife and fire specialists, significant portions of planned treatments within Jericho IRA were dropped from alternative 2. Additionally, under alternative 3, many of the treatment units and temporary roads surrounding the IRA are proposed to be dropped from treatment.

Measures to Evaluate: Acres of prescribed burning.

In addition to significant issues, the interdisciplinary team (IDT) evaluated other concerns that helped frame the scope of the analysis during the scoping process. These resource related concerns were not considered major issues because they were resolved through project design and therefore were not used to develop alternatives analyzed in detail. These concerns are addressed within the effects analysis by resource in chapter 3.

Decisions to be Made

The Responsible Official for this proposal is the Forest Supervisor of the Helena National Forest. The Forest Supervisor will make the following decisions and document them in a Record of Decision (ROD) following the completion of the final environmental impact statement (FEIS).

- Whether to implement the proposed action or an alternative to the proposed action;
- What monitoring requirements are appropriate to evaluate implementation of this project, and;
- Whether a forest plan amendment is necessary.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered by the Responsible Official for the Telegraph Vegetation Project. It includes a discussion of how the alternatives and design features common to all alternatives were developed. Numbers such as acres, miles, and volume are approximate due to the use of GIS data and rounding. Also included are descriptions and maps for the alternatives considered in detail, and a comparison of these alternatives focusing on key issues and identified measurement indicators.

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

Alternatives

Section 102(2)(3) if the NEPA states that all Federal agencies shall "study, develop, and describe appropriated alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

The range of alternatives may extend beyond the limits set by Forest Plan goals and objectives under the NEPA; however, the NFMA requires that the selected alternative fully comply with the Forest Plan, unless the plan is amended in accordance with 16 U.S.C. 1604 (i).

The range of alternatives developed and presented in this chapter was based on preliminary evaluation of the information gathered from public and internal comments during scoping activities and the purpose and need for the project. This project is intended to meet the Purpose and Need while maintaining resource conditions which are consistent with the HNF Forest Plan. Other influences included Forest Plan goals, objectives, standards and guidelines; and federal laws, regulations and policies. Within these parameters, the alternatives display a range of outputs, treatments, management requirements, design elements, and effects on resources.

In addition to the alternatives considered in detail, the IDT considered a number of other alternatives. Although these alternatives contributed to the range of alternatives, they were eliminated from detailed study for the reasons briefly described below.

Alternatives Considered in Detail

The following section describes the No Action alternative and two action alternatives considered in detail. All alternatives are subject to compliance with all valid statutes on NFS lands. Impacts to resources are considered through the National Environmental Policy Act (NEPA) of 1969.

For an alternative to be analyzed and considered in detail, it must respond to the purpose and need for action and significant issues. This document has three alternatives that were analyzed in detail.

Alternative 1 is the No Action alternative. Alternative 2 is the Proposed Action as described on pages 21 thru 22. Alternative 3 was developed based upon the significant issues that were identified during the scoping process (lynx/lynx habitat, elk cover and security, road construction, Jericho IRA, and wildlife movement/corridor). Maps of the action alternatives are located in Appendix E of the DEIS.

Alternatives at a Glance

Table 2. Treatment summary by alternative

Treatment Type	Prescription	Alt. 1 Acres	Alt. 2 Acres	Alt. 3 Acres
Intermediate Harvest Acres Total	Improvement Cut, Slashing, Jackpot Burn	0	434	434
Precommercial thinning Acres Total	Precommercial Thin	0	1,758	1,261
	Pre-commercial Thin, Underburn	0	28	28
Prescribed Fire Acres Total	Slashing, Broadcast Burn	0	1,039	595
	Slashing, Handpiling, Burning Piles	0	11	11
Regeneration Harvest Acres Total	2-Aged Seedtree with Reserves	0	16	16
	2-Aged Seedtree with Reserves, Site Prep Burn	0	166	29
	2-Aged Shelterwood with Reserves, Site Prep Burn	0	155	132
	Clearcut with Leave Trees	0	651	288
	Clearcut with Leave Trees, Jackpot Burn	0	1,046	547
	Clearcut with Leave Trees, Site Prep Burn	0	1,355	838
	Clearcut with Reserves, Site Prep Burn	0	95	6
Grand Total		**0**	**6,754**	**4,185**

Logging system	Alt. 1 Acres	Alt. 2 Acres	Alt. 3 Acres
Ground-Based	0	3,450	2,052
Cable	0	468	237
Hand and/or fire treatment only	0	2,441	1,543
Mechanical pre-commercial thinning	0	394	352

Road Activity	Alt. 1 Miles	Alt. 2 Miles	Alt. 3 Miles
Temp Road Construction, followed by Full Obliteration	0	8.5	3.4
Road Maintenance	0	43.1	42.9
Road Reconstruction	0	32.6	28.3
Road Decommissioning	0	0.0	30.0
Total Haul Route Miles	0	84.2	74.6
Burning Activity	**Alt. 1 Acres**	**Alt. 2 Acres**	**Alt. 3 Acres**
RX Fire – hand treatment followed by burning	0	1,049	605
Pre-commercial thinning followed by burning	0	28	28
Harvest followed by burning	0	3,251	1,552
Total acres with burning activity	0	4,328	2,185

Stream Crossing Improvements

Road	Stream	Existing Structure	Summary of Work	Alt. 1	Alt. 2	Alt.3
NFSR 123	Mary Ann Creek	1.8-foot X 2.5-foot metal pipe arch (28-foot length)	Replace culvert. Surface roadway above structure.	No	Yes	Yes
NFSR 123	Little Blackfoot River tributary	4-foot circular metal culvert (41-foot length)	Armor roadway with riprap along upstream fill slope between culvert and Little Blackfoot River bridge. Armor inlet and outlet w/ riprap.	No	Yes	Yes
NFSR 1801	Monarch Creek	6-foot X 4.7-foot metal pipe arch	Replace culvert with new structure to accommodate aquatic organism passage.	No	No	Yes
NFSR 1856	Mike Renig Gulch tributary (southern site)	1.5-foot circular metal pipe (23-foot length)	Remove damaged culvert; replace with rock ford.	No	Yes	Yes
NFSR 1856	Mike Renig Gulch tributary (northern site)	1.5-foot circular metal pipe (25-foot length)	Remove non-functional culvert; replace with rock ford.	No	Yes	Yes

Road	Stream	Existing Structure	Summary of Work	Alt. 1	Alt. 2	Alt.3
NFSR 495	Clemmer Gulch (lower crossing)	1.5-foot circular metal culvert (25-foot length)	Replace culvert.	No	Yes	Yes
NFSR 495	Clemmer Gulch (upper crossing)	2-foot circular metal culvert (41-foot length)	Replace culvert.	No	Yes	Yes
NFSR 4100	Little Blackfoot River	Ford	Upgrade crossing to bridge. Relocate a segment of NFSR 123 to utilize this improved crossing, and reconnect with the existing NFSR 123 alignment east of the existing Ontario Creek bridge.	No	No	Yes
NFSR 4104	Monarch Creek	4-foot X 5.5-foot metal pipe arch	Replace culvert with new structure to accommodate aquatic organism passage.	No	No	Yes
Total Number of Stream Crossing Improvements By Alternative				**0**	**6**	**9**

Alternative 1, No Action

Alternative 1 is the No Action alternative and describes the existing condition. Alternative 1 provides the baseline for a comparison of the environmental effects of the action alternatives.

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 1. The current situation as described by each resource in Chapter 3 would continue. Under the no-action alternative current management plans would continue to guide management of the project area. Ongoing work or work previously planned and approved, such as, but not limited to, routine road maintenance, weed spraying, trail maintenance, and firewood gathering would still occur. None of the actions proposed in any of the other alternatives would occur. Natural processes would continue.

Alternative 2

Alternative 2 is designed to be responsive to the Mountain Pine Beetle (MPB) outbreak in the area. The project area has experienced wide-scale tree mortality in the past few years. Treatments are needed to meet forest plan goals and direction, ensure diverse and sustainable forest stands and wildlife habitat in the future, improve conditions for fire suppression, recover economic value of dead and dying trees and to maintain and improve watershed conditions.

Establishing a greater diversity in species, age, size class and density can help the landscape to be more resilient. This project will also encourage aspen stand health and size and promote the reproduction of whitebark pine as well as provide opportunities for the local forest products industry.

This alternative was designed with publics within the local community and through the expertise of resource specialists on an interdisciplinary team. Unit treatments are designed to reduce ladder fuels and fine woody debris, create more heterogeneous stands, increase structural diversity, and restore

the fire adapted ecosystem in the area by moving the landscape towards the desired conditions. This alternative meets the purpose and need to a much greater degree than any of the other alternatives as displayed in the Comparison of Alternatives Section and in chapter 3. Appendix A displays a unit-by-unit table of all the proposed vegetative treatments within each alternative.

The following detailed features are included in alternative 2:

- To facilitate removal of timber products, approximately 8.5 miles of temporary road construction, and approximately 400 ground based landings are proposed. All road and landing construction would be decommissioned after harvest.
- Approximately 20.9 million board feet (or 20,888 MBF) of commercial timber would be harvested over approximately 3,918 acres.
- Approximately 1,050 acres are designated for prescribed fire and may include treatment with chainsaws prior to fire application if necessary. Approximately 537 acres are within the Jericho Mountain Inventoried Roadless Area and are designed to keep fire in the Telegraph Watershed.
- Approximately 1,786 acres are identified for pre-commercial thinning to improve overall stand vigor, resiliency and species diversity.
- To improve watershed conditions, reduce sedimentation, increase sizing to accommodate 100-year flow events, and/or provide for aquatic organism passage, six road stream crossings would be improved.
- To meet BMP standards, approximately 84.2 miles of road will be maintained during the life of the project.

Alternative 3

This alternative was designed to address the following significant issues identified in scoping: elk security and hiding cover, lynx and lynx habitat, road construction and Jericho Mountain Inventoried Roadless Area. To address concerns treatments were modified within elk security areas and other wildlife use areas, especially where some green stands still exist, pre-commercial thinning densities were increased to retain more elk hiding cover, treatments were dropped within some units in the WUI that met lynx habitat guidelines and temporary road construction was minimized. To address these concerns, this alternative treats approximately 2,569 less acres than the proposed action and leaves three percent more hiding cover for big game than the proposed action In addition; to improve watershed conditions, reduce sedimentation, increase sizing to accommodate 100-year flow events, and/or provide for aquatic organism passage, additional road stream crossings would be improved and non-system roads would be decommissioned in the project area to achieve water quality and big game security objectives.

The following detailed features are included in alternative 3:

- To facilitate removal of timber products, approximately 3.4 miles of temporary road construction, and approximately 265 ground based landings are proposed. All road and landing construction would be decommissioned after harvest.
- Approximately 12.0 million board feet (or 12,022 MBF) of commercial timber would be harvested over approximately 2,642 acres.
- Approximately 606 acres are designated for prescribed fire and may include treatment with chainsaws prior to fire application if necessary. Approximately 418 acres are within the Jericho Mountain Roadless Area and are designed to keep fire in the Telegraph Watershed.

- Approximately 1,289 acres are identified for pre-commercial thinning to improve overall stand vigor and species diversity.
- To improve watershed conditions, reduce sedimentation, increase sizing to accommodate 100-year flow events, and/or provide for aquatic organism passage, nine road stream crossings would be improved and approximately 30.0 miles of non-system roads will be decommissioned in the project area.
- Associated with replacing individual crossing structures, more substantial road reconstruction would also occur near the west end of NFSR 123. An existing ford located where NFSR 4100 crosses the Little Blackfoot River would be replaced with a bridge, and then NFSR 123 would be relocated to use this crossing and follow a newly constructed roadway along the east side of the Little Blackfoot River and Ontario Creek, rejoining the current alignment east of the existing Ontario Creek crossing. From the intersection with NFSR 227, the first 0.6 miles of NFSR 123 would be decommissioned – including crossing removal and roadway rehabilitation.
- To meet BMP standards, approximately 74.6 miles of road will be maintained during the life of the project.

Terminology

To help our readers better understand the treatment descriptions included within the action alternatives, we are providing this section on commonly-used terminology. More definitions can be found in the glossary of the DEIS.

Silviculture

Intermediate Harvest: Harvest designed to enhance growth, quality, vigor, and composition of a stand after establishment. Density, structure, and/or composition of the stand are altered, and the stand maintains a forested appearance. A final harvest may or may not be conducted in the future depending on management goals. In Telegraph, these treatments result in 2-aged or even-aged stands.

Improvement Harvest: Harvest in a stand pole-sized or larger, to improve composition and quality by removing less desirable trees. In Telegraph, treatment would be some group selection to remove conifers in and near aspen, and also thinning conifers where no aspen is present, to leave behind a more open aspen/conifer matrix with some patches of regeneration. This treatment is proposed in mature stands dominated by or containing a mix of healthy Douglas-fir and/or aspen along with varying amounts of mostly dead lodgepole pine, where an increase in tree quality and an open structure would be emphasized. Diameters cut would generally range from 7 to 20 inches dbh and rare seral species such as ponderosa pine, whitebark pine, and aspen would be favored where they occur.

Precommercial Thinning*:* Young plantations established from past harvest. These stands range from 15 to 40 years old, and contain roughly 400 to 1,700 trees per acre and trees 2 to 7 inches in diameter. Some of the larger pine trees in these stands have mortality associated with the MPB infestation. Treatment would be pre-commercial thinning to leave behind more open, vigorous trees so that the individual stand is healthy and contributes to landscape diversity in species composition and density. Species such as ponderosa pine, whitebark pine, and aspen would be favored where they occur. After treatment, a target tree per acre (TPA) would be generally 150-400 depending on species and site conditions.

Regeneration Harvest: Harvesting to create a new age class, resulting in uneven-aged, 2-aged, or even-aged stands. These harvests could include clearcutting, seed/shelterwood cutting, and single or group tree selection depending on the tree species and desired regeneration. For 1- or 2-aged systems, most of the overstory is removed and the stand is dominated by new regeneration. For 3-aged systems, only single trees or small groups are removed, with regeneration established in gaps.

***Clearcut*:** Most overstory trees are removed. *Leave trees* may be retained for snags or structure; leave trees are defined site specifically with prescriptions. Target density is minimal and the resulting stand is even-aged. In Telegraph, this is proposed in lodgepole stands that have been killed by beetle with few to no living trees of other species present. Generally live trees such as Douglas-fir would be retained. Lodgepole pine and/or whitebark pine natural regeneration is expected.

***Seedtree*:** Most trees are removed except those needed to provide seed for regeneration. Seed trees may be retained as *reserves* to create a 2-aged stand or removed after seedling establishment to maintain an even-aged stand. In Telegraph, this is proposed in lodgepole pine dominated stands killed by beetle that have enough healthy trees (generally Douglas-fir or Engelmann spruce) to provide seed. A mix of lodgepole pine, Douglas-fir, Engelmann spruce, and/or whitebark pine regeneration is expected that contributes to landscape diversity in species composition and density. The seed trees would be left as reserves.

Shelterwood: All trees are removed except those needed to provide seed and shelter for regeneration. A group shelterwood is left in a clumpy distribution. Shelter trees may be retained as reserves to create a 2-aged stand or removed after seedling establishment for an even-aged stand. In Telegraph, this is proposed in lodgepole stands killed by beetles that have a heavier mix of Douglas-fir and/or spruce to provide both seed and shelter. Douglas-fir and spruce dominated natural regeneration is expected. Most live trees would be retained. Shelter trees would be left as reserves.

Prescribed Burning is where fire is used as a treatment tool to accomplish a variety of goals, primarily fuels reduction and vegetation restoration. This category includes necessary slash preparation work. No ignition buffers would be required adjacent to stream courses. Hand firelines would be constructed as needed.

The following burning activities are proposed throughout the Telegraph Project area.

***Slashing*:** Cutting small diameter trees (generally less than 6 inches dbh) mechanically or with chainsaws. Slashing is used to reduce ladder fuels to lower crown fire potential; to create a sufficient surface fuels to carry a prescribed fire; and/or to add fuels to meet woody debris goals for nutrient cycling. Prescriptions may call for the retention of certain species (such as ponderosa or limber pine), or a desired spacing in order to meet target stand conditions.

***Pile/Burn*:** Hand or mechanical piling of fuels, generally follows slashing or harvest where slash disposal is needed but broadcast burning is not feasible or desirable. Slash would generally be burned when conditions are favorable, after curing. Target amounts of slash may be left to meet woody debris and nutrient cycling goals.

Jackpot Burn: Burning focused on concentrations of natural fuels accumulations and/or slash, generally after harvest or slashing. May involve burning loose piles or areas of slash where fuels are not generally continuous and/or overstory mortality not a concern (as in a natural opening). A minimal amount of mortality may occur in nearby trees greater than 6 inches dbh.

Site Prep Burn: Burning following harvest where the bulk of the canopy was removed. The goal is to reduce logging slash and prepare the site for regeneration. It is a low to moderate intensity fire where direct and indirect mortality of leave trees is less than 5 percent (reserve, shelter, or seed trees left are minimal and a high priority to protect). The goals are to reduce fine woody debris (less than 3 inches diameter), reduce duff fuel loadings, expose 5 to 25 percent mineral soil, and retain most coarse woody debris (greater than 3 inches diameter) for nutrient cycling, seedling microsites, and wildlife habitat. Burning would be designed to target the low end of mixed severity to ensure adequate soil cover is retained. Additional objectives include generating heat to open serotinous cones and reduce competing vegetation. Units targeting whitebark pine regeneration will have mixed severity effects; units targeting other species will have low severity effects.

Broadcast Burning: This is ecosystem burning with goals of reducing hazardous fuels and restoring appropriate fire regimes to the landscape. These may include areas of:

***Low Severity Burn*:** The purpose is to reduce ladder fuels and reduce overstory tree density to a minor extent. Slashing as needed would occur to create the desired fuelbed and fire intensity needed to accomplish objectives. An additional purpose is the re-introduction of fire to the ecosystem. Direct mortality less than 5 percent, indirect mortality less than 10 percent, and less than 1 acre mortality patches may occur in the overstory. Objectives include reducing fine woody debris (less than 3 inches diameter), reducing duff fuel loading while minimizing exposure of soil (less than 10 percent), and retaining most coarse woody debris (greater than 3 inches diameter) for nutrient cycling and wildlife habitat.

Objectives include reducing fine woody debris (less than 3 inches diameter), reducing duff fuel loading while minimizing exposure of soil (less than 10 percent), and retaining most coarse woody debris (greater than 3 inches diameter) for nutrient cycling and wildlife habitat.

Mixed Severity: Fire is used as a tool to achieve stand objectives with mixed severity. The purpose is to reduce ladder fuels and overstory tree density – heterogeneity in structure is desired. Overall mature tree mortality is generally 30 to 50 percent, occurring in patches. Mortality patch size and distribution are dictated by stand and burning conditions. Patches will generally not exceed 5 to 10 acres in large units (greater than 50 acres) or 20 percent of the unit size in units less than 50 acres. Slashing would occur as needed to create a fuelbed for burning and to reduce ladder fuels. Natural openings would be favored by eliminating small tree encroachment. Other objectives include reduction of fine woody debris (less than 3 inches diameter) and duff fuel loadings. Limited amounts of mineral soil would be exposed (5 to 25 percent). Up to 30 percent of coarse woody debris (greater than 3inches diameter) may be consumed but the remainder would be retained for nutrient cycling and wildlife habitat. Burning would be designed to target the low end of mixed severity to ensure adequate soil cover is retained.

Roads

Road Maintenance: The intention of road maintenance is to keep the road at an acceptable level that meets Best Management Practices (BMP) standards and allows for safe timber haul. Road maintenance activities would include surface blading, vegetation removal, minor slump repair, and drainage structure cleaning and/or installation.

Road Reconstruction: The intention of road reconstruction is to bring the road up to an acceptable level, in order to meet BMP standards and allow for safe timber haul. In addition to basic maintenance activities (listed above), reconstruction would also involve more significant roadway improvements, realignment, curve widening, or subgrade boulder or cobble excavation and removal.

Temporary Road: Temporary roads for the Telegraph Vegetation Project will be improved or constructed to a minimal standard in order to provide access for harvesting equipment and log trucks. These roads would be decommissioned following use. Telegraph Vegetation Project temporary roads will be decommissioned by obliteration, including: re-contouring (returning the prism to natural contour), removing culverts, replacing topsoil, placing woody debris upon the disturbed area to provide stability, and seeding the disturbed area.

Haul Road: Road used during project implementation to haul wood products on.

Road Decommissioning: For the Telegraph Vegetation Project decommissioning refers to full obliteration of the road: re-contouring (returning the road prism to natural contour), removing culverts, replacing topsoil, placing woody debris upon the disturbed area to provide stability, and seeding the disturbed area.

Activities Common to All Action Alternatives

This section describes activities that would occur under both of the action alternatives – alternatives 2 and 3. It includes design features, a possible Forest Plan amendment, and monitoring.

Design Features

Design features were developed to avoid or reduce potential adverse environmental impacts, as well as to respond to concerns expressed during the scoping process. Design features and mitigation

measures are an integral part of each action alternative. The following design criteria are considered a requirement of the decision, should an action alternative be selected.

Prescribed Fire:

Within cutting units a minimum of 5 tons and a maximum of 15 tons of woody material greater than 3.0 inches diameter on the small end and at least 4 feet in length will be left, evenly distributed and within 18 inches of the ground. Within units that will have a prescribed fire treatment following harvest, activity created slash shall be removed from around the base of all designated leave trees for a distance of 12 feet on the sides, 12 feet from above and 12 feet below the boles. Fuel breaks shall be created around treatment units that have prescribed fire treatment following harvest activities; this should include all vegetation material greater than 3 inches in diameter on the large end and 2 feet long or longer in length for a distance of 15 feet. This slash will not be piled or windrowed but either removed from site or scattered so as not to concentrate slash around perimeter of fuel break. Further reducing fire hazards all species over 3 feet in height not meeting minimum diameter specifications that are damaged beyond recovery by operations shall be cut and slashed below 18 inches of the ground and bucked into lengths shorter than 4 feet. The recommended specifications for a pile constructed with mechanized equipment:

- Remove residential/commercial firewood products prior to piling. This will limit piles being torn apart from firewood gathers, promote more usage of solid material, and limit impacts to air quality. Firewood products shall be placed at least twice the pile diameter away from any piles to avoid ignitions from burning of pile slash.
- Construct piles at a size-ratio of 2:3, meaning if pile is 10 feet tall it should be 15 feet in diameter. Pile branches and tops with the butt ends towards the outside of the pile, and overlapping. Perimeter of pile has very few loose ends meaning all edges of pile are pushed in or sawn off and added to pile. Place sufficient amount of 3 inch and smaller material throughout the pile, this should be approximately 30 percent of the pile volume. Minimum piling size should be approximately 8 feet across in diameter and 6 feet in height Piles should be kept compact. Do not place large stumps (greater than 14 inch dia. measured at the cut stump) in the piles
- Do not include foreign objects (garbage), treated lumber, or non-flammable material in the pile. Use a crawler-type excavator equipped with grapple or bucket with a thumb.
- Piles that are to be burned will not be located over buried utility lines. Piles should be in an area void of overstory trees and utility lines. Anticipate flame lengths of up to three times the height of your pile(s). Piles will maintain a minimum spacing of twice the pile diameter from any live overstory vegetation and/or utility lines (includes utility boxes). Piles will maintain a minimum spacing of four times the pile diameter from any structures, creating safety zone where flames, radiant heat, and airborne embers will not set structure on fire. Placement of piles will be in locations that will minimize soil and ash movement.
- Piles are not to be located on active road surfaces, in road rights-of-way, or in ditches. Piles should maintain a minimum spacing of twice the pile diameter from center line of any active road surface.
- Piles will be monitored for post-fire vegetation response and reseeding/re-vegetating burn pile sites may be needed.
- Units with prescribed burning activities (specifically jackpot, site prep and broadcast burning) may require a perimeter of fire-line construction to facilitate the burning.
- Fireline will be constructed by a combination of methods including hand, mechanical (less than 35 percent slope), and/or explosives to 18 to 24 inches wide to mineral soil. Use of natural and

existing barriers is preferred. Fireline rehabilitation associated with burning activities would be pulling back (with hand tools) the berm adjacent to the constructed line as needed, constructing water bars as needed and where fireline intersects CDNST consider disguising the course by scattering cut vegetation.

Implementation of pre-commercial thinning units would be coordinated annually with fire management personnel to determine timing and number of acres treated intended to address any potential fire concern.

Noxious Weeds:

The following Best Management Practices are required by *FMS 2081.2—Prevention and Control Measures* (FSM 2080, 5/14/01) (USDA 2001).

Roads – Required Objectives and Associated Practices

(1) Incorporate weed prevention into road layout, design, and alternative evaluation. Environmental analysis for road construction and reconstruction would include weed risk assessment.

(2) Remove the seed source that could be picked up by passing vehicles and limit seed transport in new and reconstruction areas.

(a) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. This does not apply to service vehicles that would stay on the roadway, traveling frequently in and out of the project area.

(b) Landings, skid trails, and other areas of disturbance resulting from logging activities would be monitored for weed infestations.

(c) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders as determined by the Forest Weed Specialist.

(3) Re-establish vegetation on bare ground due to construction and reconstruction activity to minimize weed spread.

(a) Vegetate all disturbed soil, except the travel way on surfaced roads, in a manner that optimizes plant establishment for that specific site, unless ongoing disturbance at the site would prevent weed establishment. Use native material where appropriate and available. Use a seed mix that includes fast, early season species to provide quick, dense re-vegetation. To avoid weed contaminated seed, each lot must be tested by a certified seed laboratory against the Montana State noxious weed lists and documentation of the seed inspection test provided.

(b) Use local seeding guidelines for detailed procedures and appropriate mixes. Use native material where appropriate and available. Re-vegetation may include planting, seeding, fertilization, and weed-free mulching as indicated by local prescriptions.

(c) Monitor and evaluate success of re-vegetation in relation to project plan. Repeat as indicated by local prescriptions.

(4) Minimize the movement of existing and new weed species caused by moving infested gravel and fill material. The borrow pit would not be used if new invaders, defined by the Forest Weed Specialist, are found on site.

(5) Minimize sources of weed seed in areas not yet re-vegetated. If straw is used for road stabilization and erosion control, it must be certified weed-free or weed-seed free.

(6) Minimize roadside sources of weed seed that could be transported to other areas during maintenance.

(a) Look for priority weed species during road maintenance and report back to District Weed Specialist.

(b) Do not blade roads or pull ditches where new invaders are found.

(c) Maintain desirable roadside vegetation. If desirable vegetation is removed during blading or other ground disturbing activities, area must be re-vegetated according to section (3) (a), (b), (c) above.

(d) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that would stay on the roadway, traveling frequently in and out of the project area.)

(e) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders, as determined by the Forest Weed Specialist.

(f) Straw used for road stabilization and erosion control would be certified weed-free or weed-seed-free.

(7) Reduce weed establishment in road obliteration/reclamation projects. Vegetate according to section (3) (a), (b), (c) above.

Timber – Required Objectives and Associated Practices

(1) Ensure that weed prevention is considered in all pre-harvest timber projects.

(a) Include weed risk assessment in environmental analysis for timber harvest projects.

(b) Remove all mud, dirt, and plant parts from all off road equipment before moving into project area. Cleaning must occur off National Forest lands. (This does not apply to service vehicles that would stay on the roadway, traveling frequently in and out of the project area.)

(c) Clean all equipment prior to leaving the project site, if operating in areas infested with new invaders (as designated by the Forest Weed Specialist).

(2) Minimize the creation of sites suitable for weed establishment. Re-vegetate bare soil as described in the Roads (3) (a), (b), (c) section above.

Timber – Recommended Objectives and Associated Practices

(1) Ensure that weed prevention is considered in all timber projects

(a) Consider treating weeds on roads used by timber sale purchasers.

(b) Treat weeds on landings and skid trails that are weed infested before logging activities, where practical.

(c) Ensure that weed prevention is considered in all timber projects.

(2) Minimize the creation of sites suitable for weed establishment. Soil disturbance should be minimized to meet harvest project objectives.

(3) Consider monitoring for weeds after sale activity and treat weeds as indicated by local prescriptions.

(a) Consider trust, stewardship, or other funds to treat soil disturbance or weeds as needed after timber harvest and regeneration activities.

(b) Consider monitoring and treating weed infestations at landings and on skid trails after harvest.

Fire – Required Objectives and Associated Practices

(1) Integrate weed prevention and management in all prescribed burning. Mitigate and reduce weed spread during prescribed fire activities.

(a) Include weed risk assessment in environmental analysis for prescribed fire projects.

(b) All crews should inspect, remove, and properly dispose of weed seed and plant parts found on their clothing and equipment.

(c) Add weed awareness and prevention education to Fire Effects and Prescribed Fire training.

(d) Re-vegetate only erosion susceptible and high risk areas (as defined in Regional Risk Assessment Factors and Rating protocol) as described in the Roads (3) (a), (b), (c) section above.

Timber – Recommended Objectives and Associated Practices

Fire – Recommended Objectives and Associated Practices

(1) Mitigate and reduce weed spread during fire activities.

(2) Integrate weed prevention and management in all prescribed burning. Mitigate and reduce weed spread during prescribed fire activities.

(a) Consider treating high risk areas (as defined in Regional Risk Assessment Factors and Rating protocol) with weed infestations (such as roads, disturbed ground) before burning and check and retreat after burning if necessary.

(b) Consider avoiding ignition and burning in high risk areas (as defined in Regional Risk Assessment Factors and Rating protocol) that cannot be treated before or after prescribed fire.

(c) Check and treat weeds at cleaning sites and all disturbed staging areas.

(d) Treat weeds within the burned area as part of rehabilitation plan to reduce weed spread.

(e) Treat weeds within the burned area as part of rehabilitation plan to reduce weed spread.

There are no BMPs specific to prescribed fire in *FSM 2080*. The above BMPs that apply would be implemented.

Additional design criteria for noxious weeds:

Frozen Ground Operation

Limiting logging activity to the dormant season on a frozen surface would greatly decrease the chance for weeds to be spread, either from actively growing plants within the logged or haul area, or from earth on the machinery. Past studies have shown a substantial decrease in soil surface disturbance resulting from logging when the activity occurs on frozen ground (McIver and Starr 2000). Limited ground disturbance would result in lower risk of increased weed infestations.

Seeding Prescription

All landings, skid trails or other activity areas that have over 30 percent ground cover removal/soil surface disturbance due to the activity would be re-contoured and seeded with a prescribed native seed mixture as soon as appropriate following the cessation of activities. Where slopes are over 15 to 20 percent, surfaces would be left rough to provide microtopography for seed and water catchment. Woody debris would be spread on the surface at a rate of 1 to 5 tons per acre in these areas to provide site stability as well as additional microsites.

The Forest Rangeland Management Special would recommend certified weed seed free native seed mixtures for the project.

Herbicide Application

Herbicide application before ground disturbance (road construction, logging activities on unfrozen ground, and prescribed fire) is recommended if biological agents are not going to be established. Two years following implementation, follow up treatment of herbicide is recommended in the ground-disturbed areas. The Forest would incorporate management of the disturbed areas as part of the base noxious weed program. All weed species would be treated with herbicides in these areas to try to limit the expansion as much as possible.

The portions of the haul route that require reconditioning prior to haul should be treated with herbicides prior to the reconditioning early in the growing season to prevent seed set, and again in the fall following reconditioning to limit the effect of the ground disturbance.

Ongoing weed spraying and grazing management would employ avoidance or mitigation techniques to limit potential impacts to regenerating stands.”

Lands and Special Uses:

Boundary

- Boundary lines would be established when in question and/or when working in close proximity to adjacent third-party lands that are not well marked.
- Corner monuments and accessories to corner monuments would be protected.
- Adjacent landowners would be notified of project activities. Private landowners would have adequate notice prior to tree harvesting or prescribed fire treatments to plan accordingly for associated noise and potential air quality effects of burning.

Non-recreation Special Uses

- Permittees and landowners would be notified of the proposed and selected actions to ensure that project activities do not materially interfere with private landowner/permittee rights. Privately owned improvements would be protected during operations.

- If detours or temporary road closures occur during project activities, signs and prior warning would be given to affected parties.
- Project managers and contractors would need to be cognizant of the location of permitted private roads and classified private roads, particularly if permission is not granted to use private roads to contractors involved in harvesting activities or to access prescribed fire units.
- The burn boss would determine how many acres could be burned and identify any effects on residents located downwind of the project burn area.

Rights of way/private land

- Road use would be coordinated with Powell County on roads having county jurisdiction.
- Private rights-of-way would be pursued with both short-term project access needs and long-term public and administrative access needs in mind.
- Private landowners would be made fully aware of project activities and the timeframe in which they would occur.

Recreation:

- Coordinate project implementation with the Forest Public Affairs Officer and Law Enforcement to ensure the public including the winter recreation groups is well informed of the schedule and its potential impacts.
- As appropriate, place interpretative panels to aid in public education of fuels management and forest health around recreation sites nearby during project activities.
- Minimize operations during big game hunting season to reduce conflicts.
- Limit log hauling to weekdays.
- Before commencing over-snow operations, ensure that work activities would allow for safe over-snow vehicle recreation opportunities.
- Repair and rehabilitate any incidental damage caused by this project to recreation improvements/facilities after project activities are completed.
- Any dispersed recreation campsites that cannot be avoided for use as landing areas should be reconditioned to their pre-disturbance state at the end of operations. This would include removing debris, re-contouring the landing, seeding native vegetation and treating noxious weeds.

Transportation:

- Roads will receive pre-haul maintenance as needed to restore the cross slope and to clean culverts and ditches. The roads will also be maintained during and after log haul.
- Logging operations during winter conditions and potential for sediment delivery during snowmelt or runoff would require the need for compliance with road maintenance, construction, and snow plowing environmental conservation measures.
- All temporary roads would be decommissioned after project activities are completed. Decommissioning of roads would ensure no future loss of elk security or sediment movement to streams.
- All temporary roads would have locked gates and be closed to the public at all times.

Visuals:

- Blend units including fuel breaks with natural landscape features such as natural openings, rock outcrops, and topography where possible. Harvest units should be shaped to mimic natural patterns found in the landscape where possible. Minimize use of straight lines or geometric shapes along edges during unit design where feasibility and safety allows.
- The Landscape Architect will work with resource specialist including timber and fuels layout crews for unit design during implementation to achieve visual objectives where feasible.
- Disturbed areas, including but not limited to temporary road, landing construction, etc. would be re-vegetated after the site has been satisfactorily prepared.
- All equipment and construction debris would be removed from units immediately following completion of implemented activities.
- Temporary road locations should be designed fit the landscape with a minimum degree of landform alteration limiting the amount of earthwork. Planning the design of alignments and reseeding of cut and fill slopes should consider minimizing impacts to scenic resources.
- In units within M-1 management areas, burned areas should be small in the foreground (0 to ½ mile from roads or trails), and have a mosaic of burned and unburned islands. (Agriculture Handbook # 608, Pg. 28 and 29.)
- Slash piles would be burned to achieve 95 percent or more consumption. Following burning, concentrations of unconsumed slash would be scattered.

Range:

- Logging activities would be coordinated with range personnel during the grazing season of July 1 to October 15 to avoid conflicts.
- In order to successfully carry fire in proposed treatment units, those units falling within grazing allotments would be rested at least one growing season prior to burning if field evaluations indicate a need to ensure fine fuels are available to carry the fire. This would be coordinated between range and fire personnel.
- Burn, regeneration, and planting units within grazing allotments would be rested at least one growing season following burning to allow for adequate vegetation recovery. This must be coordinated by the permittees, fire and range personnel to ensure proper regeneration recovery. It may necessary to exclude livestock from planted areas to allow for establishment of regeneration.
- Fencing, either temporary or permanent, may be needed to protect stands after burning or where natural barriers have been lost due to harvesting. This would be coordinated with the wildlife biologist, if deemed necessary.
- After implementation of activities have taken place, all livestock watering improvements and fences that were affected would be replaced or repaired to the condition in which they were found.

Watershed

General

- Avoid hauling and other heavy-equipment traffic during conditions where the road surface is at or near saturation.

- Any skid trails should be fully decommissioned as part of the implementation of this project.
- Snowplowing:
  - Avoid sidecasting of snow into streams. Leave drainage points in the snow berm to avoid concentration of snowmelt on the road surface.
  - Avoid driving on plowed/snow-covered roads during warm/soft conditions to avoid setting ruts.
  - Leave 3 to 4 inches of compacted snow on the road surface when plowing.
- Minimize cleaning of vegetated ditches that are still functional.
- Areas cleared of vegetation by maintenance or other activities should be seeded with an approved weed-free seed mix.
- Sediment filtering devices (e.g., wattles, weed-free straw bales, filter fence) should be used as needed to limit erosion and delivery of sediment into streams or ephemeral drainages.
- All wetlands, seeps, and springs should be identified and marked during project implementation.
- Exclude equipment/trucks from wetland areas unless during winter conditions as specified in the *Telegraph Project Soils Specialist Report*.
- Upon completion of pile burning, rake or otherwise disturb the burned surface and seed where deemed appropriate by Soils or Hydrology staff in order to prevent potential runoff from burn sites.

Prescriptions within Streamside Management Zones and Riparian Habitat Conservation Areas

- Alternatives 2 and 3 include removal of dead trees within riparian buffers (RHCA and SMZ). Equipment operations are restricted within the SMZ by law. Harvest and burn prescriptions within RHCAs have been established in consultation with the silviculture and fisheries specialists to conform to Riparian Management Objectives in the *Forest Plan* and avoid impacts to inland native fish. These design criteria include no ignition buffers within RHCAs (see the *Telegraph Project Forested Vegetation and Aquatic Species Specialist Reports* for details).

Road Reconstruction

- Road reconstruction and maintenance would be done in accordance with standard BMPs (USDA 1988; USDA 1994; USDA 1998; USDA 2012) to avoid developing sediment delivery points.
- Project-area road segments with sediment delivery points (as identified with sediment delivery points (as identified in pre-implementation surveys) should be repaired using appropriate measures (e.g., blading, grade dips, new cross-drain culverts, gravel surfacing, slash-filter windrows, straw bales).
- Road surface improvements would be maintained at minimum haul standards with an unrutted gravel surface and effective drainage for the duration of the project.
- Road surface drainage would divert most road-surface runoff to undisturbed forest floor, where conditions allow for sediment deposition and infiltration.

Temporary Roads

- Temporary roads would not cross any perennial stream channels.

- If a crossing is required over a stream channel, including intermittent drainages, a Streamside Protection Act (SPA) 124 permit and any other applicable permits would be obtained prior to implementation.
- All temporary roads would be decommissioned following project completion. In this report, the term “decommissioning” refers to full obliteration of the road—recontouring where the road cuts into a slope, ripping in flat terrain—and seeding/surface stabilization following obliteration (see the *Telegraph Project Transportation Specialist Report* for more information).
- New temporary road construction would be in accordance with standard BMPs (USDA 1988; USDA 1994; USDA 1998; USDA 2012) in a way that aids and improves the effectiveness of decommissioning following project completion.
- Until temporary roads can be decommissioned, they would be maintained to minimum haul standards and not develop sediment delivery vectors.

Fisheries

Based on the project proposal all haul roads would include varying amounts of maintenance depending on condition of the road, risk to the watershed, and magnitude of use proposed on the road. Maintenance activities to be undertaken on the roads will meet the intent of the 1999 Programmatic Road Maintenance Biological Assessment. This Biological Assessment maintained an effects assessment of May Affect Not Likely to Adversely Affect Bull Trout (USDA 1999). At a minimum surface blading to restore road drainage and cleaning of existing cross drainage features will be completed on all roads on which hauling will occur. On in-sloped roads with ditches, the ditches may be cleaned and in some cases brushing of ditches will occur. Other roads with substantial log hauling planned and important fishery values will receive some additional level of road maintenance upgrades such as installation of additional cross drainage, some surfacing on approaches to stream crossings, and in some instances upgrading the size of culverts on very small streams that do not support a fishery. If improvements are not completed then use of roads in many cases would be limited to dry periods between May 1 and September 1 to reduce risk for sediment delivery. Snowplowing of roads may be restricted on some roads even when improvements have been completed; depending on the site specific nature of the road and risk for sediment delivery to a watercourse. These measures are needed to avoid adverse effects to fish habitat.

RHCA Boundaries

Standards from the Inland Native Fish Strategy or INFISH (USDA 1995) will be implemented into any action. The following categories identify the standard widths of buffers for Riparian Habitat Conservation Areas (RHCAs) that INFISH utilizes to reduce the risk for negative effects to native fisheries:

- Category 1 - Fish bearing streams, the RHCA width is 300 feet on either side of the stream or the 100-year floodplain whichever is greater.
- Category 2 - Perennial streams not supporting fish, the RHCA is 150 feet on either side of the stream.
- Category 3 - Lakes or wetlands greater than one acre, the RHCA is a minimum of 150 feet but can be larger and extend to the outer limits of riparian vegetation, the extent of seasonally saturated soil, the extent of highly unstable areas, or the distance equal to the height of one site-potential tree.
- Category 4 - The project area is within INFISH priority watershed, therefore, the following applies. For seasonally flowing or intermittent streams, wetlands less than 1 acre, landslides and

landslide prone areas, the RHCA boundary is one site potential tree from the edges of the stream channel, wetland or landslide, landslide prone area or a 100-foot slope distance, whichever is greatest.

Additional measures designed to reduce the risk of negative effects on native fish habitat entails restricting removal of trees from RHCAs to ensure woody debris recruitment, and that pool formation and floodplain function is maintained. These and other protection measures include the following:

Situations where salvage tree cutting or removal are constrained:

a. Salvage trees would not be cut when they are in an RHCA or SMZ, leaning away from the road, and within a tree length of the stream (see exception above where road is parallel to a stream in an RHCA and then crosses a side tributary).

b. Where the road runs parallel to a stream and then crosses a tributary to the stream, the salvage trees on the downhill side of the road and within a tree length of either the stream or the tributary to the stream, can be cut if leaning toward the road or standing straight; however, they would not be removed. Trees leaning toward the creek would be left standing.

c. Where the road runs parallel to a stream and then crosses a tributary to the stream, the salvage trees on the uphill side of the road within a tree length of the tributary and leaning directly toward the tributary with no potential to hit the road would be left standing. These trees are potential contributors to large woody debris or stream channel form and function—thus INFISH standard RA-2 is met.

d. If the tree is between the creek and the road and leaning toward the road or standing straight, but within a tree length of the creek the tree may be cut, but it should be left on the ground within the RHCA to meet INFISH standard RA-2.

e. In addition, within a wider floodplain where the salvage tree is more than a tree length from the creek, between the stream and the road, but where streamside channel development is possible, the tree can be cut but would be left in place.

f. Log landings should not be located in RHCAs.

Situations where dead or insect-infested trees (referred to as salvage trees) can be removed include:

a. As provided for with INFISH standard RA-2, trees to be removed as part of salvage that are not needed for woody debris recruitment or floodplain needs, can be removed.

b. Green commercial trees within the RHCA that have not been attacked by beetles and are not otherwise at risk of dying in the immediate future cannot be removed unless site-specific rationale discussing why it would be beneficial to fish and watershed is developed for each specific unit.

c. If the tree is between the creek and the road, within a tree length of the road, leaning toward the road or standing straight, is not within a tree length of the creek and does not fall into what is considered a wider floodplain category, then the tree may be felled and removed. INFISH standard RA-2 is met. A wider floodplain is where side channel development is possible.

d. If the tree is between the creek and the road, within a tree length of the road, not within a tree length of the creek, is on a bench elevated above the floodplain, and is standing either straight or leaning toward the road the tree may be removed and still meet INFISH standard RA-2.

e. Salvage trees within the RHCA may also be removed in the situation where the road is between the creek and the tree, as these trees are not potential contributors to large woody debris or stream channel form and function—thus INFISH standard RA-2 is met. The exception would be when the road is immediately adjacent to the stream. In this situation, the tree may be removed if the portion of the tree bole exceeding 4 inches would not span the stream should the tree fall toward the creek.

f. Where the road runs parallel to a stream and then crosses a tributary to the stream, the salvage trees on the uphill side of the road, including those within a tree length of the tributary, may be cut and removed unless leaning directly toward the tributary. INFISH standard RA-2 is met as the salvage tree removal for 100 feet upstream of a road crossing would not impair floodplain function of the tributary, as the trees leaning directly toward the stream would be left standing.

g. Precommercial thinning of green trees using hand treatments is allowed.

h. Prescribed burning is allowed as long as it meets state stream management zone (SMZ) rules. No ignition would take place in RHCAs but fire would be allowed to back into them.

i. For trees within RHCAs associated with wetlands, tree removal would follow guidance in the hydrology and soils reports.

On roads where snowplowing will be allowed the guidance in the 1999 Programmatic BA for road maintenance activities (USDA 1999) will be followed to reduce risk for sediment delivery to streams and thereby help avoid adverse effects to fish habitat. Specifics are provided below and in the Hydrology Specialist Report.

- For roads where snowplowing is planned, mark road cross-drain features prior to snowplowing so that side-cast snow does not inhibit the function of road cross drain features.
- Side-casting of snow should be avoided in areas adjacent to streams where there is potential to cause snow or ice damming.
- Drainage openings in snow berms will be provided and maintained.
- Drainage will be spaced as required to obtain satisfactory surface drainage without discharge on erodible fill slopes.
- Dozers and skidders will not be used to plow snow on system roads without prior notification of the forest hydrologist or fisheries biologist.
- Compacted snow (3 to 4 inces) must be left on the roadway during plowing operations to protect the road surface and prevent mechanical removal of the surface.
- Avoid driving on plowed/snow-covered roads during warm/soft conditions and do not set ruts. Damage from, or as a result of snow removal, will be restored by the following summer.

It is especially important to keep road drainage ditches and cross drain culverts clear of logging debris and maintain their function while tree cutting and yarding is occurring.

Herbicide applications will follow guidance from the 2005 Helena Forest Herbicide FEIS ROD regarding limits of Tordon applied within any specific 6th code hydrologic unit such that the projected levels of herbicide that may reach surface waters will remain below 0.07 parts per million.

Various roads would also have site specific measures for the INFISH Priority Watersheds. These measures include time restrictions on use of the road for commercial hauling (large, 18-wheelers to remove trees) and other road specific restrictions as well as optional special improvements not necessary for the project to occur. Additional site specific road improvements and restrictions on log hauling or snowplowing on some roads adjacent to bull trout streams during egg incubation or fry remaining in stream substrates may be required following Section 7 Terms and Conditions.

Soils

Design Features for all units:

- Operations (ground based and cable/skyline) will be conducted when soils are generally dry, or during "winter-conditions." Winter conditions are defined as a minimum of six inches of frozen ice/snow AND a minimum of six inches of frozen soil.
- Harvesting in isolated areas determined to be wet would be avoided with all operations unless operations are conducted under "winter conditions".
- Log landings and slash material will be placed only in dry, upland locations rather than wet areas.
- Ground-based heavy equipment operations will be limited to slopes less than 35 percent gradient (USDA Forest Service 1988; BMP 13.02 and 14.07), excluding steeper, short, isolated unit angulations that are determined to present no harm to the overall soil resource.
- On slopes greater than 35 percent gradient, larger than the above short, isolated annulations, use hand-falling and lead-end suspended log yarding operations, such as skyline cable or helicopter yarding (USDA Forest Service 1988; BMP 14.09).
- To sustain long-term soil nutrient cycling, retain a minimum of 5 tons per acre of coarse woody material (greater than 3-inch diameter) following treatments in warm, dry forest habitat types, and a minimum of 10 tons per acre in all other forest types (Graham et al. 1994; Brown et al. 2003).
- Conduct prescribed burning when the forest floor is moist (Harvey et al. 1994, page 43).
- Potential cumulative effects of livestock grazing in proposed treatment units would be mitigated by deferring grazing for at least 1 to 2 years following vegetation treatments. This will minimize possible cumulative effects of grazing and vegetation treatments.
- Design burn prescriptions to retain adequate ground cover that would limit surface erosion rates to comply with Region 1 soil management guidelines of generally less than 1 to 2 tons per acre per year. Greater than 40 percent ground cover should be retained to prevent detrimental accelerated erosion following prescribed burning (Johansen 2001). Ground cover can include: plant duff or litter, coarse woody material that is in contact with the ground, basal vegetation, and rocks greater than 2-inch diameter.
- Design burn prescriptions to achieve low to moderate fire intensity (USDA 2012, Fire-1. Prescribed Fire Plan Page 54; Harvey et al. 1994, page 43).
- Following implementation of proposed vegetation treatments (including road construction and road decommissioning), sites would be monitored for noxious weed invasion, and subsequent

weed treatments would be conducted to control and eradicate weeds." With this mitigation, soil cumulative effects from noxious weeds would be minimized.

- Many of the access roads in the project area had roadside hazard trees removed recently as part of the forestwide hazardous tree removal project. These narrow strips overlap with many planned treatment units. Generally, very few if any additional trees would be cut in the overlap areas, but equipment may need to operate in them to facilitate tree removal for the rest of the unit. Impacts would be mitigated by utilizing the same landings and skid trails to the extent that it is feasible.
- Construct fireline to the minimum size and standard necessary to contain the fire and meet overall resource objectives.
- Locate and construct fireline in a manner that minimizes erosion by considering site slope and soil conditions, and using and maintaining suitable water and erosion control measures.
- Avoid building firelines in or around riparian areas, wetlands, marshes, bogs, fens, or other sensitive water-dependent sites unless needed to protect life or property.

Design Features for specific units:

- **Winter conditions** will be required for harvest on the following units to ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met: Alternatives 2 and 3 Units 17 and 155.
- Soil disturbance will be evaluated following harvest activities to determine if burning after harvest ("**deferred burning**"), as proposed, can also be implemented and remain within Region 1 Soil Quality Standards. If it is determined that burning will exceed soil quality standards, then burn prescriptions will be adjusted so activities remain within standards. If burning prescriptions cannot be changed, then burning will be delayed until adequate soil recovery has occurred and soil quality standards can be met. The following units require either **deferred burning or winter logging** in order ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met: Alternative 2 Units 001, 002, 007, 019, 020, 060, 061, 077, 091, 152, 154, 160, 165 and 167. Alternative 3 Units 001, 002, 007, 19a, 020, 077, 091, 152, 154, 160 and 165a.
- Alternatives 2 and 3 Unit 52 will require **deferred burning and winter logging** in order ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met. Additionally, in the portion of the unit that overlaps the roadside hazard tree removal, skid trails and landings be reused to the extent practicable.
- The burn prescriptions for Alternative 2 Units 011, 011s, 027, 056, 059, 063, 066, 069, 074, 075, 076, 080, 084, 085, 087, 088, 089, 101, 103, 105, 106, 109, 110, 111, 112, 113, 114, 116, 117, and 121 will be designed to target **low severity burning** to ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met. Similarly, burn prescriptions for Alternative 3 Units 011, 011s, 027a, 059a, 063a, 066a, 069, 074, 084a, 085a, 087, 088, 089a, 089b, 89c, 101a, 103a, 105, 106a, 109, 113a, 114, 116a, 117a, 121, 143a, and 145a will be designed to target **low severity burning** to ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met.
- Alternative 2 Units 143 and 145 will require **winter logging with either deferred burning or low severity burning** to ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met.
- **Decommissioning non-system** or unauthorized routes within Alternatives 2 and 3 Units 008 and 102 will be necessary for soil restoration to ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met following the harvest or burning activities.

- **Hand treatment** in pre-commercial thinning units will be required for the following units to ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met: Alternatives 2 and 3 Unit 130 and Alternative 2 Unit 157.
- Alternatives 2 and 3 Unit 18 will require **winter logging and reuse of old jammer roads for skid trails or hand treatment** to ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met.
- **Reuse of primary skid trails and landings** from the adjacent roadside hazard tree units will be necessary in Alternatives 2 and 3 Unit 9 to ensure that the Region 1 Soil Quality Standards for detrimental soil disturbance are met.
- In order to meet the Region 1 Soil Quality Standards for Unit 104, **decommissioning of non-system roads** within the unit will be necessary in addition to low severity burning, and either winter logging or deferred burning.
- In order to meet the Region 1 Soil Quality Standards for Alternative 2 and Alternative 3 Unit 023, **reuse of primary skid trails and landings** from the adjacent roadside hazard tree units and **either winter logging or deferred burning**.
- In order to meet the Region 1 Soil Quality Standards for Alternatives 2 and 3 Unit 093, the unit will be split east and west as bisected by a road/Continental Divide Trail, and the western portion of Unit 093 is not treated with ground based equipment or prescribed fire due to high existing detrimental soil disturbance related to historic mining features. The eastern portion of Unit 093 is expected to meet Region 1 Soil Quality Standards as proposed in both Alternatives 2 and 3.
- Unit 066 in Alternative 2 has a non-system road within the unit. In order to meet the Region 1 SQS rehabilitation the non-system roads would need to occur to reduce the predicted detrimental disturbance to comply with R1 SQS. These roads should be reclaimed following treatment since they will be used for facilitating the proposed treatment.

Wildlife

- If any listed species are detected in the project area, activities will be examined to determine if modification is necessary.
- All prescribed fire should be implemented prior to May 1 or after July in order to protect nesting birds. If prescribed fire needs to be implemented between May 1 and July 31, active ignition should be avoided at known nest locations.
- HNF Recommendations from the Final Report of the Montana Cooperative Elk-Logging Study, 1970-1985 for Coordinating Elk and Timber Management would be implemented during timber harvest. Applicable design elements include:
    - Logging activity will be confined to a single drainage at a time with all work completed in the shortest time frame possible.
    - Logging operations will be prohibited during the first two weeks of the general rifle season in order to maintain big game habitat capability and hunting opportunity.
    - All temporary roads will be closed to the public.
    - Recreational use of firearms will be prohibited for anyone working within an area closed to the general public.
    - Road construction will not occur in elk winter range.
    - Slash clean-up inside clearcuts will be reduced below 1.5 feet.

  - Timbered areas adjacent to winter foraging areas will be retained.
  - Timber harvest on winter range will be scheduled outside of the winter period.
- If elk calving and nursery areas are identified prior to or during project implementation, these areas will be protected. This would be from late May through July unless surveys indicate areas are no longer being used.
- For known and new active goshawk nests, a no treatment buffer of a minimum of 30 to 40 acres will be maintained around nest trees.
- At least 180 acres of nesting habitat per home range will be retained in the Project area with an emphasis on stands that have been used by goshawks for nesting.
- No ground disturbing activities would occur inside known post fledgling areas from 15 April through 15 August to protect the goshawk pair and young from disturbance during the breeding season until fledglings are capable of sustained flight. Site-specific data will continue to be used and if needed, timing restrictions will be designed to reflect variations in fledgling dates.
- Retain deformed trees for use by goshawks as nest trees.
- Prescription design modifications (such as leaving clumps of advance regeneration) are recommended in many units. These changes will not change the basic treatment terminology applied to the units.
- All temporary roads would be decommissioned after project activities are completed. Decommissioning of roads would ensure no future loss of elk security.
- All temporary roads would have locked gates and be closed to the public at all times.
- Forest Plan standards regarding snags would be met as described in the Habitats of Special concern report. While OSHA requires felling of snags deemed to be safety hazards, site-specific silvicultural prescriptions would include snag retention and coarse woody debris goals.

Forested Vegetation

- Logging areas would be open to firewood gathering after the sale is closed, and prior to burning if wood is available and resource values can be protected.
- In general, landing piles would be burned within 2-3 years of harvest.
- No whitebark pine trees would be cut (designated to be removed) regardless of size, condition, or distribution in any treatment.

Forested Habitats of Special Concern

Old Growth:

- No treatment would occur in old growth.

Whitebark pine:

- No whitebark pine would be cut regardless of size, condition, or distribution.
- Generally, conifers within 10 to 20 feet of living whitebark pine would be cut.
- To the extent possible whitebark of all size classes would be protected from logging equipment. This may include ensuring that designated skid trails avoid whitebark and trees are directionally felled away when possible.

- Whitebark would be protected from fire mortality in prescribed burning areas through techniques such as directional felling of slash, pulling slash away 10 to 20 feet, depending on tree size, and designing ignition patters to limit fire intensity to whitebark. Jackpot fuels would be arranged to avoid scorching whitebark trees.
- To the extent that funding and rust resistant stock is available, whitebark would be planted in harvest units where it has been identified as a potential component.

Ponderosa pine:

- No ponderosa pine would be cut, if encountered (rare).

Aspen:

- Conifers less than 20 inches diameter breast high (dbh) would be cut or girdled in aspen clones, and within 20 feet of the edge of aspen. Prescribed fire may or may not occur in clones depending on site-specific prescriptions.

Snags:

- If a snag designated for retention must be removed for safety (OSHA), it would remain onsite as coarse woody debris and a substitute snag selected for retention.
- No retention of individual dead lodgepole pine is desired; these trees are generally small and not windfirm. Groups or clumps of lodgepole snags may be left in inoperable areas or when mixed in with other retention trees.
- All whitebark snags would be retained.
- In regeneration harvest units, roughly 20 snags per 10 acres from a mixture of diameter classes available, with seral species preferred, would be retained where they do not pose a safety or feasibility concern; and all snags greater than 20 inches dbhwould be retained.
- In intermediate harvest units, snag retention goals would be to retain all snags greater than 20 inches dbh, and additional snags to average at least 2 snags per acre of the largest, most windfirm snags available. There would also be live trees in various size classes to provide snag replacement, and likely inoperable areas where all snags would be retained.
- In burn units, retention of medium to large snags is an objective; prescription specifications would generally include limiting cutting of snags greater than 12 inches diameter unless they are a specific safety or line containment hazard.
- Retain the rare remnant snags that may be found in pre-commercial thinning units.

Sensitive Plants

- Known populations of Hall's rush occurs in or near units 060, 063, and 122 in wet meadow habitats. These populations would be buffered and protected during unit layout and implementation.
- If any other sensitive plant populations are found within the project area during unit layout or implementation, a Forest Botanist would be consulted to evaluate the proper procedures to take.
- A 100-foot buffer around any sensitive plant population species would be required when herbicides are applied. Within this buffer only hand pulling of weeds would be allowed.
- If any sensitive plant populations are located in the future, a species appropriate buffer would be applied around the sensitive plant population when herbicides are applied. Within this buffer hand pulling of weeds would be allowed.

Air Quality

- Section 190 of the Clean Air Act requires the EPA to issue technical guidance on Reasonably Available Control Measures (RACMs) and Best Available Control Measures (BACMs) for prescribed fires. RACMs and BACMs would be incorporated into all planned burning activities associated with treatment units.
- Prior to initiating any burning activities, a burn plan in compliance with the Montana/Idaho Airshed Group Operating Guide would be prepared for areas proposed within alternatives 2 and 3.
- Location, timing, and possible smoke effects would be disclosed in the local newspaper and to local residents prior to burning.
- During the burn implementation periods, the prescribed burn boss would be responsible for monitoring site specific smoke analysis with current weather and air quality conditions prior to ignition. Using that information, the burn boss would determine how many acres can be burned and identify any effects on residents located downwind of the project burn area.
- Coordination of prescribed fire activities in other project areas would take place to ensure the amount of smoke would be manageable if multiple units across the project area were burned.

Heritage

- National Heritage Protection Act compliance must be completed prior to project implementation. When phased surveys are completed, the heritage survey implementation plan would be updated and forwarded to project proponents. The heritage specialist will provide site location maps to field crews for review before unit implementation. Historic properties or unevaluated cultural sites will be avoided by project activities or mitigated through additional consultation with the Montana State Historic Preservation Office per 36 CFR 800. If new cultural sites are located during project implementation, a forest archaeologist would be contacted to review the site and would determine appropriate site protection measures. If these mitigation measures are followed, then it is recommended that the project be allowed to proceed as a No Adverse Effect activity. However, if the scope of work changes or any additional cultural resources are encountered during implementation of this project, then work should stop in the area and the forest archaeologist be contacted. Work in that area can only resume if mitigation measures can be determined and/or re-evaluated if necessary.

Minerals

- Forest Minerals personnel will provide maps of known reclaimed and un-reclaimed mine sites, hazardous mine openings, discharging adits and active Plan of Operations areas to implementation resources annually prior to field season.
- Heavy equipment would avoid tracking over reclaimed areas, and over un-reclaimed waste rock or tailings piles.
- Provide for vegetative buffer zones, or use slash as surface cover around waste piles and reclaimed areas to reduce the potential for erosion from these areas in the event of a high intensity storm or extreme runoff event post vegetation treatment.
- Provide for vegetative buffers zones and avoid tracking of heavy equipment around adits discharging water to limit alteration of flow conditions.

- Treatment areas where mining workings are known or suspected could be inventoried prior to treatment activities to identify potential mine related hazards. Identified hazards would be flagged by Forest Minerals personnel.
- Avoid constructing burn piles (hand or mechanically generated) or the tracking of heavy equipment over mine features that have been closed with polyurethane foam product.
- Coordinate timber harvest, other vegetation treatment and commercial log hauling activities with active mining claimants conducting mining related activities under an approved Plan of Operations.
- Any previously unidentified abandoned-inactive mine features discovered during implementation should be reported to Forest Minerals personnel as well as the Forest Archaeologist.

Forest Plan Amendment

Implementation of any of the action alternatives would require a site specific amendment to the 1986 Helena National Forest Plan (Forest Plan) for lands encompassed by the Telegraph Vegetation Treatment Project. This site-specific amendment would exempt the Telegraph Vegetation Project from the Forest Plan forestwide standard for thermal cover on winter range in the Jericho herd unit (Big Game Standard 3, Forest Plan page II/17). The site-specific amendment would also exempt the Project from winter range restrictions in order to proceed with winter logging in select units and from limitations on the size of openings associated with clearcuts. forestwide Big Game Standard 6 (Forest Plan page II/19) directs that the Montana Cooperative Elk-Logging Study Recommendations in Appendix C of the Forest Plan will be followed during timber sale and road construction projects. Those recommendations include scheduling logging outside of the winter period on winter range (Forest Plan page C/10) and limiting the size of clearcuts to 100 acres or less. The need for this amendment is predicated on winter range validation with Montana Department of Fish, Wildlife, and Parks (MFWP). Winter range in the Telegraph Vegetation Project is based on coarse distribution maps created by MFWP. These winter range maps represent general species distribution at a one square mile Section level. This amendment would be applicable only to implementation of the decision for the Telegraph Vegetation Project.

Monitoring

Monitoring and evaluation compares the end results being achieved to those projected in the Forest Plan. Monitoring is conducted on a sample basis to evaluate the overall progress in implementation of the Forest Plan, the assumption on which the Forest Plan is based, and to provide a feedback loop for determining the effectiveness of project and mitigation implementation. Monitoring and evaluation would be conducted as described in the Forest Plan and individual specialist reports. The monitoring plan for the Telegraph Vegetation Project will be included in the Record of Decision.

Alternatives Considered But Not Given Detailed Study

Federal agencies are required by the Council on Environmental Quality (CEQ) to rigorously explore and objectively evaluate reasonable alternatives and 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. Therefore, a number of alternatives were considered but dismissed from detailed study for reasons summarized below.

The proposed action is limited to the specific fuel and vegetation treatment activities proposed on National Forest System (NFS) land in the Telegraph Vegetation Project area. That said, the geographic extent of some areas used to analyze different resource components (watershed, fuels and wildlife home ranges) may extend beyond the project area. The analysis of effects disclosed in this document includes those occurring from the entire "scope" of the decision. Scope is defined in 40 CFR 1508.25 as the range of actions, alternatives, and impacts to be considered in an EIS. Any new information that develops after the decision of this analysis would be considered prior to implementation.

Area Treatment with Verbenone

It was suggested by one commenter that the FS should treat the area with Verbenone. Verbenone is a MPB anti-aggregate pouch that is manually placed on trees to try to keep flying MPB away from a particular area. Since the MPB epidemic is largely over in the Telegraph project area and due to the large existing mortality that makes the area at low risk for future infestations for the immediate future, it was decided that this alternative did not need to be carried forward.

No Logging

It was suggested by one commenter that we should analyze a “no logging alternative.” For the EIS we will be analyzing a no action alternative that will display the effects of no treatment within the project area. The possibility of a prescribed burn only alternative was discussed within the IDT but was decided to be largely unfeasible and not likely to meet the project objectives stated in the project purpose and need.

Treat South and West of Elliston

One commenter suggested that we should look to treat the area directly south and west of the town of Elliston. This area does not lie within the Telegraph project boundary. Portions of this area were considered for treatment under the Elliston Face project. Because this area lies outside of the established project boundary it will not be considered in detail under the Telegraph Vegetation project.

Eliminate Units (with roads and noxious weeds present) from Fire Management Proposals

One commenter asked for an alternative to be developed “that eliminates units that have noxious weeds present on roads within units from fire management proposals.” The IDT interpreted this to mean eliminating any unit that has roads and weeds present from fire management proposals. Because some level of weeds are present along almost all roads within the project area this would essentially eliminate fire management from all units in which it is proposed. Eliminating all fire treatments from the project would not meet fuels and site preparation objectives and also would not meet purpose and need objectives.

Make Temp Roads Permanent, Create New OHV Routes, and Open Existing Closed Routes

Several commenters stated that they use the project are for motorized recreation and would like to see new temporary roads left in place, and old road closures opened back up. Other commenters asked for new OHV routes to be developed, including a motorized historic mine tour route. Since the Divide Travel process is ongoing and addresses most of these issues for now we won’t be addressing travel management decisions through the Telegraph Vegetation Project.

Comparison of Alternatives

This section provides a tabular summary of the effects of implementing each alternative. The tables display Purpose and Need, Key Issues, Harvest Systems, and Resource Measurement Indicators by alternative. The action alternatives address key issues to varying degrees, dependent upon specific alternative design elements.

Table 3. Purpose and need indicators by alternative[1]

Purpose and Need Indicators	Alt 1	Alt 2	Alt 3
Habitat Resiliency, Diversity and Reforestation			
Acres of **aspen** promoted by treatment type	0	705	705
Acres of **whitebark pine** promoted by treatment type	0	781	366
Forest Vegetation Simulator estimated % **WBP** composition in example stand (stand 1 - TPA/%Total TPA – 5 years)	0	70/44%	70/44%
% project area treated			
• Regeneration Harvest	0	15	8
• Intermediate Harvest	0	2	2
• Pre-commercial Thinning	0	8	5
• RX Fire	0	4	3
• Cumulative (w/past act)	16	37	29
Acres of old growth adjacent to treatment units	0	669	456
Hazardous Fuels Reduction			
Acres of treatments that reduce surface fuel loading levels, remove vertical standing dead, and break up contiguous dead and down vegetation that would alter fire spread and provide for firefighter and public safety.	0	4,996	2,924
Provide Wood Products for Local Economies			
Volume production (MBF)	0	20,888	12,022
Watershed Values			
Miles of Road Decommissioned	0	0	30
Stream Crossing Improvements	0	6	9

Table 4. Significant issues by alternative

Issues	Alt 1	Alt 2	Alt 3
Lynx and lynx habitat			
Acres of multistory snowshoe hare habitat in the WUI within the project boundary	4.472	3,277	3,897
Acres of stand initiation snowshoe hare habitat in the WUI within the project boundary	1,455	781	1,086
Acres of early stand initiation habitat in the WUI within the project boundary	535	1,312	900

Issues	Alt 1	Alt 2	Alt 3
Elk security and hiding cover			
Acres of hiding cover			
Jericho Elk Herd Unit	25,810	23,423	24,454
Spotted Dog/Little Blackfoot Elk Herd Unit	53,149	49,328	50,801
Acres of hiding cover in security areas			
Jericho Elk Herd Unit	3,139	2,821	3,074
Spotted Dog/Little Blackfoot Elk Herd Unit	17,196	16,770	16,873
Acres of hiding cover in intermittent refuge areas			
Jericho Elk Herd Unit	863	765	854
Spotted Dog/Little Blackfoot Elk Herd Unit	1,957	1,678	1,869
Road Activity (miles)			
Temporary Road Construction followed by full obliteration	0	8.5	3.4
Road maintenance	0	43.1	42.9
Road reconstruction	0	32.6	28.3
Haul routes	0	84.2	74.6
Jericho Inventoried Roadless Area			
Acres of Prescribed burning	0	537	418

Table 5. Harvest systems and acres by alternative

Harvest Systems Used	Alternative 1	Alternative 2	Alternative 3
Ground based	NA	3,845	2,405
Cable	NA	468	237
Hand and/or fire treatment only	NA	2,441	1,543
Total	**NA**	**6,754**	**4,185**

Table 6. Resource measurement indicators by alternative

Resource (measurement indicator)	Alt 1	Alt 2	Alt 3
Hydrology/Aquatic Organisms			
Water Quantity Cumulative Effects (percent water yield increase over undisturbed forest)			
Little Blackfoot –Hat Creek	8%	9%	9%
Mike Renig Gulch	8%	10%	9%
Ontario Creek	10%	12%	11%
Telegraph Creek	12%	14%	13%
Sedimentation from treatment units (tons, probability of sedimentation in the first year after treatment)			
Little Blackfoot -Hat Creek	N/A	0.01 (16%)	0.01 (16%)
Mike Renig Gulch	N/A	0.10 (18%)	0.06 (18%)
Ontario Creek	N/A	0.13 (13%)	0.04 (13%)
Telegraph Creek	N/A	0.23 (12%)	0.16 (12%)
Sedimentation from Roads (average tons/year)			
Little Blackfoot -Hat Creek	4.3	0.1	0.1
Mike Renig Gulch	11.2	1.1	1.1
Ontario Creek	2.6	0.4	0.4
Telegraph Creek	3.5	0.6	0.6
Road decommissioning (miles decommissioned within 150 of a stream)			
Little Blackfoot -Hat Creek	0	0	0.7
Mike Renig Gulch	0	0	0.5
Ontario Creek	0	0	0.5
Telegraph Creek	0	0	3.9
Vegetation			
Snags/ac in Third Order Drainages (post treatment)			
Drainage 1106B	33	20	27
Drainage 1107	37	26	30
Drainage 1108-1	32	26	28
Fuels			
Acres treated with in Wildland Urban Interface (WUI)	0	6,753	4,184
Soils			
Acres of predicted detrimental soil disturbance – short term	0	575	339
Wildlife			
Elk			
% Elk habitat effectiveness on summer range			
Jericho Herd Unit	56%	56%	56%

Resource (measurement indicator)	Alt 1	Alt 2	Alt 3
Spotted Dog/Little Blackfoot Herd Unit	56%	56%	56%
% Elk hiding cover by elk herd unit on summer range			
Jericho Herd Unit	73%	66%	69%
Spotted Dog/Little Blackfoot Herd Unit	65%	60%	62%
% Hiding cover /open road density mi/mi^2 by elk herd unit			
Jericho Herd Unit	73%/1.27	66%/1.27	69%/1.27
Spotted Dog/Little Blackfoot Herd Unit	65%/1.06	60%/1.06	62%/1.06
% Elk security habitat by elk herd unit			
Jericho Herd Unit	12%	12%	12%
Spotted Dog/Little Blackfoot Herd Unit	30%	30%	30%
% Elk Intermittent Refuge Areas by elk herd unit			
Jericho Herd Unit	3%	3%	3%
Spotted Dog/Little Blackfoot Herd Unit	4%	4%	4%
% Elk thermal cover by elk herd unit on winter range			
Jericho Herd Unit	5%	5%	5%
Spotted Dog/Little Blackfoot Herd Unit	3%	3%	3%
Lynx			
% Lynx Analysis Unit (LAU) in an early stand initiation structural stage			
di-03	1.3%	1.4%	1.4%
di-04	3.3%	9.2%	6.5%
di-05	2.5%	2.5%	2.5%
% LAU regenerated by timber harvest on NFS land in a 10-year period			
di-03	0.03%	0.54%	0.40%
di-04	0.07%	13.09%	6.64%
di-05	0.95%	0.95%	0.95%
Other wildlife resources			
Acres of potential Flammulated Owl habitat in the project area	6,688	5,077	5,506
Acres of potential Northern Goshawk habitat (Nesting) in the project area	9,524	7,057	7,919
Acres of potential Northern Goshawk habitat (Foraging) in the project area	17,709	12,172	14,320
Acres of potential Pileated Woodpecker Habitat in the project area	7,643	5,926	6,364
Acres of potential Hairy Woodpecker Habitat in the project area	7,746	5,930	6,368
Acres of potential American Marten habitat in the project area	12,036	8,855	10,069
Acres of potential Fisher habitat (Summer) in the project area	4,857	3,500	4,119
Acres of potential Fisher habitat (Winter) in the project area	20,103	14,111	16,483

Resource (measurement indicator)	Alt 1	Alt 2	Alt 3
Noxious Weeds			
Predicted acres of noxious weed infestation due to proposed activities	0	575	339

[1] Incorporates all design features/mitigation measures

Chapter 3. Affected Environment and Environmental Consequences

Introduction

This section presents the biological, physical and socioeconomic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparing the alternatives as described in chapter 2.

This chapter is arranged by resource area, starting with an overall introduction to vegetation to provide the reader a better understanding of the overall vegetative condition. Following each resource description is a discussion of the potential effects (environmental consequences) to the resources associated with the implementation of each alternative. Potential effects, including direct, indirect, and cumulative effects are disclosed. Effects are quantified, where possible, and qualitative discussions are also included. Acre totals are approximate within tables and text due to rounding.

This analysis uses best available science, but recognizes that opposing science exists. A literature review of opposing science sent to the project by the public in scoping responses was reviewed and where appropriate, incorporated information within literature into analysis, issue statements and the development of alternatives.

This DEIS incorporates by reference the resource specialist reports in the project record (40 CFR 1502.21). Specialist reports contain detailed data, executive summaries, regulatory framework, assumptions and methodologies, analyses, conclusions, maps, references, and technical documentation that the resource specialists relied upon to reach conclusions in the DEIS. This chapter presents the relevant resource components of the existing environment – the base line environment. It describes the resources of the area that would be affected by the alternatives. This chapter also discloses the environmental effects of implementing the alternatives. These form the scientific and analytical basis for comparing the alternatives described in chapter 2. All resource professionals have integrated the design features and mitigation measures described in chapter 2 into their analyses and conclusions.

This DEIS incorporates the Forest Plan by reference and tiers to the FEIS completed for the Forest Plan, and amendments. The discussions of resources and potential effects take advantage of existing information included in the Forest Plan and other sources as indicated. Where applicable, such information is briefly summarized and referenced to minimize duplication. The planning record includes all project-specific information such as resource reports, ecosystem analyses, and other results of field investigations. The record also contains information resulting from public involvement efforts. The planning record is available for review by contacting the Helena National Forest office.

Analyzing Environmental Consequences

Environmental consequences are the effects of implementing an alternative on the biological, physical, economic, and social environment. The Council of Environmental Quality regulations implementing the National Environmental Policy Act include a number of specific categories to use for the analysis of environmental consequences. Several form the basis of much of the analysis that follows. They are explained briefly here.

Direct, Indirect, and Cumulative Effects

Direct environmental effects are those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity, but would occur in the foreseeable future. The project is expected to be active over approximately the next 7 to 10 years, or from the time the decision is made to full implementation. Cumulative effects result when the incremental effects of actions are added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time. Past activities contributed to the existing condition and are considered in the affected environment. Present and reasonably foreseeable future actions are assessed along with the effects of the proposed action to determine whether significant cumulative effects may occur. This analysis is consistent with the Council on Environmental Quality memo from James L. Connaughton titled "Guidance on the Consideration of Past Actions in Cumulative Effects Analysis" dated June 24, 2005, incorporated by reference.

In order to understand the contribution of past actions to the cumulative effects of the proposed action and alternatives, this analysis considers the current environmental conditions as a reflection of the aggregate impact of all prior human actions and natural events that affected the environment and might contribute to cumulative effects.

The cumulative effects analysis does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis. There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions over the last century, and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because there is limited information on the environmental impacts of individual past actions, and one cannot reasonably identify each and every action over the last century that has contributed to current conditions. Additionally, we cannot focus on the impacts of past human actions and ignore the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By looking at current conditions, we are sure to capture all the residual effects of past human actions and natural events, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005, regarding analysis of past actions, which states, "agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions." The cumulative effects analysis in this EIS is also consistent with Forest Service National Environmental Policy Act (NEPA) Regulations (36 CFR 220.4(f)) (July 24, 2008).

The HNF Schedule of Proposed Actions (SOPA) was reviewed and forest and district personnel consulted to identify current and reasonably foreseeable projects on the Helena Ranger District. Contacts were made with adjacent Forests for proposed activities to be considered for affected resources cumulative effects analysis.

Assessment areas vary by resource, and so do the other actions included in each cumulative effects analysis. Cumulative effects may include estimated effects from present logging (timber harvest, fuels treatments, road and landing construction and maintenance) and wildfire activities (e.g.,

suppression activities and the affected burn areas). Other actions may include but are not limited to grazing, mining and fuels reduction and/or forest health projects in the vicinity.

Ongoing activities include annual road maintenance, firewood gathering, recreation trail use for hiking and snowmobiling, dispersed camping, hunting, and appropriate responses for fire suppression. The past, present and reasonably foreseeable actions considered for this project analysis are displayed in appendix C on figure C-1 (map) with impacts noted in tables C-3 (past activities), C-4 (ongoing activities), and C-6 (foreseeable actions).

Vegetation

This section provides an overview of vegetation. It describes the methods used for data collection and ways the data are used to analyze the alternatives including terminology and classifications used to describe types of vegetation, natural forces that affect vegetation at broad scales, and the current vegetation characteristics of the Telegraph area. The following resource areas use the information in this section to describe further the existing condition and effects:

- Fire and Fuels
- Fire Regime Condition Class (FRCC)
- Forested Vegetation
- Habitats of Special Concern
- Wildlife
- Noxious Weeds
- Sensitive Plants
- Range (livestock grazing)

To gain an understanding of existing conditions and environmental effects, information must be viewed at different scales. Some effects can be displayed accurately at the project scale; others may need a broader scale. In some cases, there are differences in vegetation conditions depending on the scale of analysis. In this introduction, four scales of analyses are addressed. These areas include both National Forest System lands as well as lands in other ownerships.

- *Helena National Forest* (HNF) – **978,799** acres
- *Divide Landscape* – **233,813** acres
- *The Telegraph Combination Boundary* includes approximately **117,966** total acres. The boundary includes two elk herds units and several 6th code HUCs (watersheds).
- *The Telegraph Project Area* includes approximately **23,669** acres

Information Used

- Region 1 Existing Vegetation Map Product (R1-Vmap) is a vegetation map product produced by the Northern Region Geospatial group (USDA 2011a; USDA 2009a).
- Aerial Detection Surveys (ADS) are maps of visible insect and disease presence generated annually in the Northern Region based on visual observations taken during survey flights. The Telegraph area has been flown every year from 2006 to 2012. The aerial survey standards and GIS mapping handbook for this data are in the project file (USDA 1999; USDA 2003).

- Forest Inventory and Analysis (FIA) is a dataset made up of hierarchical points established to a nationwide systematic grid FIA points provide a grid based, statistically reliable inventory dataset across the Forest using national data collection protocols. The HNF has added points that intensify the base grid, by placing four times the number of points across the Forest, using collection protocols established for the Northern Region compatible with the national protocols as defined in Region 1 Grid Intensification Using CSE protocols Field Procedure (USDA 2008) and Common Stand Exam Field Guide for Region 1 (USDA 2012b). This dataset is referred to as "intensified grid data."
- FSVeg is a warehouse for data that is recorded using standard data collection protocols. Data housed in FSVeg includes FIA intensified grid data, described above, and stand examination data. Stand examinations are statistical plot surveys taken at the stand-level, measuring stand characteristics such as species, heights, diameters, physical defects and insect and disease activity of trees. Most stand exams available in the analysis areas were taken in the 1980's and 1990s; the FVS model (described below) is used to "grow" these stands into the future.
- FSVeg produces the Region 1 FSVeg Old Growth Report based on the Region's old growth definition and minimum criteria found in Green et al. (1992).
- The R1 Summary Database is a data analysis system used to analyze intensified grid data.
- The Forest Vegetation Simulator (FVS) is an individual-tree, distance-independent growth and yield model that predicts forest stand dynamics.
- The Forest Activity Tracking System (FACTS) is the current activity database in which all management and natural events are recorded. Records in this database date back generally to the 1950s.
- Detailed field diagnoses (walk-through surveys) were done by silviculture personnel.

Methodology and Scientific Accuracy

This analysis is based on the best available science and acknowledges that there is incomplete and unavailable information. "Scientific uncertainty, incomplete information, and controversy among experts are inescapable facets of the scientific process" (Clarke 2006). Uncertainty arises from factors such as complexity, natural variability, random variation, measurement error, and lack of knowledge (Clarke 2006). Elements of uncertainty are considered qualitatively. Policy measures designed to deal with uncertainty include public participation, interdisciplinary processes, and monitoring (ibid).

There are a series of tables that display numbers of acres and percentages. All raw numbers and calculations can be found in the Project file. The values shown are rounded. In some cases due to rounding the total is slightly less or more than the actual total; in these cases, an acre or percentage was added to or subtracted from the largest value. Multiple "acre" columns may be present in the raw data exported for summaries in Excel spreadsheets. The acre column to the farthest right is the one that was generally updated in GIS and is used for pivot table summaries.

Vegetation Structure and Composition Methodology

Descriptions of potential and existing vegetation are derived by summarizing available data, primarily VMap, using GIS tools and pivot tables. Additionally, the R1 Summary Database is used to summarize FIA grid intensification data. Fine scale information is derived from stand examinations where available and site visits.

Vegetation is a complex resource. Historically, various organizational structures have been used to describe vegetation. Classifications are a way to group forests based on similar vegetation, site potential, and responses to disturbances; the various systems used are complementary and meant to be considered together because they offer valuable information regarding vegetation. Some classifications indicate potential vegetation and not necessarily the current vegetation. These are useful to discuss site potential, future stand conditions, indirect effects to alternatives, and long-term insect susceptibility. Other classifications indicate current existing vegetation and are useful to describe current conditions, direct effects, and short-term insect susceptibility.

Potential Vegetation Methodology

Biophysical settings are land delineations based on the physical setting of an area, elevation and aspect and the potential natural vegetation (PNV) that can occupy a specific environmental setting (Hann and Bunnell 2001; Hann and Strohm 2003). Biophysical setting is used to describe the environmental setting, and hence the land's capacity to support a specific ecosystem. It is important to understand the limits and potential of landscape areas based on climate, position in the landscape, and vegetation. An important part of the biophysical setting is PNV, defined as the potential of a land area to support a specific type of natural vegetation. The concept of PNV is based on climax successional theory, which states that vegetation communities are constantly changing, moving toward an "endpoint," which has been called a "climax" (Pfister et al. 1977). This process, succession, is the progression of change in the composition, structure, and processes of a plant community through time. Scientists theorize that a particular group of species would occupy each stage, and that the stage is predictable over time (Winthers et al. 2004). This interpretation of PNV states that succession proceeds to a climax state limited only by climatic constraints, and assumes that no natural disturbances occur to disrupt the progression. Because certain vegetation stages and types can be reasonably predicted within a given biophysical setting, resource professionals can predict the vegetation stages that would occur following a given type of disturbance.

Seven vegetated biophysical settings occur in the boundaries of interest. These settings were modeled using stand exam data, satellite imagery classification, intensified grid data, and on-the-ground knowledge. A description of each setting is available in the project record.

Table 7. Biophysical setting descriptions

Photo of biophysical setting	Description
	Ponderosa Pine/Douglas-fir (Inland Northwest) (PPDF1): This setting occurs at low elevations on southerly aspects. Typical sites are mountain slopes, ridges, and foothills. This type is most commonly a mix of Douglas-fir and ponderosa pine, although other conifers such as Rocky Mountain juniper and limber pine occur on calcareous substrates. The habitat types range from abundant dry Douglas-fir climax to a minor amount of ponderosa pine climax. Ponderosa pine forest typically separate grasslands from Douglas-fir, but, in some areas where the climate is too cold, ponderosa pine does not occur and the grasslands give way directly to Douglas-fir.

Photo of biophysical setting	Description
	Douglas-fir Interior Northern and Central Rocky Mountains – Dry (DFIR2-D): The warm dry segment of DFIR2 occurs on south, west, southeast, and southwest aspects. It ranges in elevation from 5,500–6,200 feet. Douglas-fir is the dominant conifer, with the understory dominated by snowberry trending to grass. Common juniper can be a major component. Ponderosa pine and lodgepole pine can occur occasionally. The habitat types are Douglas-fir climax types, and sites are more moist and productive than PPDF1. These sites typically border ponderosa pine climax sites or grasslands. These drier Douglas-fir forests are often found on harsh aspects (south or west), and timber productivity is low.
	Douglas-fir Interior Northern and Central Rocky Mountains – Moist (DFIR2-M): The moist segment of DFIR2 is cooler, found on all aspects at elevations of 6,200-6600 feet. This setting is dominated by a mix of Douglas-fir and lodgepole pine. This split was made to reflect the higher occurrence of lodgepole pine due to the change in aspect. The understory is generally dominated by pinegrass (*Calamagrostis rubescens*). The habitat types in this setting are Douglas-fir or spruce climax forests. These areas are more moist and productive (generally moderate) than the warm DFIR2 setting and are more likely to be found on north and east aspects, and at slightly higher elevations. Lodgepole pine is a common seral component or dominant species.
	Interior West Lower Subalpine Forest (SPFI1): This setting occurs in the lower subalpine zone—6,600 to 7,000 feet—on gentle to moderately steep terrain. Lodgepole pine is generally the most common conifer, with Douglas-fir, subalpine fir, and Engelmann spruce occurring as well. Whitebark pine occurs at the upper elevations. More moist sties can be dominated by subalpine fir and spruce. Many habitat types are included in this setting, primarily subalpine fir climax types but a few spruce and lodgepole pine habitat types as well. The subalpine fir series typically border the spruce or Douglas-fir climax forests on their lower bounds in eastern Montana. Timber productivity ranges from low to high.

Photo of biophysical setting	Description
	Interior West Upper Subalpine Forest (SPFI2): This setting occurs in the upper subalpine zone. These areas are above 7,000 feet and are moderately steep to steep terrain. Relatively dry, cold sites are dominated by whitebark pine, Engelmann spruce, and subalpine fir. These border subalpine fir forests and are bounded by timberline at upper elevations. Lodgepole pine is often a dominant seral component as well as whitebark pine, and timber productivity is generally high. In the absence of disturbances, shade-tolerant subalpine fir eventually dominates.
	Riparian (RIPA): Bottomlands and montane riparian forests in a wide variety of climates and ecoregions, including cottonwood, aspen, and other riparian communities. In general, riparian areas have characteristics (such as cooler temperatures, saturated soil, higher relative humidity, etc) that reduce fire frequency and severity relative to their surrounding uplands. The expected fire regime varies by the type of stream and the surrounding biophysical settings.
	Deciduous Woodland (DWOA): On the HNF, this setting is characterized by aspen (although aspen may also be found in RIPA) and is found on mid-elevation slopes in a variety of topographical conditions, usually in patches within a mixed conifer matrix (such as Douglas-fir, Engelmann spruce, and subalpine fir) which often become present or dominant in the absence of fire. Generally subject to infrequent replacement fire with occasional mixed fires, all of which promote suckering and can result in multi-storied mature stands.
	Mountain Grassland with Shrubs (MGRA3): The vegetation is grassland dominated by fescues, bluebunch wheatgrass, sedges, tufted hairgrass, and oatgrass with intermingled broad-leaved forbs and scattered shrubs. This type can occur at all elevations and all aspects. It is made up of non-forested habitat types.

Each biophysical setting is discussed in terms of vegetation classes. These are types of vegetation that would be expected to exist in the reference condition—the condition that would be present if fire was occurring in a typical frequency on the landscape—compared to the actual mix of vegetation classes that exist today. Vegetation classes are described in relation to the seral stage in which the class generally occurs. A seral stage is described in terms of vegetation succession as follows:

Table 8. Vegetation classes

Photo of vegetation class	Description
	Early seral is the first vegetative response to a disturbance such as fire, insects, disease or logging that have removed or killed the overstory. This vegetation condition can have various dominant life forms, depending on the biophysical setting. In conifer forests, the dominant tree size is from 0.1 to 5.0-inch diameter breast height (dbh– the diameter of a tree at 4.5 feet).
	Mid seral is a vegetation condition that occurs from several years to several decades after the early seral stage, depending on the biophysical setting. This condition is dominated by conifers in a forested setting, or dominated by perennial grasses or shrubs in a non-forest setting. Dominant trees in this condition are pole-sized—5.0 to 9.0-inch dbh.
	Late seral is a vegetation condition that can last for many decades with no or moderate disturbance such as insects, fire, or management that does not remove the entire overstory. In a forested setting, this type is dominated by trees that are greater than 9.0-inch dbhand is older than a mid seral stand.

Canopy cover is a distinction made in mid and late seral stands. This refers to the spacing between plants in the dominant vegetation, typically associated with tree spacing, although it is applicable to shrubs such as sagebrush as well. Closed and open are defined differently for various settings. For example, in a ponderosa pine/Douglas-fir setting, a closed canopy has trees that are more closely spaced than an open canopy, and occupy at least 30 percent of an area. In a Douglas-fir inland forest setting, a closed canopy has trees more closely spaced that occupy at least 50 percent of a given area.

Table 9. Canopy cover for vegetation classes

Closed canopy	Open canopy

The PNV system used as the basis for biophysical settings in this area is **habitat typing**, based on the work of Pfister and others (1977). Factors used to determine habitat types include climate, geophysical characteristics, and soils. Each habitat type represents a relatively narrow segment of environmental variation and delineates potential for vegetative development based on climax successional theory (Pfister et al. 1977). Conifer habitat types are named for the climax tree species that would dominate at the “final” phase. The tree species currently dominating the site may be different and, in some cases, a site may rarely reach climax due to repeated disturbance. Habitat types also characterize the grass, forb, and shrub species that occur in the understory. Forested **habitat type groups** are assemblages of habitat types with similar disturbance response, potential stocking, productivity, down wood accumulation, fire frequency, species composition, and stand structures; these groups are used to understand site-specific vegetation potential. Green et al. (1992) groups are commonly used. Biophysical settings are related to forested habitat types as shown in table 10.

Table 10. Biophysical settings and forested habitat type crosswalk

Biophysical Setting	Habitat Type Codes
PPDF1	All Limber Pine series & All Ponderosa Pine series Douglas-fir/bluebunch wheatgrass; Douglas-fir/Idaho fescue; Douglas-fir/rough fescue; Douglas-fir/snowberry + bluebunch wheatgrass phase; Douglas-fir/pinegrass all phases; Douglas-fir/white spirea, Douglas-fir/kinnickinnick.
DFIR2-D	Douglas-fir/bluebunch wheatgrass; Douglas-fir/Idaho fescue; Douglas-fir/rough fescue; Douglas-fir/snowberry all phases; Douglas-fir/pinegrass, all phases except PIPO; Douglas-fir/elk sedge; Douglas-fir/white spirea; Douglas-fir/kinnickinnick; Douglas-fir/common juniper; Douglas-fir/heartleaf arnica
DFIR2-M	Douglas-fir/dwarf huckleberry; Douglas-fir/ninebark all phases; Douglas-fir/blue huckleberry + huckleberry and kinnickinnick phases; Douglas-fir/twinflower all phases; Douglas-fir/pinegrass all phases except PIPO. Spruce series.
SPFI1	Spruce/cleft-leaf groundsel all phases; subalpine fir/devil's club; subalpine fir/queencup beadlily all phases; subalpine fir/sweet scented bedstraw; subalpine fir/dwarf huckleberry; subalpine fir/bluejoint all phases; subalpine fir/twinflower all phases; subalpine fir/menzisia; mountain hemlock/menziesia; subalpine fir/beargrass all phases; subalpine fir/blue huckleberry; subalpine fir/grouse whortleberry all phases but western meadowrue; subalpine fir/Sitka alder; subalpine fir/pinegrass; subalpine fir/virgin's bower; subalpine fir/heartleaf arnica; subalpine fir/elk sedge all phases; subalpine fir/smooth wood-rush phase menziesia; All lodgepole pine series.
SPFI2	Subalpine fir/grouse whortleberry phase western meadowrue; subalpine fir/mountain gooseberry; subalpine fir-whitebark pine/grouse whortleberry; subalpine fir/smooth woodrush all phases; whitebark pine-subalpine fir; whitebark.

Existing Vegetation Methodology

In addition to understanding the potential vegetation of a site, the existing vegetation must also be classified and understood. One basic forested vegetation description used is **forest type**, which is simply the tree species that currently dominates. Dominance can be determined from aerial photography, satellite imagery, data collection, or field visits. Using more refined definitions specified by FIA, R1 VMap, and the R1 Summary Database protocols (USDA 2011a), **dominance type or group** similarly denotes the dominant species based on the percent cover of species or groups of species in a polygon. These naming conventions are based on the species currently dominating a site, not the potential. There is a tie between existing vegetation and potential vegetation, but the current dominant species may not be the same as the potential dominant species. For example, a ponderosa pine forest or dominance type often grows on a Douglas-fir habitat type and is perpetuated by frequent disturbance. In these areas, if disturbance does not occur, eventually the forest type will shift to Douglas-fir through succession.

Forest types can be cross-walked to dominance types defined by FIA, R1 VMap, and the R1 Summary Database (introduced in subsequent sections). Rather than define a forest type site based on a single most dominant tree species, dominance types are based on percent cover of several species or groups of species in a polygon. The overall concept between these naming conventions is similar in that they are based on the tree species currently dominating a site, not potential vegetation. The following table shows how forest types relate to dominance types for common forests on the HNF. It does not show all dominance types or forest types on the HNF.

Table 11. Forest type and dominance group crosswalk

Forest Type	Dominance Groups (6040)
PP (ponderosa pine)	PIPO (ponderosa pine) PIPO-Imix (ponderosa pine, intolerant mix) PIPO-Tmix (ponderosa pine, tolerant mix)
DF (Douglas-fir)	PSME (Douglas-fir) PSME-Imix (Douglas-fir, intolerant mix) PSME-Tmix (Douglas-fir, tolerant mix)
LP (lodgepole pine)	PICO (lodgepole pine) PICO-Imix (lodgepole pine, intolerant mix) PICO-Tmix (lodgepole pine, tolerant mix)
ES (Engelmann spruce)	PIEN (Engelmann spruce) PIEN-Imix (Engelmann spruce, intolerant mix) PIEN-Tmix (Engelmann spruce, tolerant mix)
AF (subalpine fir)	ABLA (subalpine fir) ABLA-Imix (subalpine fir, intolerant mix) ABLA-Tmix (subalpine fir, tolerant mix)
WB (whitebark pine)	PIAL (whitebark pine) PIAL-Imix (whitebark pine, intolerant mix) PIAL-Tmix (whitebark pine, tolerant mix)

It is also useful to describe the structure of the existing vegetation. At the broad to mid-scale, the HNF uses VMap to describe two elements of forest structure: canopy cover and tree size class which are somewhat similar to the vegetation classes described for biophysical settings. The density of tree stems is depicted by **canopy cover**, which is a measure of the coverage of tree crowns in a stand as a percentage of the land area. VMap displays four classes of canopy cover. The second structural element is **tree size**, which is a measure of the tree trunk diameters. VMap also displays four classes of tree size, which can be generally correlated to age classes or stand developmental stages.

Additional forested vegetation structure terms may be used in some reports:

- Vertical structure is the number of size (height) classes in a stand.
- Diameter breast height (dbh) is the diameter of a tree at 4.5 feet (breast height). When describing the stand average, dbh is often weighted by basal area to reflect the mature trees.
- Quadratic mean diameter (QMD), the diameter of a tree of average basal area in a stand.
- Basal area per acre (BA/ac), a measure of density, is the cross-sectional surface area of trees at breast height measured in square feet. BA/ac represents trees taller than breast height.
- Canopy cover is the coverage of tree crowns in a stand, as a percentage of the land area.
- Age classes are tree ages grouped by meaningful classes.
- Size classes are meaningful groups of tree trunk diameters.

Landscape Level Processes

At all scales, the natural world is in a constant state of change. Some changes, such as wildfire and insect outbreaks, can occur quickly and cause rapid visible changes, while other processes such as forest succession result in slow, incrementally small changes less noticeable to the human eye.

Dominant processes include succession, decay and nutrient cycling, and disturbances such as fire, blow-down, insects, and diseases. Forest conditions and structures exist because of the physical site they occupy and disturbances to which they are exposed. Broad-scale processes interact with each other in time and space to impact vegetation conditions.

Heterogeneity is the quality of consisting of dissimilar elements, as with mixed habitats or cover types occurring on a landscape (Turner et al. 2001). Heterogeneity on forest landscapes may occur as mosaics of patches generated by many events, but also may be created by single large events that occur infrequently (Kashian et al. 2005). **Resiliency** refers to the capacity of a system to tolerate disturbance without shifting to a qualitatively different state that is controlled by a different set of processes (Turner et al. 2012). **Sustainability** refers to the use of the environment and resources to meet current needs without compromising the ability of a system to provide for future generations (Turner et al. 2012). Because landscapes are dynamic and unique there is no optimal landscape mosaic that will increase all ecosystem services; however land managers can intervene in some drivers to sustain ecosystems services (Turner et al. 2012). The appropriate level of heterogeneity for a landscape varies, but generally a resilient forested landscape is made up of a mosaic of age classes, composition, and succession stages because variability ensures that not all areas are equally susceptible to the same disturbances at the same time. As an example, mountain pine beetle (MPB) has recently played a dramatic role in altering conditions of vegetation in part due to widespread homogeneity of susceptible stands.

Succession

Succession is the progression of change in the composition, structure, and processes of a plant community through time (Winthers et al. 2004). Change occurs constantly in a natural ecosystem—sometimes in small ways, such as the death of an individual tree, or in large ways through wildfire, insects, disease, or management. Succession occurs constantly in most vegetation types. Immediately following severe disturbance, the forest is classified in the early seral stage, or stand initiation. This stage is often dominated by shade-intolerant, fast-growing trees which establish quickly (Tappeiner II et al. 2007). In the absence of disturbance, the forest progresses through mid seral stages (stem exclusion) and then into stand re-initiation in which shade-tolerant species establish under the canopy. Eventually, without disturbance the ecosystem moves into late seral stages (climax) in which shade-intolerant species may become excluded. Frequent natural disturbance may prevent a site from ever reaching a climax state. Many structural processes occur during the successional development of forest stands, including establishment, canopy closure, competitive exclusion, lower tree canopy loss, biomass accumulation, density-dependent tree mortality, density-independent tree mortality, canopy gap initiation and expansion, generation of coarse woody debris, understory re-development, establishment of shade-tolerant trees, maturation of pioneer tree cohort, canopy elaboration, development of tree decadence, and pioneer cohort loss (Franklin et al. 2002).

Historic Vegetation, Fire, and Landscape Mosaic

It is not known site-specifically what forest conditions were historically beyond the past 100 years. Based on research performed at larger scales, in general low elevation dry forests in Region 1 have experienced changes in disturbance processes, structure, and function. Causes of change include fire suppression, forest management, and climate change (Hessburg and Agee 2003; Hessburg et al. 2005; Westerling et al. 2006). Changes include higher tree density, more multi-storied stands and ladder fuels, and a greater homogeneity of structures across the landscape which result in a greater probability for disturbances to affect large contiguous areas (Hessburg et al. 2005). Forest types with naturally high fire frequencies and mixed severity regimes, primarily ponderosa pine and Douglas-fir, have been altered substantially (Hessburg et al. 2005). Fire in dry forests has shifted from low-intensity, high frequency regimes to moderate and high-severity regimes, with consequent increases

in uncharacteristic large-scale stand-replacing fires (Lehmkuhl et al. 2007). Landscapes are increasingly homogeneous in composition and structure, and the regional landscape is set up for severe, large fire and insect disturbance events (Hessburg et al. 2005). The role of fire as a stand replacement agent becomes more pronounced when the natural fire-free interval is increased through fire suppression. The FRCC Specialist Report provides information relative to the reference conditions compared to existing vegetation.

Northern Rockies ecosystems evolved with fire as an important landscape process and are often termed “fire-dependent ecosystems” (Arno 1980). Fire is a key process that helped shape the structure and function of historical forests. Fire suppression has been quite successful and has had dramatic influences on vegetation. Roads, railroads, grazing by domestic livestock and big game, urbanization, agriculture in former grasslands, and rural settlement have all influenced fire exclusion (Hessburg et al. 2005) in addition to federal land management policies. Landscape-scale vegetation homogeneity can encourage landscape-scale disturbances such as large fires (Hessburg and Agee 2003). Higher elevation forests generally fall under a long fire interval with higher intensity fires that often burn as mixed-severity or stand-replacement. Westerling et al. (2006) attribute the increase in wildland fire frequency in the west over the last twenty years to alterations in fire regimes due to climate changes over a large geographic area. Throughout the west, more frequent fires are burning for extended periods of time compared to the infrequent fires lasting less than one week that were common prior to the mid-1980s (Westerling et al. 2006) (Fire and Fuels Specialist Report).

Many small wildfires occur on the HNF annually. On average, 30 fires occur per year on HNF ownership. About 42 fires occur every year including all lands the HNF has administrative jurisdiction over for fire protection. Approximately 194,173 acres have burned in wildfires within the HNF administrative boundary since 1970 including private in-holdings. Looking at the big picture, approximately 537,690 acres have burned when taking into account wildfires on all ownerships where a portion burned on the HNF. These wildfires burned on private, state, BLM and other National Forest Land as well as on the HNF. Since 1984, seven large wildfires have occurred. The occurrence of large fires increased in the 1980s, consistent with a trend throughout the West (Westerling et al. 2006). None of the large fires to date have burned in the Divide landscape area where the Telegraph project area is located. The only significant fire to occur in the area was the MacDonald Pass fire of 2009, which burned roughly 170 acres in the Combination Boundary, outside of the Project Area.

Table 12. Major historic fires on the Helena National Forest since 1970

Fire Name	Year	Acres Burned	Landscape
North Hills	1984	26,950*	Big Belt Mountains
Canyon Creek	1988	211,490*	Blackfoot/Bob Marshall
Warm Springs	1988	46,900	Elkhorn Mountains
Cave Gulch	2000	29,024	Big Belt Mountains
Maudlow/Toston	2000	81,687*	Big Belt Mountains
Snow/Talon	2003	37,405	Blackfoot
Meriwether	2007	46,298*	Big Belt Mountains

Historic fire disturbances have been quantified for the HNF using a coarse-filter approach which analyzed the pattern of fire disturbance that would have historically burned prior to settlement by European Americans (Hollingsworth 2004). Burning by Native Americans was considered part of the

historic fire regime. This analysis found that forestwide, historically 156,615 to 792,330 acres would have burned per decade (Hollingsworth 2004). While fire exclusion resulted in acreage burned well below historic levels prior to 1970, aided by cool moist climate conditions, table 12 suggests that more recent decades are approaching historic levels of acreage burned despite fire suppression efforts in part due to warmer, drier climate conditions. The historic analysis also showed results for each landscape on the HNF. The Divide landscape, where the Telegraph project is located, historically would have burned an average of 39,124 to 170,242 acres per decade (Hollingsworth 2004). These fires would have included low to moderate intensify in dry conifer fire groups and stand-replacing fire in moist conifer fire groups. Fire occurrence data indicate that essentially no large fires have occurred on this landscape in the last century. Therefore, the Divide landscape and the Telegraph project area are not within the historic range of variability for fire disturbance. Although we will never know site-specifically what the results would have been had fire suppression not occurred, it is reasonable to conclude that in a general sense the lack of fire on this landscape has resulted in an altered mosaic of vegetation.

The vegetation conditions that exist today in the Telegraph area were shaped not only by fire suppression, but also climatic trends, large fires that occurred prior to settlement, fuelwood cutting that occurred around the turn of the previous century to support the mining and railroad industries, and modern timber harvest. Fire history maps indicate that much of the area burned in a large wildfire in approximately 1890. Fuelwood cutting for the mining and railroad industries was also common around the turn of the century. The climate early in the 20th century when forests were re-establishing following these disturbances was generally cool and moist, conducive to forest growth. The landscape became characterized by relatively densely stocked stands dominated by even-aged lodgepole pine, with some subalpine fir and spruce at upper elevations and drier Douglas-fir dominated at lower elevations. With the exception of small fires that were suppressed, the homogeneity of this landscape was broken up somewhat by modern timber harvest from the 1970s to 1990s, which predominantly consisted of clearcutting patches usually (but not always) less than 40 acres in size where it was feasible to build roads. While the result of this management was to diversify age classes, the patch size and pattern is not necessarily consistent with what would have been created by natural fire. While stand replacement effects would have been typical, there would also have been mixed and low severity fires that left substantial remnant components. The areas of past harvest have regenerated and support young forested stands; today these areas stand out as “green forest” areas surrounded by dead and dying trees impacted by the mountain pine beetle. In some areas, aspen also established and expanded after past harvest. Today the aspen is generally mixed with conifers.

The regenerated lodgepole that established after modern harvest generally still bear “open cones”; that is, they produce cones that open each year when ripe and disperse seed. Young lodgepole trees produce open cones during the early phases of stand development to provide seed to increase stand density in lightly regenerated areas, and to regenerate patches created after subsequent small disturbances. Many of these trees are beginning to reach the age where a large proportion is expected to transition to serotinous coned habit; serotiny is typically expressed from 30 to 60 years of age (USDA 1983). Serotinous cones do not open when ripe, and can be stored on the tree or on the ground surface for many years waiting to be opened by wildfire or the sun’s heat. Lodgepole in fire prone ecosystems has evolved to produce serotinous cones in the mid to later stages of stand development to ensure that seed is available for regeneration after the next stand-replacing event.

Traditional thinking generalizes lodgepole as even-aged forests across large landscapes that regenerate from large stand-replacing disturbances. However, the age structures of lodgepole pine stands may be much more variable across the Rocky Mountains than the traditional dogma suggests (Kashian et al. 2005). Alternative age structures in some areas studied have apparently resulted from

variations in site quality and disturbance history (Muir 1993). Infrequent stand replacing fires play a definite role; however, the interval between any two fires in one area might be only a few years (Fischer and Clayton 1983). Fires that occur during herb/shrub stage of stand development may extend this period; while fires that occur during the pole stage would depend on fire severity (Fischer and Clayton 1983). Fire suppression efforts in this century have had the effect of decreasing acreage burned in normal fire seasons, reducing the natural variability in landscape patterns that would otherwise be created by small fires (USDA 1990). As a result, the larger, contiguous blocks of uniform stands are subject to large MPB outbreaks and catastrophic fires when fire weather is extreme (USDA 1990). Aside from the past harvest patches, this was the condition of the landscape which contributed to the size and intensity of the recent mountain pine beetle outbreak.

Patch, pattern, disturbance regimes, and regeneration mechanisms are important when considering a desirable landscape mosaic. The lodgepole pine cover type that occurs on habitat types east of the Continental Divide would naturally be arranged in oblong stands 10 to 50 acres in size (USDA 1990). The crown fire cycle is 110 to 170 years on these types (USDA 1990); however additional disturbances would naturally occur more frequently to impact some percentage of the cover type on a given landscape. Typical fire events that occur on a 3- to 6-year cycle are usually wind-driven and burn with variable intensity; while fires that occur during a drought year in a 20- to 40-year cycle are often “blow up” fires that burn with high intensity as long as there is adequate fuel to carry the fire (USDA 1990). Historically, a 5-year crown fire event could be expected to impact roughly 1 percent of the type, in patches of an average 100 acres; while a 30-year event would impact 10 percent of the type with an average of 10,000-acre size (USDA 1990). The Telegraph area has not experienced any of these disturbance events over the last century which would have diversified the age class structure.

Insects and Disease

This section describes the ecology and landscape disturbance processes relative to insects and disease. Information regarding the current status of insect and disease activity is covered under the Vegetation Existing Condition section.

Mountain Pine Beetle (MPB)

MPB (*Dendroctonus ponderosae)* is a native, aggressive primary bark beetle which attacks pines and can cause widespread mortality (Amman et al. 1990). Drought makes trees more vulnerable to attack, and insect populations respond to increased temperatures by speeding up reproductive cycles (McKenzie et al. 2007). MPB is attracted to the largest trees available (Preisler and Mitchell 1993), but is also attracted to weakened trees and can kill trees as small as 5 inches diameter. Tree death is caused by the feeding of larvae which girdle the cambium, aided by blue-stain fungi (Amman and Logan 1998). Stands susceptible to MPB are those with high components of pine; a dense structure; and an advanced age (Shore and Safranyik 1992). MPB prefers dense, shady stands because the microclimate is conducive to survival and communication (Bartos and Amman 1989); and because trees in dense stands are less vigorous (Preisler and Mitchell 1993). Historically, MPB has caused mortality in forested ecosystems; an outbreak continues until the beetle runs out of food or weather conditions cease to be conducive, although parasites and predators can reduce populations (Amman and Cole 1983). Weather that regulates MPB includes extreme cold for extended periods in the winter, late spring or early fall frost, and wet springs/summers (Amman and Cole 1983). Evidence suggests that due to warmer climate conditions MPB is active at higher elevations, higher latitudes, and/or for longer durations than seen previously (Nealis and Peter 2008, Carroll et al. 2003, Brunelle et al. 2008). Additionally, human factors such as fire suppression have caused the homogeneity of susceptible hosts to be more extensive. Frequency of infestation generally ranges from 20-40 years,

with the epidemic lasting around 6 years (Cole and Amman 1980). However, outbreaks are often more tied to forest conditions than a predictable cycle.

On the HNF, mountain pine beetle (MPB) infestation peaked at 585,557 acres in 2009 (Gibson 2009), covering over 60 percent of the administrative land base. The infestation has now subsided, attributable largely to host depletion (USDA 2012c). While most of the trees killed were lodgepole pine, ponderosa and whitebark pines were also affected. Several factors contributed to creating homogenous, susceptible forests that fuel this beetle outbreak:

- Suppressing fires which would have created a mosaic of age classes, species, and density.
- Much of the last century was cool and moist, conducive to growing dense trees. Conversely, recent decades have been warm and dry, causing stress and conditions conducive to MPB.
- Harvest practices around the turn of the century resulted in large areas being cut to build the railroad and mining industries; these areas are even-aged and mature today.
- The small extent of recent harvest has done little to break up the homogeneity of the landscape.

Douglas-fir Beetle (DFB)

DFB (*Dendroctonus pseudotsugae)* is a native primary bark beetle that affects Douglas-fir. At endemic levels, it infests scattered trees and groups, including blowdown and trees injured by fire, defoliation, or root disease (Schmitz and Gibson 1996). Disturbances can trigger increased outbreaks that cause widespread mortality, typically lasting 2 to 4 years (Negron et al. 2001). Douglas-fir evolved with DFB; outbreaks occurred and landscape patterns of vegetation resulted in spatially confined disturbances (Hessburg et al. 1994). Today, outbreaks appear to occur for longer periods of time over entire landscapes (Hessburg et al. 1994). While all forests have been altered following a century of fire suppression and management, some of the greatest changes in vegetation and insect response have occurred in low and middle elevation Douglas-fir, ponderosa and lodgepole pines (Hessburg et al. 1994). DFB is more abundant than under historical conditions and stands with old, large stressed trees that have escaped fires over the last century are experiencing the most damage (Hessburg et al. 1994). DFB has not been particularly active on the HNF in recent years.

Bark Beetles and Climate Change

Climate change may affect the dynamics of insect populations in two ways: directly through the physiological processes of insects, and indirectly through their host plants and natural enemies (Williams and Liebhold 2002). Changes in climate, particularly toward hotter and drier conditions, may increase the frequency of outbreaks and allow bark beetles to move northward or higher in elevation into other ranges of their host species or the ranges of new potential hosts (Williams and Liebhold 2002). Temperature increases may predispose forest ecosystems to stresses, acting both directly through increasingly negative water balances and indirectly through increased frequency, severity, and extent of disturbances, chiefly fire and insect outbreaks (McKenzie et al. 2007). During mountain pine beetle outbreaks, widespread tree mortality reduces forest carbon uptake and increases future emissions from the decay of killed trees (Kurz et al. 2008a).

Bark Beetles and Fire

The interaction of bark beetles, fuels and fire is complex. Studies have shown that beetle outbreaks lead to changes in fire behavior (Jenkins et al. 2008). Fire behavior varies in post-outbreak stands depending upon when they occur; the net result of epidemics is a substantial change in species composition and a highly altered fuels complex. Early in epidemics there is an increase in the amount of fine surface fuels. In post-epidemic stands large, dead, woody fuels and live surface fuels dominate. For surface fires both rate of spread and fireline intensity are higher in epidemic than in

endemic stands. Passive crown fires are more likely in post-epidemic stands but active crown fires are less likely due to decreased aerial fuel continuity. Schmid et al. 2007 suggest that MPB-killed trees result in increases in dry fuel loads and thereby increase the potential for severe fires.

Western Spruce Budworm (WSB)

WSB (*Choristoneura occidentalis)* is a defoliator which is affecting mainly Douglas-fir in the Flume Chessman analysis area, but also impacts Engelmann spruce and subalpine fir. Development of outbreaks depends on suitable habitat, although the insect is greatly influenced by climate, weather, parasites, and predators; WSB does well in dry climates and dry aspects (Carlson and Wulff 1989). WSB feeding can have effects on cone and seed production and tree growth. Impacts are often short-term and mature trees can recover quickly after populations subside; mortality is usually limited to suppressed regeneration and pole-sized trees which collect falling larvae from the canopy (Bulaon and Sturdevant 2006). Vigorous stands withstand and recover from damage better than stressed stands. Stand vulnerability can be reduced using silviculture or prescribed burning (Bulaon and Sturdevant 2006). WSB defoliation has been widespread across the HNF and in the project analysis areas over the last several years.

Pine Engraver (Ips)

Pine engraver (*Ips pini*) is a secondary bark beetle that targets pines. Pine engraver is not an aggressive tree killer, though large populations infest logging slash, wind-thrown trees, or trees broken by wind or snow (Kegley et al. 1999). It can build to outbreak populations and kill groups of trees, particularly in unthinned young stands 2 to 10 inches diameter (Livingston 2004), and it is common for the insect to produce two to three generations per year (Kegley et al. 1999). The first flight occurs in April or May, with the last flight finishing by August. Outbreaks are predicted in drier than normal years, typically in dense young ponderosa pine, and seldom last more than one season (Kegley et al. 1999). Trees in vigorous stands are infrequently utilized; the maintenance of stand vigor is important. Currently *Ips* is present on the HNF, generally affecting weakened trees in conjunction with MPB.

White Pine Blister Rust (WPBR)

Since WPBR (*Cronartium ribicola*) was introduced to North America in 1910, it has spread through the range of 5-needled pines. It has a complicated life cycle composed of five types of spores on two hosts; it requires an alternate host such as *Ribes spp*, to complete its lifecycle (Tomback et al. 2001). The disease creates cankers on branches and the bole of the tree, usually eventually girdling and killing it. Some trees are resistant and can survive indefinitely. However, most whitebark are susceptible because they do not have natural defenses to this exotic disease. The percentage of whitebark that are genetically resistant may increase slowly through the process of natural selection. Forces of natural selection could be harnessed if 5-needled pines are given a chance to regenerate (Tomback et al. 2001). Mortality is heightened by the interaction between WPBR, MPB, and climatic stressors that reduce tree vigor. As WPBR has moved into fragile, high-elevation ecosystems, normal successional pathways have been greatly altered. The combination of MPB, fire suppression and WPBR are raising concerns about the long-term viability of whitebark ecosystems. WPBR is present where 5-needled pines are found on the HNF.

Dwarf Mistletoe (DMT)

DMT is a family of native parasitic plants that extract water and nutrients from living conifers. DMT reduces tree vigor, causing irregular branching, branch kill, and top kill. Premature death eventually follows, usually aided by secondary bark beetles (Hawksworth and Johnson 1989). The parasitic activity of DMT causes reduced tree diameter, height growth, cone and seed production, direct tree mortality, or predisposition of other pathogens and insects. However, witches brooms and tree

mortality also provide structural diversity and habitat. In the long term, heavily invested stands can begin to decline, resulting in a shift toward other tree species. No alternative would have a substantial impact to the presence or condition of this pathogen at any scale. (ibid)

Root Disease

Root diseases are pathogens that live in root systems and break down cellulose and lignin. They compromise the uptake of water and nutrients and eventually cause mortality. Root diseases are commonly endemic in areas with susceptible hosts, and spread through root-to-root contact or spores that enter stumps. Actions such as species conversion to less susceptible hosts and regeneration harvest can decrease damage from root diseases (USDA 2002b). Older trees and higher density stands are at higher risk to root disease damage than younger, more open growing stands (USDA 2002b).

The most significant root diseases in Montana are Armillaria root disease (*Armillaria ostoyae)*, laminated root disease (*Phellinus weirii)*, annosus root disease (*Heterobasidion annosum)*, and Schwenitzii root and butt rot (*Phaeolus schweinitzii).* Annosus root disease has not been recorded on the HNF. Armillaria can be found on the HNF; also, brown cubical root and butt rot is quite common in various parts of Forest, causing decay in the butt logs of larger, older DF trees (USDA 2006b). Stresses (drought, competition, insects, etc) predispose trees to Armillaria by reducing host vigor and compromising defenses (Wargo and Harrington 1991). Armillaria carries over in roots, stumps and snags from one generation to the next, surviving fire and harvest. Partial cutting may intensify this disease because trees may succumb before the benefits from release are realized, and stumps are food bases for the fungus (Wargo and Harrington 1991). Tree species most susceptible to root disease on the HNF is Douglas-fir, subalpine fir second; the most tolerant species are pines (USDA 2006b). Although root diseases cause mortality and growth loss, they also influence structure and species composition across landscapes. They also influence succession, especially in the absence of natural fire (USDA 2007). On sites with a root disease-susceptible forest type and climax, high levels of disease will maintain early stand development. These stands experience waves of mortality as trees become large enough for their root systems to contact the disease.

Impacts of Armillaria can be reduced by favoring resistant species, maintaining species diversity, reforesting stands with locally adapted species, promoting tree vigor, and reducing inoculum sources by uprooting stumps (USDA 2005). Prescribed fire is unlikely to eliminate the disease, although it may reduce inoculum. Thinning that favors seral species may reduce root disease over the long term; also, greater spacing can improve tree vigor which may increase tolerance to root disease (USDA 2005c). Maintaining stands in a vigorous condition will help minimize losses (Wargo and Shaw III 1985). Cutting trees in infested areas can exacerbate Armillaria due by creating stumps; management strategies to mitigate this include inoculation of stumps, removal of stumps; planting alternate species; and planting trees at a distance from infected stumps (Morrison and Mallett 1996).

Schweinitzii root and butt rot (*Phaeolus schweinitzii*) primarily affects mature and over-mature Douglas-fir and may pre-dispose affected trees to Armillaria or DFB (Hoffman 2004). Infection occurs through the roots of trees, and damage consists of butt decay and windthrow potential. Management strategies for this disease include preventing over-maturity, preventing basal stem damage to residual trees, maintaining growth and vigor, and favoring less-susceptible species whenever possible. Little to no root disease is known to occur in the analysis areas, although Schwenitzii may be present in mature Douglas-fir areas.

Vegetation Existing Condition

Vegetation Composition and Structure

Potential Vegetation

The following table and figures show the proportion of biophysical settings in the combination boundary and project area. These biophysical settings were modeled using legacy stand exam plot information, satellite imagery classification, intensified grid data, and on-the-ground knowledge of the plant communities. The biophysical settings DFIR2-M and SPFI1 dominate the Project Area and Combination Area, with DFIR2-D also well-represented. Douglas-fir generally dominates DFIR2-D, with some mix of ponderosa pine and/or lodgepole pine possible. Lodgepole pine is abundant as a seral dominant in DFIR2-M and SPFI1, although most mature lodgepole has recently been killed by MPB; these areas make up 60 percent and 69 percent of the combination area and project area respectively. MPB may hasten succession to comparatively shade tolerant Douglas-fir (in DFIR2-M) or subalpine fir (in SPFI1) if present, or revert to new lodgepole regeneration. The areas denoted as "blank" lie outside of the extent covered by VMap. Small areas are coded as barren, deciduous woodland (aspen), riparian, and water. Small amounts of PPDF1, the driest type and the most likely to contain ponderosa pine, are present along with some grasslands particularly in the combination boundary. Similarly, a small amount of SPFI2 is also present; it is in these areas that whitebark pine is mostly likely to occur, although it may also be found in SPFI1.

Table 13. Biophysical settings in the combination and project areas

Biophysical Setting	Combo Boundary Acres / %	Project Area Acres / %
Barren	177 / trace	2 / trace
DFIR2D	17,613 / 15%	5,361 / 23%
DFIR2M	43,098 / 37%	10,316 / 44%
DWOA	638 / 1%	2 / trace
PPDF1	2,303 / 2%	335 / 1%
RIPA	594 / 1%	131 / 1%
SPFI1	26,664 / 23%	5,982 / 25%
SPFI2	845 / 1%	3 / trace
WATER	40 / trace	0 / 0
MGRA3	14,019 / 12%	1,537 / 6%
Blank (outside VMap extent)	11,976 / 10%	0 / 0

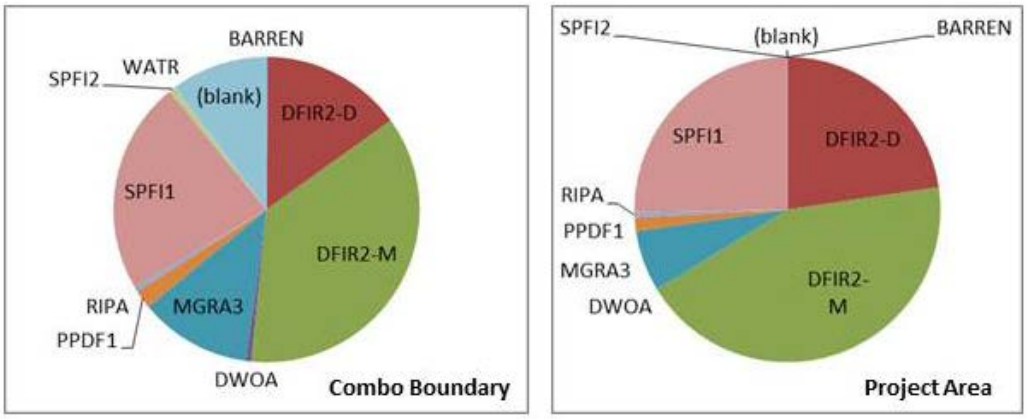


Figure 6. Biophysical setting proportions

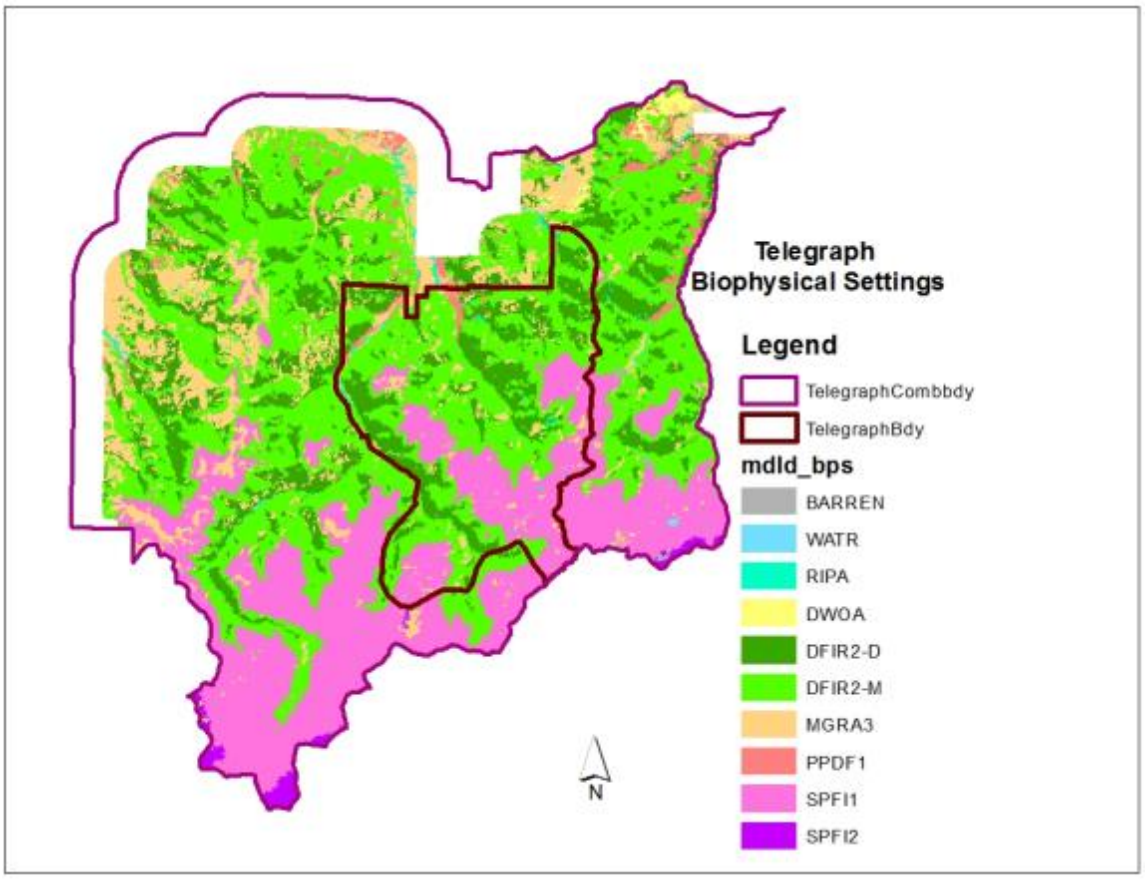


Figure 7. Mapped biophysical settings

Existing Vegetation - VMap

VMap work is displayed to summarize three attributes of vegetation prior to and after the MPB: **type** (species composition, "dominance group 6040"); **size** (classes based on diameter); and **density** (tree canopy cover classes). These are summarized at the combination and project area analysis scales.

Type: Dominance Group

Non-forested groups are lumped together and not analyzed in detail. These areas make up 23% and 7 percent of the combination and project area boundaries respectively. “Tree” types are discussed in further detail. When a single species makes up greater than 60 percent of the composition, the dominance group is named for that species (i.e., “Douglas-fir”). When a species makes up greater than 40 percent but less than 60 percent, the group is named for that species and then identifies the remaining composition as intolerant or tolerant (i.e., “Douglas-fir Intolerant Mix”). VMap considers intolerant species to include ponderosa, lodgepole, Douglas-fir, and whitebark; and shade tolerant species to include spruce and subalpine fir. It is possible to derive the likely composition of these mixes. For example, a low elevation Douglas-fir Intolerant Mix is likely to contain ponderosa pine, whereas a high elevation polygon is likely to contain lodgepole pine. If no species represents at least 40 percent, the polygon is simply an intolerant or tolerant mix. The primary dominance groups present at both scales are Douglas-fir, lodgepole pine, and mixes thereof. Very small amounts of other groups are present (ponderosa pine, subalpine fir, Engelmann spruce, whitebark pine, aspen, and mixes thereof).

The preponderance of lodgepole pine dominance at both scales “pre-MPB” illustrates the landscape level susceptibility to the MPB. Comparing pre- and post-MPB, the evident and logical effect of the MPB has been that lodgepole, ponderosa, and whitebark pine components have been reduced and Douglas-fir, subalpine fir, and spruce dominated types increased based on the minor components and/or advanced regeneration of these species expected to persist in those areas based on elevation and habitat type. Some areas remain dominated or mixed with pines where small trees (not susceptible to beetle) were present, and/or because there were no shade tolerant components and new lodgepole pine seedlings are expected to establish. Depending on elevation and habitat type, some of the lodgepole pine shifted to Douglas-fir, subalpine fir, or stayed lodgepole pine. The most prevalent types (Douglas-fir and lodgepole pine) will be explored in further detail in combination with tree size and canopy cover.

Table 14. Dominance groups ("domgrp6040"), pre and post MPB Combo Boundary and Project Area

Dominance Group	Combo Boundary		Project Area	
	Pre-MPB %	After-MPB %	Pre-MBP%	After-MPB%
Non-forested/blank types	23%	23%	7%	7%
Ponderosa pine (PIPO)	trace	trace	trace	trace
Ponderosa pine-intolerant mix (PIPO-IMIX)	trace	trace	trace	trace
Douglas-fir (PSME)	20%	33%	28%	43%
Douglas-fir intolerant mix (PSME-IMIX)	6%	0%	7%	0%
Lodgepole pine (PICO)	39%	24%	41%	22%
Lodgepole pine intolerant mix (PICO-IMIX)	10%	0%	15%	0%
Lodgepole pine tolerant mix (PICO-TMIX)	trace	0%	Trace	0%
Subalpine fir (ABLA)	trace	7%	Trace	11%
Subalpine fir tolerant mix (ABLA-TMIX)	1%	1%	1%	1%
Engelmann spruce (PIEN)	trace	trace	trace	trace
Engelmann spruce tolerant mix (PIEN-TMIX)	trace	trace	trace	trace
Whitebark pine (PIAL)	trace	trace	0%	0%
Whitebark pine intolerant mix (PIAL-IMIX)	trace	0%	Trace	0%
Aspen (POTR5)	1%	1%	trace	trace
Intolerant Mix (IMIX)	trace	10%	0%	15%
Tolerant Mix (TMIX)	0%	trace	0%	0%

Fire Behavior Fuel Model 101, Short, Sparse Grass

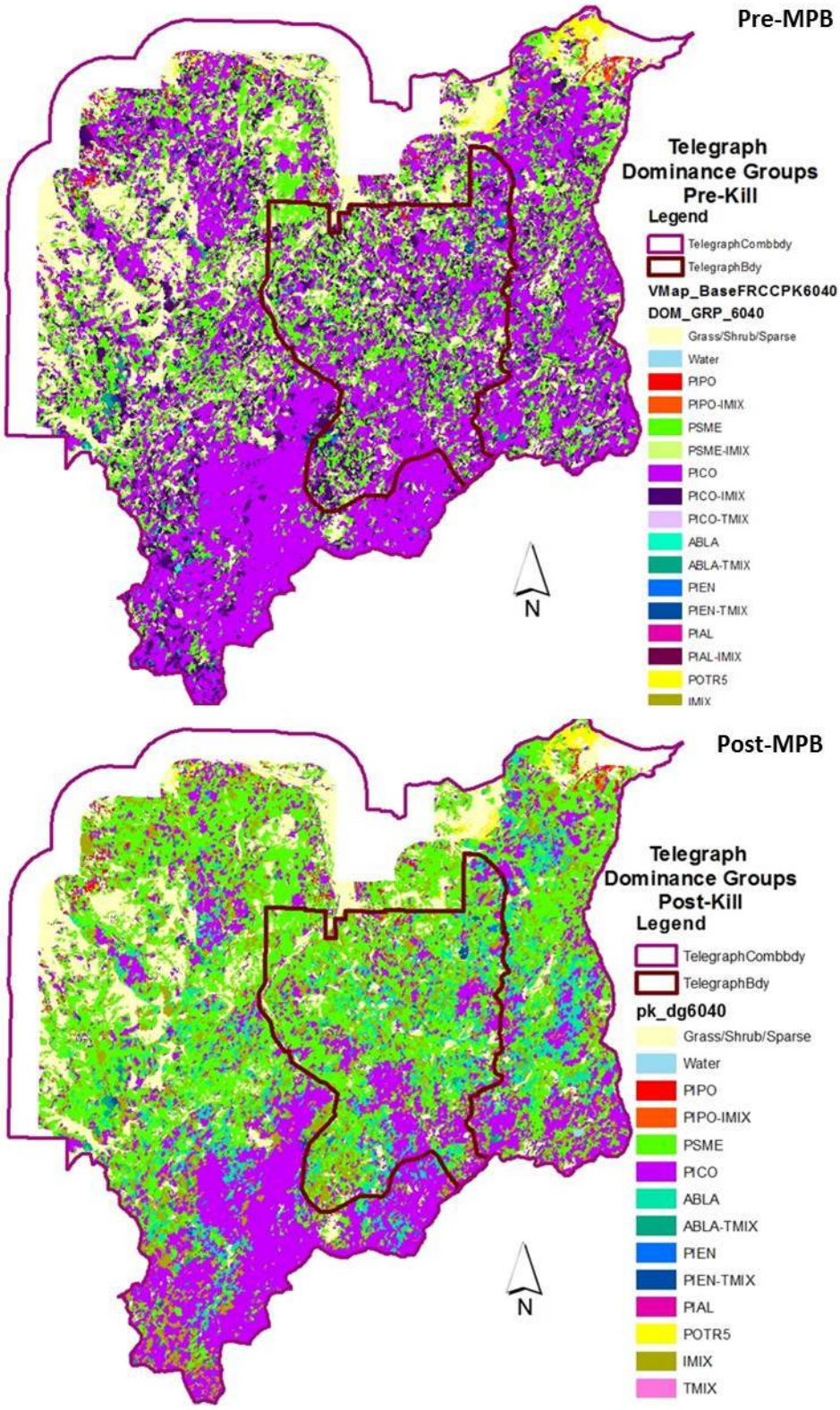


Figure 8. Dominance Group Maps, Pre and Post MPB

The Post-MPB dominance groups represent the most accurate picture of existing vegetation at the mid-scale. The charts below show the existing proportion of dominance groups for the analysis scales of interest based on the post-MPB conditions described above. The areas previously containing a mix of lodgepole are now dominated by Douglas-fir (PSME) or subalpine fir (ABLA). PICO still dominates on some areas, primarily where the size class was too small to be susceptible to MPB.

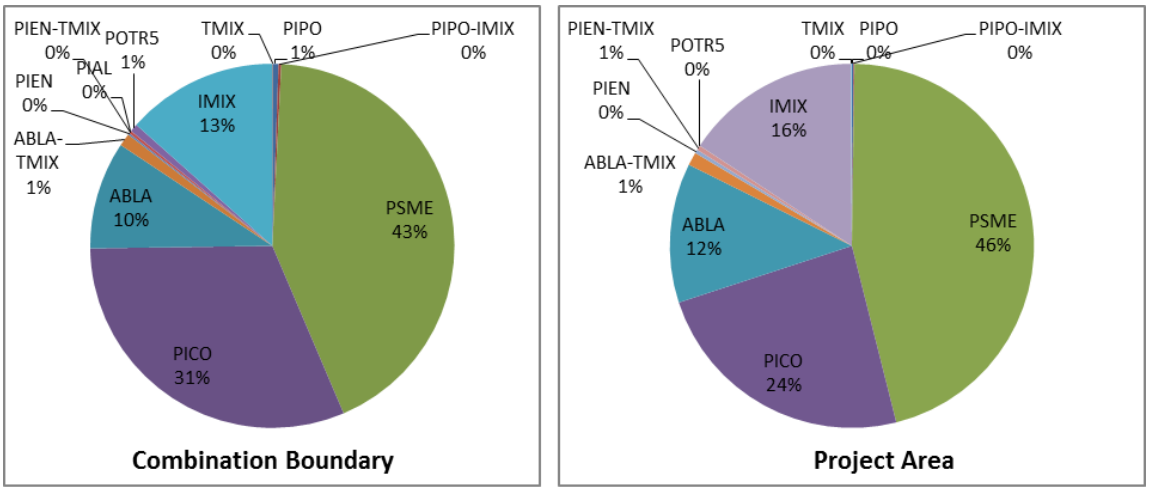


Figure 9. Dominance group proportions, post-MPB (existing condition)

Over time dominance groups will continue to shift through time according to natural successional pathways, influenced by natural disturbances. MPB has recently caused a shift away from lodgepole pine composition in areas with more shade tolerant components, primarily Douglas-fir and subalpine fir. In the absence of fire these species may dominate formerly pine areas until the next disturbance, persisting and growing in areas with abundant lodgepole snags and ultimately jack-straw coarse woody debris, shading out potential pine regeneration which requires open conditions to regenerate. In areas with little to no seed source for shade tolerant species, lodgepole may regenerate in MPB-killed areas as serotinous cones are opened by sunlight. In some areas with poor growing conditions, lack of exposed seedbeds, or a lack of seed, regeneration may be patchy or take some time to establish.

Size: Tree Size Class

For tree size, only *tree lifeform* areas are included in calculations (grass, shrub, water, and sparsely vegetated areas are excluded). Tree size classes of polygons in VMap are classified into four categories: seedling/sapling, small tree, medium tree, and large tree. Comparing the distribution of size classes of pre and post MPB at both analysis scales, there is a clear shift from medium and large tree classes to small tree classes as large pine components die and are replaced by advanced regeneration of shade tolerant species and/or new pine seedlings. The beetle has shifted the class, but has maintained and slightly enhanced the homogeneity the landscape. In other words, rather than a landscape dominated by medium to large trees, the landscape is still relatively homogeneous but now dominated by small trees. Large living trees are increasingly rare. Over time size classes would continue to shift according to natural successional pathways, influenced by natural disturbances.

Table 15. Tree Size Class, Pre and Post MPB, Forested Areas Only

Tree Size Class	Combo Boundary		Project Area	
	Pre-MPB	Post-MPB	Pre-MPB	Post-MPB
0-4.1” dbh, seed/sap	1%	7%	1%	6%
5-9.9” dbh, small	34%	58%	27%	51%
10-14.9” dbh, med	52%	28%	58%	34%
15”+ dbh, large	12%	7%	13%	9%

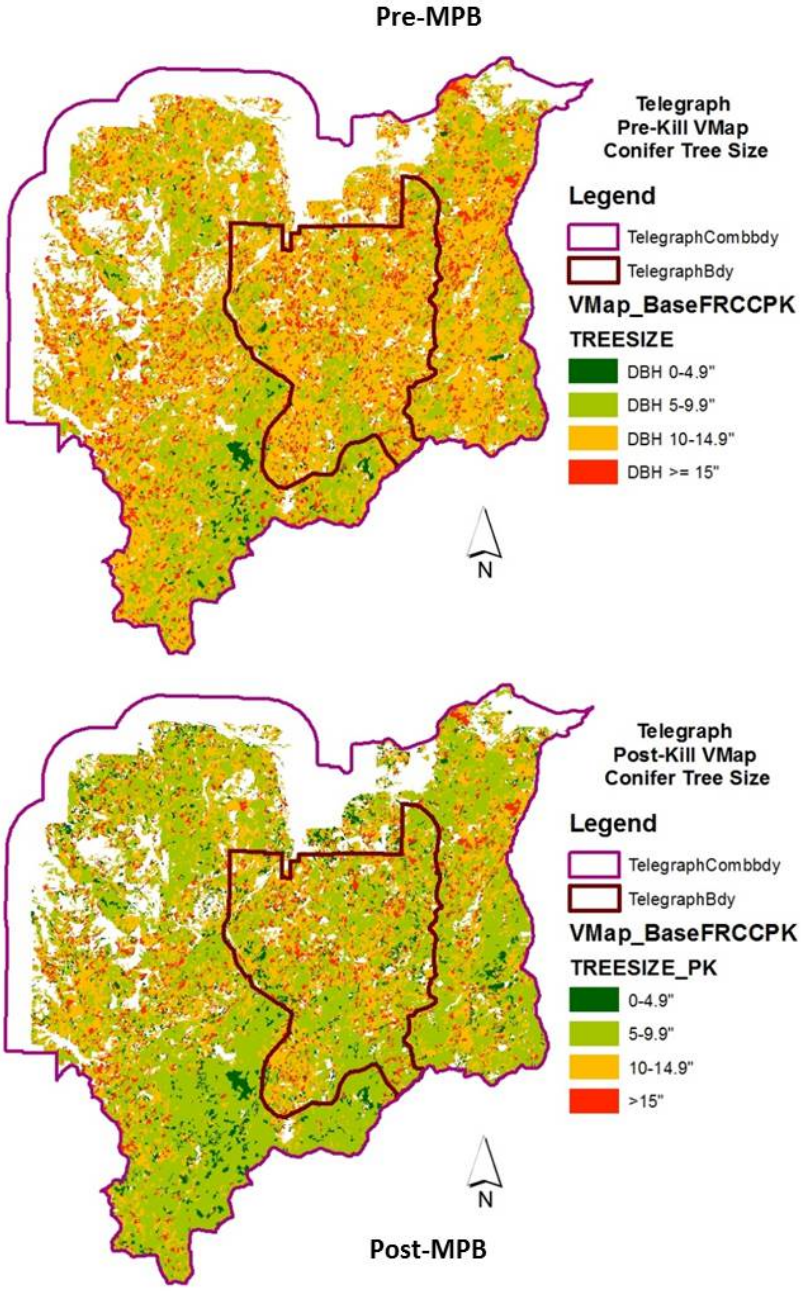


Figure 10. Tree size class maps, pre and post MPB

As with dominance group, the Post-MPB condition depicts the existing condition for size class as shown in the figure below. The small tree 5 to 9.9 inches size class is the most prevalent condition present, likely consisting of surviving lodgepole and trees of other species in mixed stands that were previously overtopped by lodgepole. The 10 to 14.9 inches size class is also common, likely corresponding to Douglas-fir dominated forests in general. The large tree class (15 inches+) is relatively rare. The seedling class is also fairly rare, because many of the lodgepole forests killed had enough trees retained to only move them to the small tree class; and many regenerating stands from past harvest have grown larger than the seeding class.

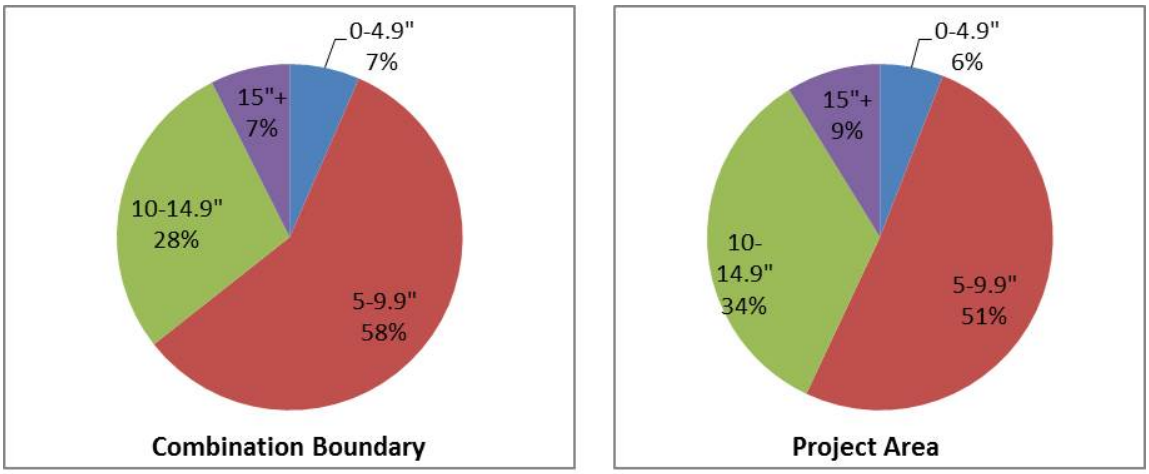


Figure 11. Post-MPB Proportions of Tree Size Classes

Density: Tree Canopy Cover

As with size class, for tree canopy, only *tree lifeform* areas are included. Tree density (of living trees) is described using four classes tree canopy cover classified in VMap: low cover, low/mod cover, mod/high cover, and high cover. These classes do not incorporate the stem density represented by dead trees that are still standing. Abundant dead trees (snags) are present across areas that were previously dominated by lodgepole pine. At both scales, pre-MPB was dominated by high canopy cover (greater than 60 percent, present on over 60 percent of both analysis areas). This density placed large proportions of the landscape at elevated risk to bark beetles, where it corresponded with pine species composition and medium to large tree size classes. After the MPB, post-MPB Vmap shows that many areas shift to low to moderate cover after dead trees fall. In this characteristic, the beetle has generally enhanced the heterogeneity of the landscape by distributing canopy cover classes relatively evenly across all four classes, rather than being heavily skewed toward high canopy cover as was present pre-MPB. In short, the amount of forests with low canopy cover has increased substantially at both scales, while those with high cover have decreased substantially.

Table 16. Tree Canopy Cover Class, Pre and Post MPB, Forested Areas Only

Tree Canopy Cover Class	Combo Boundary		Project Area	
	Pre-MPB	Post-MPB	Pre-MPB	Post-MPB
10-25% Low	9%	18%	9%	18%
26-40% Low/Mod	9%	29%	10%	30%
41-60% Mod/High	19%	30%	21%	29%
>60% High	62%	23%	61%	24%

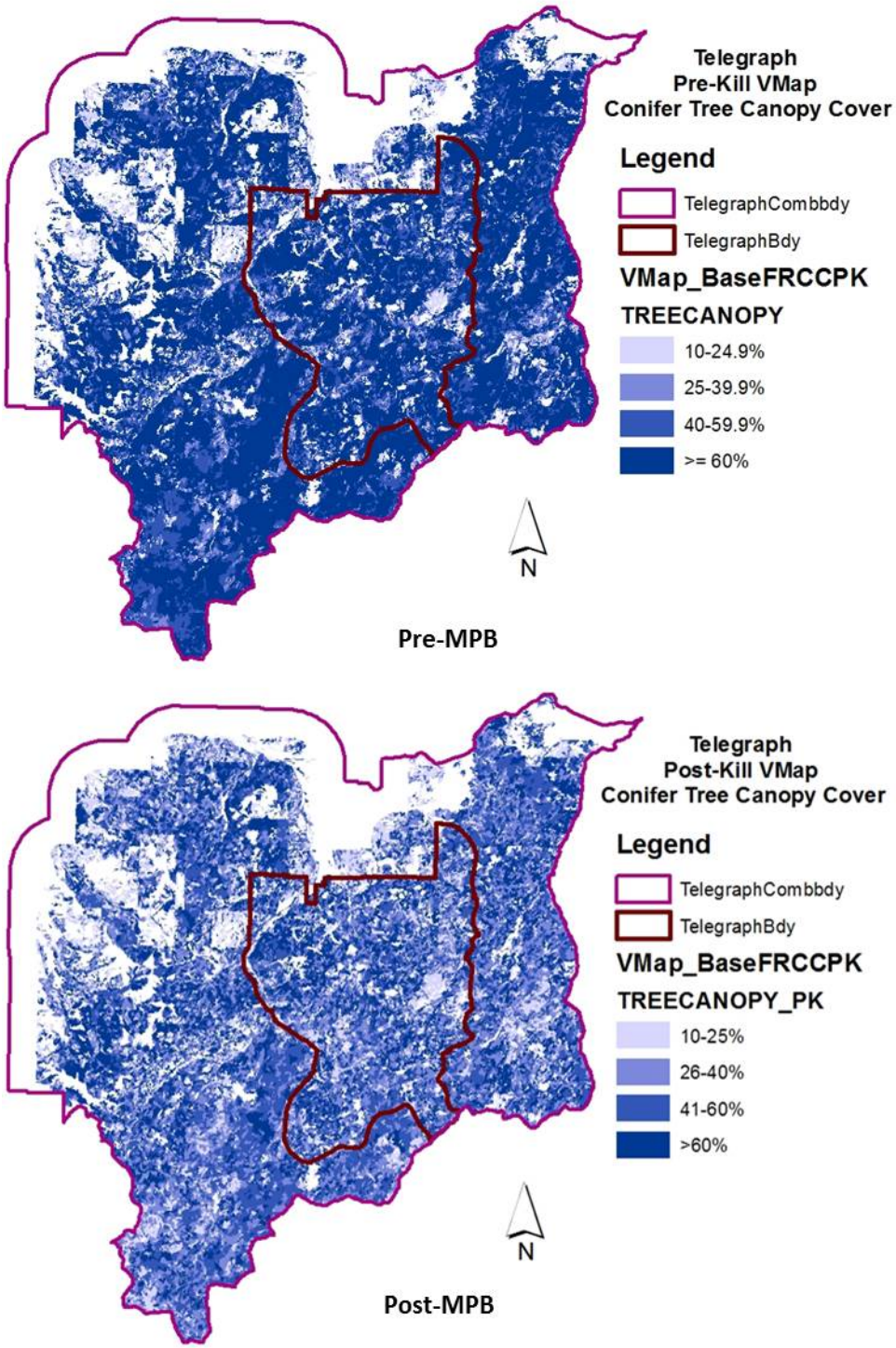


Figure 12. Tree Canopy Class Maps, Pre and Post MPB

As with the other VMap attributes, the existing condition is depicted by Post-MPB, with proportions as shown in the figure below. Some dense forests (greater than 60 percent canopy cover) still exist on nearly a quarter of the landscape, likely to occur in either mature Douglas-fir forests or young regenerating forests. The more open classes are likely present in areas impacted recently by MPB.

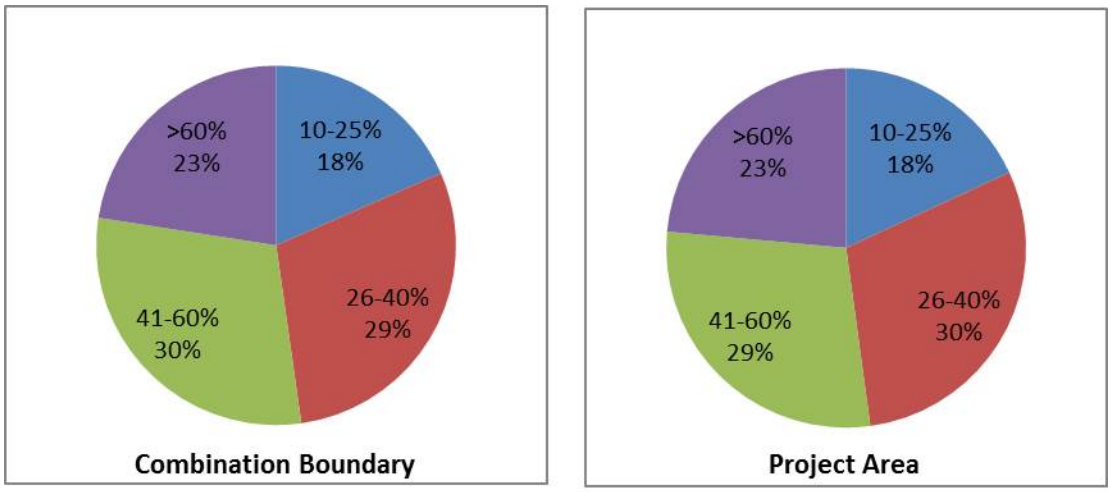


Figure 13. Post-MPB Proportions of Tree Canopy Classes

Representative Combinations of Type, Size, and Density

For the most abundant dominance groups present in the boundaries of interest (Douglas-fir and lodgepole pine), it is useful to show the combination of type, cover, and size class to describe in more detail the most prevalent forest conditions and habitat. Together these types make up approximately 74 percent and 70 percent of the combination and project areas respectively. These conditions are the most common found at the scales of interest to describe existing vegetation immediately following the MPB outbreak. The proportion of tree size classes and canopy cover classes logically varies by dominance type. The lodgepole pine forests are in the seedling and small tree size classes following the MPB outbreak. All size classes are represented in Douglas-fir forests, with small and medium trees the most common. There are no large/very large size classes in lodgepole areas, and while some are present in Douglas-fir areas they are not particularly abundant. All canopy covers are also represented in Douglas-fir forests; however open forests (10 to 25 percent canopy cover) are the least common. Canopy covers over 60 percent are quite common in Douglas-fir forests, which may indicate susceptibility to bark beetles in the larger size classes. Conversely most lodgepole pine forests are in more open cover classes immediately following the MPB outbreak. Please refer to the figure below.

Forests will slowly change over time through succession and other natural events, starting with the changes recently caused by the MPB outbreak. Dead and dying trees would eventually fall to the ground. Shade-tolerant advance regeneration would likely persist and grow to dominate mixed sites where lodgepole has died. In openings and areas without shade tolerant species already established, it is likely that lodgepole natural regeneration may establish as serotinous cones open with the sun's heat. Eventually these new stands may again become mature stands dominated by lodgepole pine. Because the bulk of the landscape is currently dominated by small to medium trees, there would be a period with few old forests. Eventually if no disturbance enhances heterogeneity, this young landscape may again eventually grow into a landscape dominated by mature forests susceptible to stand replacing disturbances over large areas.

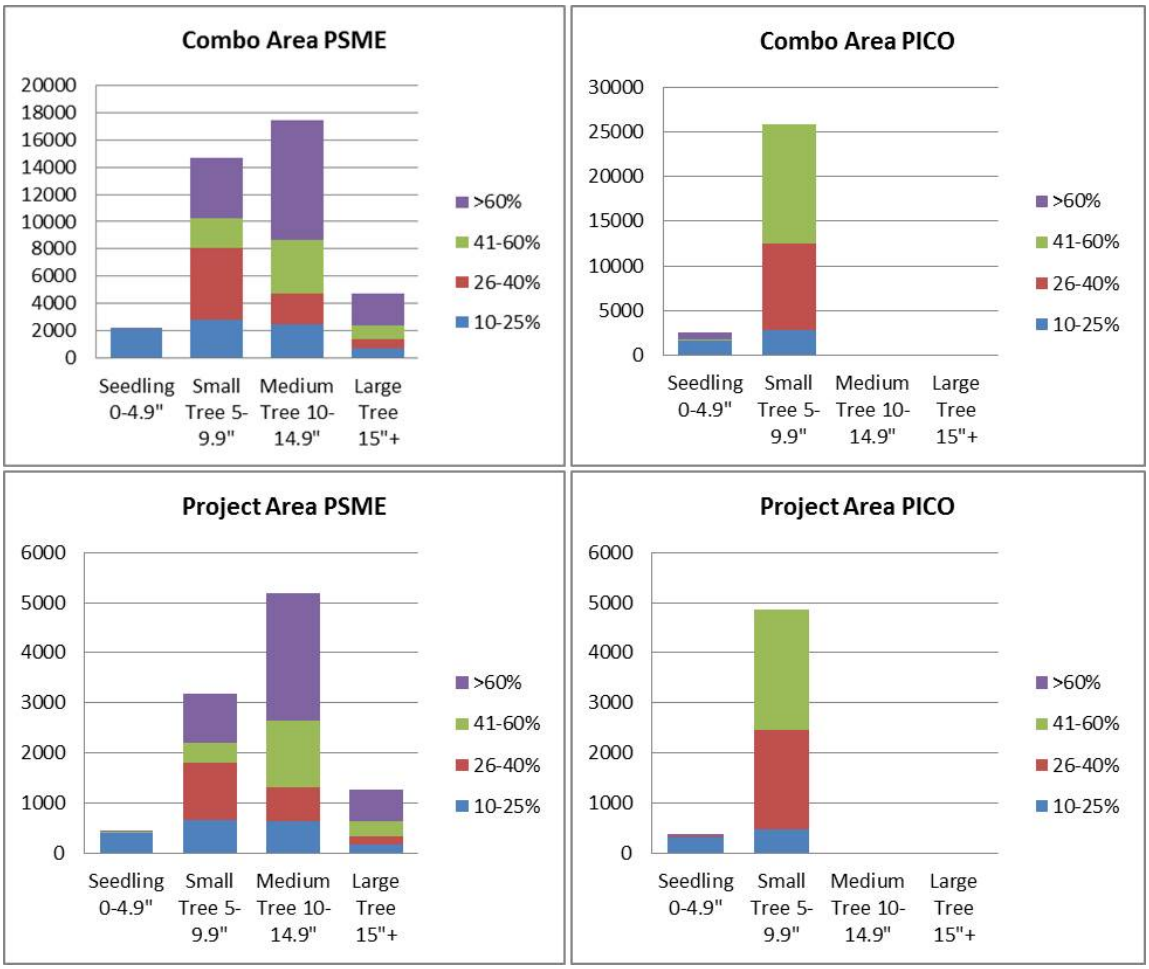


Figure 14. Detailed Structure, Douglas-fir and Lodgepole pine Dominance Groups

Existing Vegetation – R1 Summary Database

Reports were run from the Summary Database (FIA intensification plot data) to further summarize vegetation. These data provide statistical estimates on many more vegetation attributes than are represented by VMap, although they are not depicted spatially. Queries and data reports can be found in the project record. The plots were initially installed from 2006 to 2008, and are on a regular 10-year re-measurement schedule. However, "live/dead" re-measurements have been conducted on plots that contained at least 20 BA of live pine trees in order to capture changing conditions due to the MPB outbreak. In the Divide landscape, which encompasses the Telegraph Combo and Project Areas, re-measurements were done in 2009 and 2010. Because the greatest extent of insect mortality occurred in 2009, the data generally captures the effects of the outbreak.

All estimates have a 90 percent confidence interval, and are made excluding plots that have been burned or harvested since the time of inventory.

The data show results consistent with VMap summaries. At both scales, lodgepole pine (PICO) and mixes thereof dominate the species composition. Canopy cover classes are relatively evenly distributed due to components of other species not affected by MPB, but older age classes are limited. Similarly, size classes are dominated by seedling/sapling and small trees, with plots greater than 10 inches are fairly rare. Vertical structures are dominated by single-storied plots.

Table 17. Broad Scale Vegetation Characteristics, R1 Summary Database

Scale	Basic Structure							Canopy Cover Class				Age Class (Years)				
	Dominance Group 6040*					Basal Area Per Acre	BA Weighted dbh	0–9.9%	10–24.9%	25–59.9%	60+ %	0–39	40-79	80-159	160+	n/ Seedlin
	PICO + Mix	PIAL + Mix	PSME + Mix	ABLA + Mix	PIEN + Mix											
Combo	54%	3%	22%	6%	8%	87 ft^2	7.35"	24%	11%	36%	29%	21%	29%	27%	3%	21%
Project Area	63%	0%	6%	6%	25%	75 ft^2	7.34"	19%	31%	13%	38%	31%	31%	19%	0%	19%

Scale	Size Class (dbh)						Vertical Structure			
	0–4.9"	5.0–9.9"	10-14.9"	15-19.9"	20+	None/Seedling	1 Storied	2 Storied	3 or C (Multi)	None
Combo	26%	49%	10%	3%	3%	10%	72%	7%	14%	7%
Project Area	25%	63%	6%	6%	0%	0%	81%	6%	13%	0%

*Dom Group of "none" applies to 7% of the plots in the Combo Area

Insect and Disease Existing Condition

As described in the Landscape Disturbance Processes section, the MPB has been the most active insect on the HNF in recent years. The MPB outbreak reached the peak of its acreage extent in 2009 and has been subsiding since.

The progression of the outbreak is easily visualized by utilizing yearly Aerial Detection Surveys. Each year, some portions of the Forest are not flown. Additionally, each year active infestation polygons are mapped and may overlap with previous years; therefore the acres mapped are not necessarily cumulative. Finally, on a given polygon only the "primary" insect map is included in data summaries; therefore, when MPB is mapped and summarized, other pests such as western spruce budworm that may also be present on that polygon are not shown.

MPB infested acres are currently below 2006 levels, in large part due to host depletion. However, active MPB pockets are present where living hosts remain. The other two insects of interest on the HNF are western spruce budworm (WBS) and Douglas-fir beetle (DFB). WSB remains active, with population fluctuations year to year. This prolonged outbreak may be a consequence of warm weather and high density in Douglas-fir forests. Despite a brief population build after the wildfires of 2000, DFB populations remain low, but hazard exists due to tree density, drought, and WSB defoliation.

Table 18. Forestwide Insect Infestation in Helena Nationa Forest – Acres (Aerial Detection Surveys 2006-2012)

Year	MPB	DFB	WSB
2006	34,300	5,279	413,384
2007*	118,300	420	70,042
2008*	350,770	5088	192,403
2009	585,557	107	521,000
2010	372,049	28	38,776
2011*	192,467	212	106,918
2012	20,629	69	197,589

* In 2008, the southern Belts were not flown. None of the Big Belts were flown in 2007 or 2011. Wilderness areas are typically not ever flown.

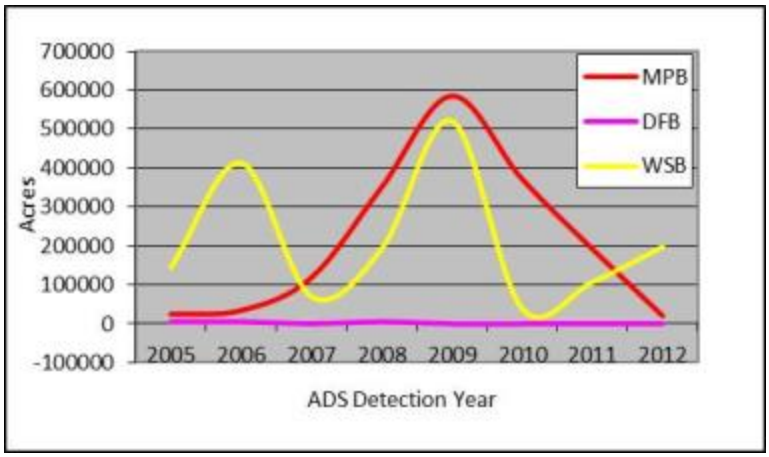


Figure 15. Forestwide Insect Infestation – Acres (Aerial Detection Surveys 2005-2012)

MPB is the most active insect within the Telegraph combination and project areas. As with the Forest as a whole, the outbreak in the Telegraph area began roughly in 2006, peaking in 2008 and 2009. The outbreak has now subsided, largely due to host depletion. The beetle was able to successfully infest and sweep through the forests due to the preponderance of mature, dense lodgepole-pine dominated forests. This insect has progressed out of the outbreak phase in general, and will remain on the landscape in endemic quantities. MPB is not expected to rise to outbreak populations again until the forest grows and in time the landscape contains susceptible mature pine forests again. The bulk of the Telegraph Combination and Project Areas have been impacted by MPB since 2006. At the peak of the outbreak in 2009, **94 percent** of the Project Area and **77 percent** of the Combination Boundary was infested by MPB. The Telegraph landscape was one of the most impacted landscapes on the HNF due to the quantity of susceptible forests available to the MPB.

While causing less dramatic effects, other insects are present within the combo boundary and project area. Most prevalent is western spruce budworm, with Douglas-fir beetle. There is potential for WSB to continue affecting large expanses of Douglas-fir. This defoliator has been active since roughly 2005, and although it subsided in some years due to cool, wet springs continues to be active during dry years. DFB has been mapped only at endemic levels. However, there is potential for DFB to increase in populations in susceptible Douglas-fir stands, especially in stands stressed by overstocking, drought, and WSB. There may have been more DFB and/or WSB activity in the Telegraph area than shown in the summaries because they may have occurred on polygons where MPB is shown as the primary pest.

No diseases are mapped with ADS. However, based on site visits white pine blister rust is infecting whitebark pine; dwarf mistletoe in lodgepole pine was also likely present in many mature stands prior to the beetle infestation; and root disease may be present. Refer to the *Forested Vegetation specialist report* for more information regarding insects and diseases at finer scales. Refer to the following figure and table for depictions of the acres infested by insects in the Telegraph combination and project area boundaries from 2006 to 2012.

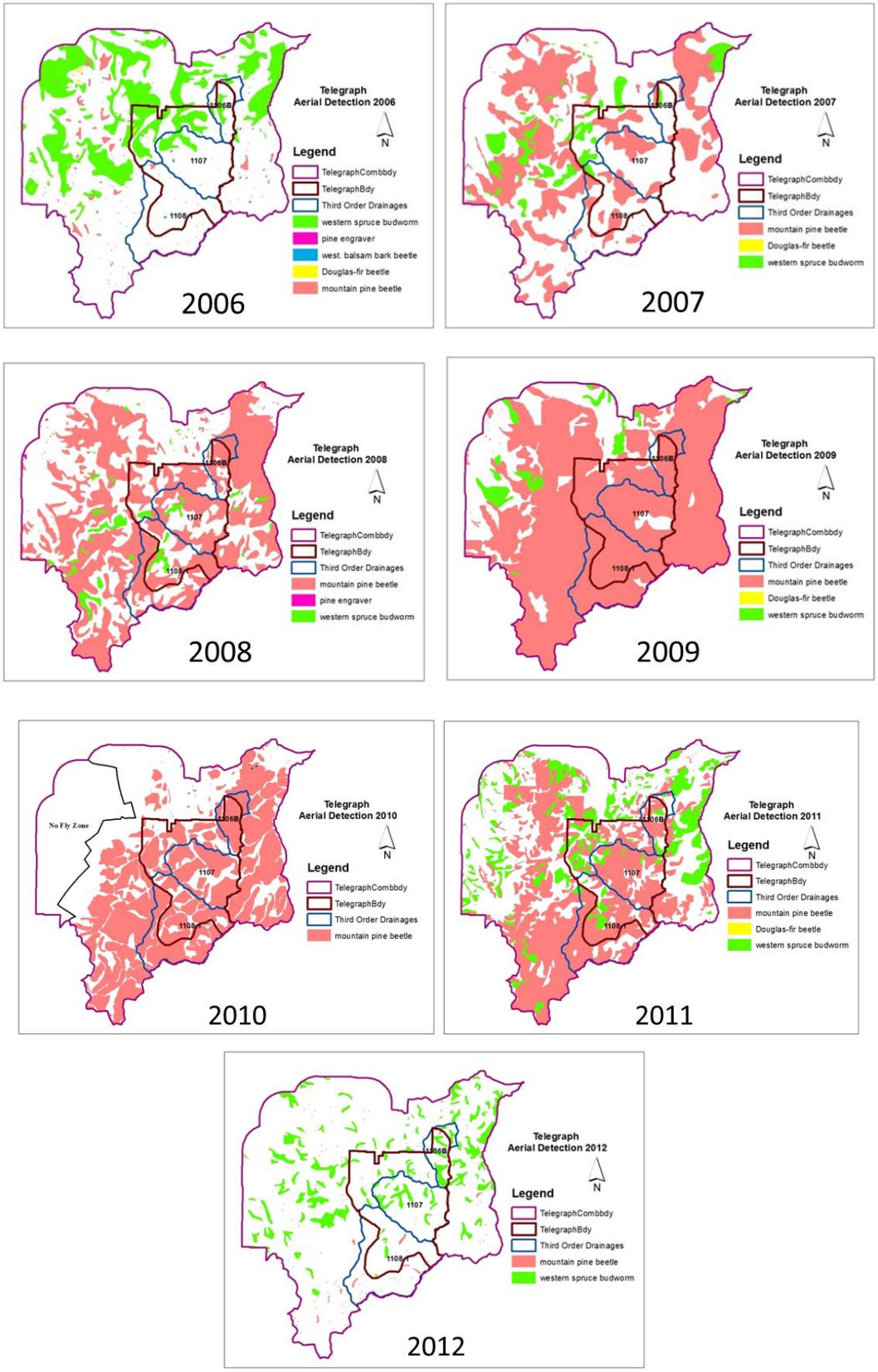


Figure 16. Insect Progression 2006 to 2012, Telegraph Boundaries

Table 19. Insect Infestation, Telegraph Boundaries, 2006-2012 ADS

	MPB		WSB		DFB	
Detection Year	***Combo Area Acres / %***	***Project Area Acres / %***	***Combo Area Acres / %***	***Project Area Acres / %***	***Combo Area Acres / %***	***Project Area Acres / %***
2006	1958 / 2%	128 / 1%	25,068 / 21%	4,432 / 19%	205 / trace	43 / trace
2007	35,520 / 30%	5,960 / 25%	6,811 / 6%	1,539 / 7%	4 / trace	0 / 0%
2008	58,581 / 50%	13,347 / 56%	3,124 / 3%	979 / 4%	0 / 0%	0 / 0%
2009	90,626 / **77%**	22,152 / **94%**	3,738 / 3%	0 / 0%	2 / trace	0 / 0%
2010	56,183 / 48%	16,912 / 71%	0 / 0%	0 / 0%	0 / 0%	0 / 0%
2011	49,384 / 42%	14,778 / 62%	15,412 / 13%	2,914 / 12%	48 / trace	8 / trace
2012	523 / trace	92 / trace	11,051 / 9%	2,404 / 10%	0 / 0%	0 / 0%

Forested Vegetation

Introduction

The purpose of the Telegraph Vegetation Project is to be responsive to the mountain pine beetle outbreak in the area, recover economic value of the dead and dying trees, promote desirable regeneration, improve conditions for fire suppression effectiveness as well as firefighter and public safety in the area in the event of a wildfire, and maintain diverse wildlife habitats. The project also seeks to maintain or improve watershed values. This translates in a general sense to providing multiple ecosystem services related to sustainable forest cover. This suite of values would best be provided by a landscape that is ***resilient*** with respect to natural disturbance regimes. This section addresses forested vegetation at the project and treatment unit scales. Refer to the *Vegetation Introduction, FRCC, Habitats of Special Concern, Sensitive Plants, and Fire and Fuels Specialist Reports* for a comprehensive understanding of vegetation at multiple scales.

Assumptions

Forested vegetation is dynamic and analysis requires assumptions. Climate change presents an aspect of uncertainty in future conditions, disturbance regimes, and vegetative responses. This analysis assumes that tree species evolved with different fire frequencies, and that fire suppression has disrupted natural fire frequencies. Relationships between climate, natural disturbances such as fire and insects, and human activities such as fire suppression are synergistic and complex forces that impact vegetation structure and condition. It is assumed that fire suppression policies will continue in the area.

A variety of well-researched, documented, and accepted analysis tools are used, including habitat typing (Pfister et al, 1977), statistically valid sampling (FIA plots, common stand exams), and the Forest Vegetation Simulator model (FVS). Specific assumptions made with FVS are documented in an Appendix.

Based on yearly aerial detection surveys (ADS), it is assumed the mountain pine beetle has primarily run its course in the Project Area; substantial additional mortality is not anticipated although localized beetle populations may still be active.

Information Used

A variety of well-researched, documented, and accepted analysis tools are used. The following section describes databases and models that are used to describe the vegetation resource. More detailed protocols, limitations, and/or assumptions are documented in the *Vegetation Introduction*.

- Statistically valid data is housed in the *FSVeg database*. Data includes landscape-level FIA plots and grid intensification plots. The *Summary Database* is a summary dataset of plots which provides statistically valid estimates. FSVeg also houses *stand examination* data. These are statistical plot surveys taken at the stand-level, measuring stand characteristics such as species, heights, diameters, physical defects and insect and disease activity of trees. These data are used to statistically summarize vegetation conditions at appropriate scales. The data is also used for FVS modeling.
- *FACTS* (Forest Activity Tracking System) is the current activity database in which all management and natural events are recorded. Records in this database date back generally to the 1950's. Spatial Data Engine (SDE) is the spatial component (GIS, geographic information system) of this database. This information is used to describe past activities for cumulative effects.
- *Silvicultural diagnoses* were done in the field in 2008 for every proposed treatment unit. Diagnoses are walk-through surveys conducted by a certified silviculturist documenting detailed observations of vegetation conditions.
- *The Forest Vegetation Simulator (FVS*) growth and yield model was used utilizing stand exam data. FVS "grows" stands into the future; disturbances and treatments can be applied to evaluate effects. FVS also models hazard ratings to insects through time.
- GIS covers and tabular data housed in the Forest library were used, such as management area delineations, habitat types, and photographic imagery.
- *VMap* (Vegetation Map product) produced by the R1 Inventory and Analysis Team in the Regional Office provides mapping of vegetation characteristics based on remote sensing.
- *Aerial Detection Survey* (ADS) data is provided by the Forest Health and Protection Group in the Regional Office. ADS data was used to analyze insect and disease trends.
- The *best available science* was used; the sources of this information include recent and historic peer-reviewed publications, other environmental analyses and specialist reports, and relevant thesis works. Concerned members of the public submitted additional citations; these were reviewed and, where applicable, included.

Methodology and Scientific Accuracy

This analysis is based on the best available science and acknowledges that there is incomplete and unavailable information. "Scientific uncertainty, incomplete information, and controversy among experts are inescapable facets of the scientific process" (Clarke 2006). Uncertainty arises from factors such as complexity, natural variability, random variation, measurement error, and lack of knowledge (Clarke 2006).

There are a series of tables that display numbers of acres and percentages. All raw numbers and calculations can be found in the Project file. The values shown are rounded. In some cases due to rounding the total is slightly less or more than the actual total; in these cases, an acre or percentage was added to or subtracted from the largest value.

Please refer to the *Vegetation Introduction* for detailed information regarding the scientific accuracy of all information sources used. Additionally:

- ***Silvicultural diagnoses***: Detailed silvicultural diagnoses were done in 2008. Documentation for each unit includes a detailed summary of vegetation conditions, insect activity, evidence of past harvest, snag conditions, other pertinent information; informal plots (non-statistical) were measured and recorded on a data form; an old growth assessment form; and photographs.
- ***Forest Vegetation Simulator (FVS)***: FVS is an individual-tree, distance-independent growth and yield model. Due to a lack of comprehensive data, several example units were chosen to display representative effects. An extension was used to model insect hazard ratings. All data can be found in the Project File. Several stands were chosen as examples for modeling. Because stand data is not available for every stand, and the selection of exams was purposive, these data cannot be extrapolated to statistically represent all stands in the Project Area or alternatives. However, the data is statistically reliable for the stand where it was collected. Representative stands with data that overlapped proposed treatment areas were selected to display as examples and to quantify expected trends. While FVS is used to show trends, it cannot reflect all variability present. Therefore, in addition to modeling, on-the-ground (diagnoses), professional judgment, and literature sources are used to describe variations.

Forested Vegetation Affected Environment

Introduction

The Project Area is located in the Little Blackfoot Watershed, west of the Continental Divide. This area is characterized by lodgepole pine forests. These are productive sites, and timber production is emphasized in the Forest Plan. Engelmann spruce and subalpine fir are common shade tolerant components that dominate some stands nearing climax. Douglas-fir is a dominant species in lower elevation stands, and a minor component in higher elevation stands. Ponderosa pine is a very rare component in low-elevation stands, and whitebark pine is a rare component at highest elevations. There are aspen clones scattered across the landscape, in isolated pockets. Finally, the landscape is sprinkled with non-forested meadows, typically along rolling ridge tops. Timber projects were implemented prior to the 1990's, creating a patchwork of regenerating clearcuts. Aside from this patchwork, lodgepole forests were homogenous and characterized by dense, mature trees with little age class diversity, and as a result the mountain pine beetle (MPB) caused extensive mortality. The outbreak peaked in 2009, affecting over 94 percent of the Project Area with intensities of greater than 90 percent mortality in some stands. Stands assessed in 2008 contained few live mature lodgepole, and site visits in 2013 found that these forests have transitioned to the "gray phase"; that is, the needles have fallen. Western spruce budworm (WSB) is moderately active, causing low to moderate defoliation in Douglas-fir, subalpine fir, and Engelmann spruce. Dwarf mistletoe (DMT) was moderate to severe prior to the MPB; many of the affected trees have died but the pathogen is present in some survivors. No substantial root disease has been observed but could occur particularly in Douglas-fir stands. Other pathogens are present, including spruce broom rust and white pine blister rust.

The stands established after prior harvest make up their own vegetation component for analysis because of their extent across the landscape. Due to the relatively cool, moist climactic period during which these stands were established, reforestation and initial stand growth was generally successful and vigorous. Very few, if any, reserve trees were left from the previous stands. These areas are strongly even-aged and homogeneous in structure, often dominated by lodgepole but Douglas-fir, subalpine fir, spruce, and aspen also occur. While some of the larger trees may have been impacted by MPB, for the most part these young forests were not highly susceptible and have in large part

survived. Where it did cause an impact, the MPB generally thinned rather than replaced these stands. Other insects and pathogens such as WSB, DMT, western gallrust, and lophodermella play a role. Due in part to these agents and dense forest stocking and competition for resources, many of these stands are slowing in growth and vigor.

Proposed treatment units fit within this landscape context. For the purposes of analysis, the proposed treatment areas are broken into four broad categories:

1. Lodgepole pine dominated mature (prior to MPB) forests
2. Douglas-fir dominated mature forests
3. Subalpine-fir dominated mature forests
4. Young stands established after previous harvest

Analysis Area

The spatial and temporal bounds of this analysis capture the existing condition and effects of alternatives. The analysis areas for the affected environment include the project boundary and individual proposed treatment units. This report focuses on stand-level effects and their contribution to the landscape context; at scales larger than the Project Area the differences between the No Action and the Proposed Action do not put context to the decisions to be made. Temporally, the existing condition reflects a snapshot of the most recent data available. The effects analysis considers short term impacts (within 5 years) and where appropriate long-term implications (50 years). The analysis area for cumulative effects is the Project Area.

Project Area Composition, Patch, and Pattern

The *Vegetation Introduction* showed that biophysical settings DFIR2-M and SPFI1 dominate the Project Area. Lodgepole pine is a common component in DFIR2-M and a dominant in SPFI1; these areas together make up 69 percent of the Project Area. The *Vegetation Introduction* also summarized VMap Pre and Post MPB for 3 attributes: **type** (species dominance); **size** (diameter classes); and **density** (canopy cover classes).

- Lodgepole pine dominance groups pre-MPB represented 56 percent of the Project Area, while Douglas-fir groups represented 35 percent. Generally, MPB reduced pine components. Post-MPB estimates that after the outbreak, lodgepole dominance groups represent only 22 percent while Douglas-fir groups increased to 45 percent; subalpine fir to 12 percent; and “intolerant mix” to 15 percent. Some areas remained dominated or mixed with pines where small trees were present.
- Tree size classes are classified into four categories: seedling/sapling, small tree, medium tree, and large tree. Comparing pre- and post-MPB, there has been a shift from medium and large tree classes to the small tree class. MPB has maintained the homogeneity the landscape; the difference is that rather than a landscape dominated by medium to large trees, the landscape is dominated by small trees. Large living trees are rare. The seedling class is also rare, because many infested forests contain mid-canopy remnants; and most past harvest stands have grown past the seedling stage.
- Density of living trees is described using classes tree canopy cover: low (10 to 25 percent) low/mod (26 to 40 percent), mod/high (41 to 60 percent), and high (greater than 60 percent). These classes do not include standing snags. Pre-MPB showed the Project Area dominated by high canopy cover (61 percent), reflecting an elevated risk to beetles. After MPB, many areas

shift to low or moderate. In this characteristic, the beetle has enhanced landscape heterogeneity by distributing cover across all classes. High cover forests still exist on 24 percent of the Project Area, made up of mature Douglas-fir and previously harvested stands.

The *Vegetation Introduction* focuses on two primary forest types - Douglas-fir and lodgepole pine - because together they make up 70 percent of the Project Area. Due to the MPB, lodgepole forests are in the seedling and small tree size classes. Conversely, all size classes are represented in Douglas-fir forests, with small and medium trees the most common. There are no large/very large size classes in lodgepole, and while some are present in Douglas-fir they are not abundant. All canopy covers are represented in Douglas-fir; however open forests (10-25 percent cover) are the least common. Canopy covers greater than 60 percent are common in Douglas-fir, which may indicate susceptibility to bark beetles in the larger size classes. Conversely, most lodgepole pine is in open cover classes due to MPB. In many cases, the result of past harvest has been a patchwork of small patches (less than 40 acres) across the gentle topography in the Project Area. However, some notable areas show a relatively large contiguity of the past harvest that fragments the landscape. The untreated portion of the landscape (84 percent) is relatively homogeneous in terms of age classes.

The stands proposed for treatment fit in this context. These areas had site visits in 2008 to describe their condition site-specifically. These conditions are summarized for four broad groups. Of all the mature forest areas included in the Proposed Action, 90 percent were dominated by lodgepole pine prior to the MPB, as shown in the Figure below. The forest types for previously harvested stands are discussed separately. Please refer to the *Habitats of Special Concern Specialist Report* for information on aspen and whitebark pine.

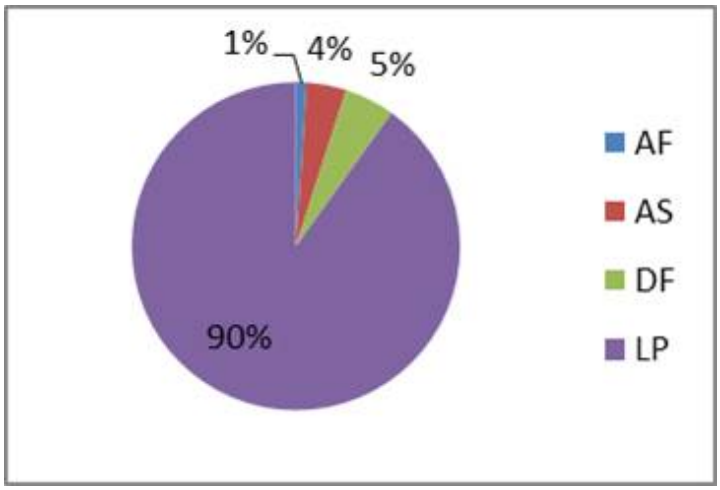


Figure 17. Forest Types in Proposed Action Units Excluding PCT

Productivity

Timber production is an emphasis on roughly 75 percent of the Project Area and economic recovery is part of the purpose and need. It is infeasible to measure productivity for every stand; numerous systems have been developed to help managers estimate productivity. Site productivity is the capacity of a site to produce wood (Tappeiner II 2007). Sites with plentiful resources can support higher tree densities; therefore, productivity can be shifted by factors such as climate, soil impacts, disturbances or management to the extent that they change the availability water, light, and nutrients.

Productivity may be estimated using classifications of plant community types such as habitat typing (Pfister et al. 1977). The most common habitat type in proposed treatment areas is 692 (41 percent), with a variety of other types represented including 281, 292, 323, 662, 670, 690, and 720 which

represent over 3 percent each. These generally correspond to ***Forest Plan Habitat Type Group 3***, the exception being 323 which is in Group 2. The volume yield capability for these types is low to moderate, ranging from 25 to 70 cubic feet per acre per year (Pfister et al. 1977, Apx E-4). Similarly, the Forest Plan estimates that sites in Group 3 range from 20 to 50 cubic feet per acre per year (USDA 1986, Appendix M).

Volume growth can be expressed for individual stands using even-aged concepts such as periodic annual increment (***PAI***) and mean annual increment (***MAI***), measured in cubic feet per acre. PAI is the volume growth of the stand over a specified period, and MAI is the total increment (volume) divided by the age of the stand (Helms 1998). ***CMAI*** is culmination of mean annual increment, the point at which growth rates cease to increase and begin to decrease. This is the point where MAI is maximized and equals PAI. PAI eventually drops because growth is governed by the law of diminishing returns. CMAI is often used to indicate the appropriate time to perform regeneration harvest, although disturbances such as insects could warrant treatment sooner. The Forest Plan adopts CMAI as a guideline for rotation lengths in timber-emphasis management areas. The Forest Plan estimates that CMAI occurs around age 110 in these habitat types, and a rotation age of 100 to 125 is recommended (USDA 1986, Apx H). Based on these guidelines, most of the mature forests in the Telegraph area had likely reached CMAI and were at or very near rotation age at the time of the MPB outbreak.

"***Stocking***" is an indication of growing-space occupancy relative to a standard (Helms 1998). Given the purpose and need, objectives that need to be balanced to determine appropriate stocking levels include individual tree vigor and growth, stand volume production, and resiliency to provide wildlife habitats and watershed values. *Overstocked* stands may stagnate, do not provide ample individual tree growth, become stressed, and/or experience mortality. Conversely, *understocked* stands do not provide for adequate tree cover, volume growth, or adequately capture site resources. *Stocking charts* assist in defining desirable "***management zones***" of stocking; stands at densities below this zone may be considered understocked and stands above the zone are overstocked. The R1 Silvicultural Practices Handbook provides stocking charts (FSH 2409.17). These general management zones may be adjusted to account for resiliency factors such as climate and susceptibility to insects, disease, and fire mortality. Stocking charts are appropriate for existing young stands and defining target objectives for stands to be regenerated; the stands must be even-aged having a normal distribution of diameters (FSH 2409.17).

Suitable Acres Affected by MPB

Of the 94 percent of the Project Area impacted by MPB (*Vegetation Introduction)*, much of it occurred on ***suitable timber land***; i.e., management areas (MAs) designated as suitable for timber production. In the Project Area, this includes MA's T-1 and T-5. To estimate the suitable area impacted by MPB, the acreage infested as detected in 2009 (the peak of MPB extent) was overlain with the map of management areas. This shows that **16,780 suitable acres** were infested, roughly 71 percent of the Project Area. This number is used as the basis for comparing regeneration and value recovery on suitable areas impacted by MPB. The R1 Summary Database was also used to estimate the how much dead lodgepole pine is present on the landscape. This data shows that there is an average of 38 square feet per acre of dead basal area of lodgepole pine greater than 7 inches dbh at the Combo Boundary Scale; and 32 square feet per acre at the Project Area scale.

Group 1: Lodgepole pine dominated stands

Diagnosis Summary

Stands with a lodgepole pine forest type (not including previously harvested stands) comprise **90 percent** of the areas in the Proposed Action. Most of these (56 percent) are on habitat type 692

(*subalpine fir/beargrass, grouse whortleberry phase*). This type occurs on gentle slopes and cool, well drained benches, with lodgepole as the seral dominant and widely scattered Douglas-fir (Pfister et al. 1977). Other subalpine fir/beargrass types (690, 691) are similar, with varying proportions of grouse whortleberry versus blue huckleberry. Most of the other lodgepole pine units are also on subalpine fir climax types, primarily *subalpine fir/dwarf huckleberry* (640) and associated phases, and *subalpine fir/twinflower* (660) and associated phases. Roughly 17 percent occur on Douglas-fir or spruce climax types at lower elevations. Type 281 (*Douglas-fir/blue huckleberry, huckleberry phase*) is the most common, and is found on relatively cold sites for the Douglas-fir series, with lodgepole pine a major component of seral stands (Pfister et al. 1977).

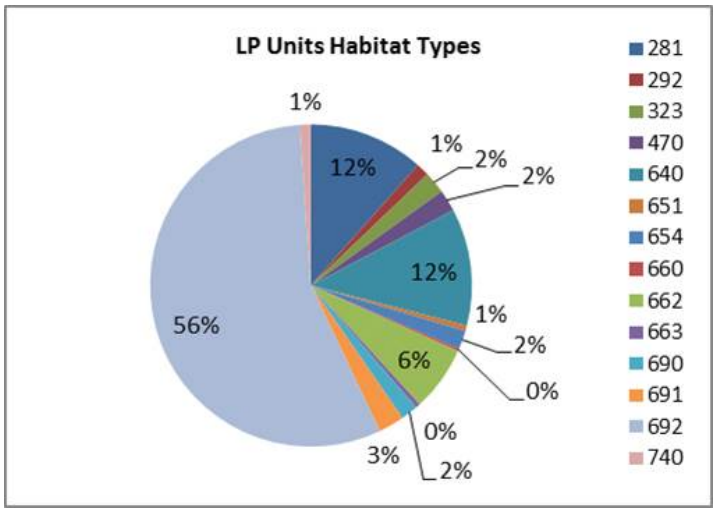


Figure 18. Habitat Types for Lodgepole pine Dominated Units

Basic stand characteristics were estimated during site visits based on visual estimates and non-statistical plots. Prior to the MPB, these stands contained over 100 square feet basal area per acre, mostly 120 to 140 square feet per acre. This, along with average diameters commonly over 10 inches dbh and ages greater than 100 years translated into high susceptibility to MPB. Most stands (70 percent) were single-storied. In these areas, the likely successional trajectory would be natural regeneration of lodgepole pine as the dead trees fall. The other 30 percent were 2-storied; these are more likely to shift in dominance to younger or shade tolerant surviving components.

FSH 2409.17 provides a stocking chart for lodgepole pine or mixed species stands with lodgepole pine. A theoretical stand with common conditions (120 BA/ac, 11 inches diameter, 300 TPA) would have been within the stocking zone of management based on timber production. However, this condition was not resilient for the long term, and based on age most stands had likely reached CMAI. The MPB has replaced the stands. An appropriate future zone of management may target densities at the lower end of the management zone to provide both timber production and resiliency.

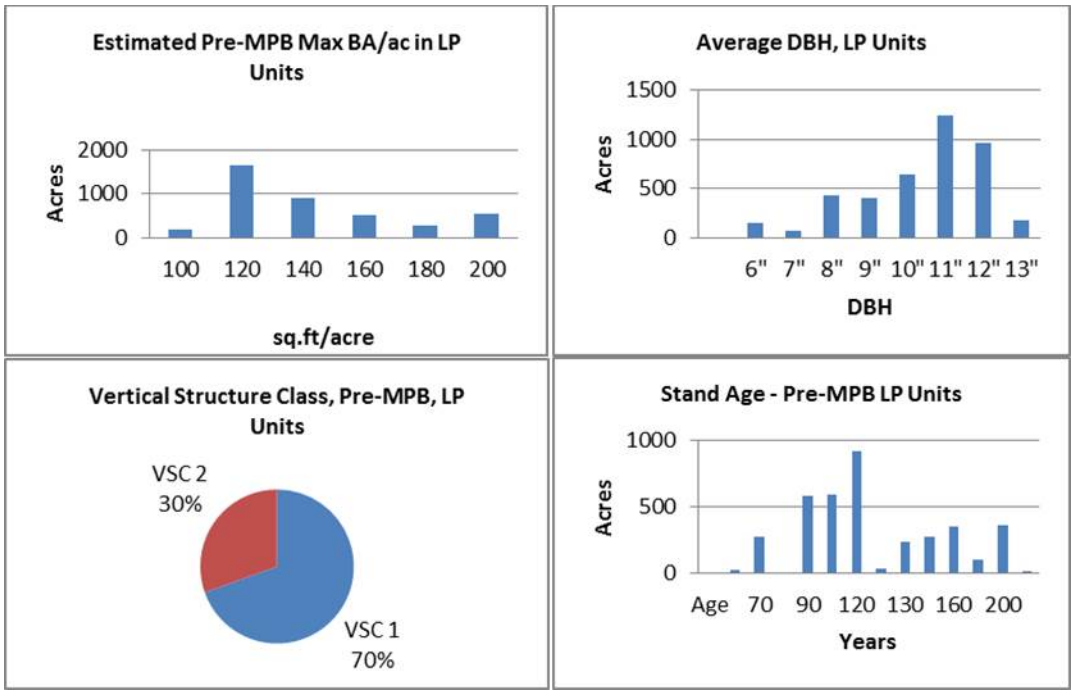


Figure 19. Basic Characteristics prior to MPB, Lodgepole pine units, Existing Condition

Figure 20. Representative Photos, Lodgepole pine dominated units, Proposed Action

Insects and Disease

The primary insects and disease in the lodgepole pine stands include MPB and dwarf mistletoe. Other minor agents, such as secondary beetles, gall rust, and needle and canker pathogens may be present but cause less substantial impacts. Additionally, white pine blister rust (WPBR) is present if and where whitebark pine occurs; refer to the *Habitats of Special Concern Specialist Report.*

- MPB, *Dendroctonus ponderosae*, was noted in all lodgepole stands. This primary bark beetle has been at outbreak levels across the HNF, with the peak of infestation extent occurring in 2009 in the Project Area. A high proportion of lodgepole over 5 inches dbh have been killed due to high stand and landscape susceptibility factors. MPB populations are subsiding due to host tree depletion. Factors such as density, basal area or SDI, tree diameter, and host density are consistently identified as primary attributes associated with MPB infestations (Fettig et al. 2007). Cochran and others (1994) recommend SDI 170 as a threshold for the probability of serious mortality from MPB in lodgepole. A basal area of 80 square feet per acre has been described as a critical density threshold for susceptibility in lodgepole (Amman and Logan 1998). Most lodgepole stands proposed for treatment met these thresholds. High hazard to this insect would not occur in these areas again until forests regenerate and grow to maturity.
- Lodgepole pine dwarf mistletoe (*A. americanum*) was present in many lodgepole pine stands. Many infected trees have been killed by MPB, but the pathogen is still present in remnant survivors and has the potential to infect new generations, reducing height and diameter growth, affecting tree form, and pre-disposing weakened trees to MPB in the future. DMT is a family of native parasitic plants that extract water and nutrients from living conifers. DMT reduces tree vigor, causing irregular branching, branch kill, and top kill. Premature death eventually follows, usually aided by secondary bark beetles (Hawksworth and Johnson 1989). The parasitic activity of DMT causes reduced tree diameter and height growth, decreased cone and seed production, direct tree mortality, or predisposition of other pathogens and insects (USDA 2006). Witches brooms and tree mortality also provide structural diversity and habitat. In the long term, heavily invested stands can begin to decline, resulting in a shift toward other tree species (USDA 2006).

FVS Example Stand

The stand used as an example of the lodgepole pine type is **33702039**, in Proposed Action Unit 167 on a 663 habitat type (*subalpine fir/twinflower*). This was an even-aged stand that sustained high MPB-caused mortality, with minor Douglas-fir, spruce, and subalpine fir components. The stand exam data is from 1990; the stand was grown forward in FVS to depict today's condition consistent with the stand diagnosis data.

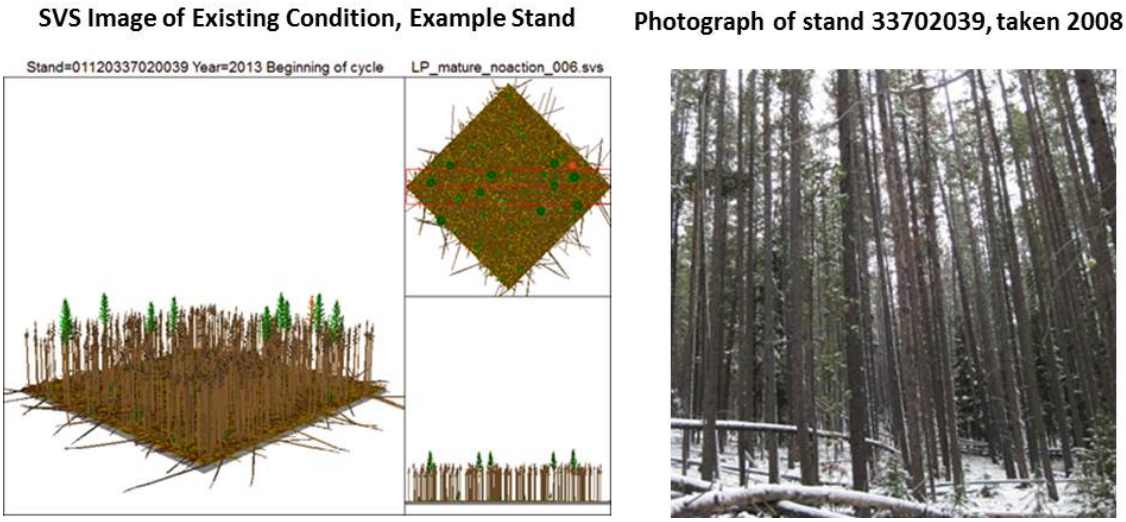


Figure 21. Example Images, Lodgepole Pine Dominated Mature Stand, Existing Condition

The stand is now comprised of the surviving stand components, mostly less than 6 inches diameter. The live basal area per acre is low as the stand initiation phase begins. The dead and dying lodgepole from the cohort killed by MPB are standing in the short term. There is abundant downed wood.

Table 20. Composition and Structure, FVS, Mature Lodgepole Example Stand Existing Condition

Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
<6” dbh: 347 >6” dbh: 11	8 ft^2/ac	2”	Single-storied	28’	36% LP; 27% DF; 20% AF; 7% ES	1,786 ft^3/ac

*QMD = quadratic mean diameter

Prior to the outbreak, in 2003 the MAI of merchantable volume was 45 cubic feet per acre, within the range of expected productivity for this type. Currently, the volume is low as the stand rebounds from MPB. FVS estimates the merchantable volume to be low based on how long it has been tree death.

Table 21. Volume Attributes, FVS, Mature Lodgepole Example Stand Existing Condition

Merchantable Volume / Acre	MAI (total ft^3 volume/stand age)
1,150 MBF/ac	2.5 ft^3

Because of the outbreak which killed susceptible hosts, the MPB hazard has dropped. The moderate rating remains based on a few lodgepole survivors. For the time being, this stand is not highly susceptible as it enters a regeneration phase post-outbreak.

Table 22. Insect Hazard, FVS, Mature Lodgepole Pine Example Stand Existing Condition

MPB Hazard
2, Mod

Group 2: Douglas-fir dominated stands

Diagnosis Summary

Mature Douglas-fir stands make up **5 percent** of the areas in the Proposed Action. Most occur on habitat type 292, *Douglas-fir/twinflower phase pinegrass*. This type occurs on relatively cold sites and lodgepole pine is a seral component. Habitat 692 is also common, which was the dominant habitat type for lodgepole pine forest type also. Although Douglas-fir is not the climax, these stands contain a preponderance of Douglas-fir growing at the upper end of its elevation range. The driest stands occur on habitat type 323 (*Douglas-fir/pinegrass, pinegrass phase*); although not common, these stands represent the driest type, and while they are generally still too cold for ponderosa pine, lodgepole is a common seral component.

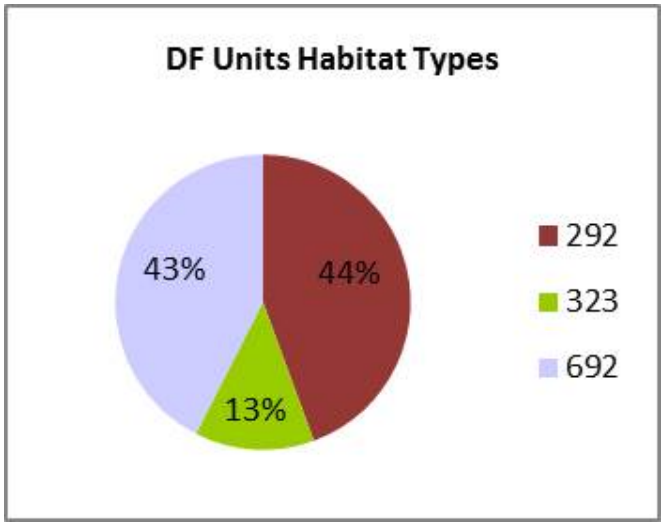


Figure 22. Habitat Types for Douglas-fir Units, Proposed Action

Because only a few units are dominated by Douglas-fir, the basic metrics do not incorporate much variation. Basal area per acre averages 100 to 140 square feet per acre with diameters 8 to 13 inches. Both single and 2-storied stands occur, and age ranges between 100 and 200. Scattered aspen clones are present. Utilizing standard stocking charts for Douglas-fir in this area, a theoretical stand containing the most common characteristics (140 BA/ac, 13 inches dbh, and 400 TPA) would be approaching the upper limit of the management zone (FSH 2409.17). Considering the desire for resiliency, however, the desired zone of management would be lower and these stands are likely overstocked.

Figure 23. Basic Characteristics, Douglas-fir dominated units, Proposed Action Existing Condition

Figure 24. Representative Photos, Douglas-fir dominated units, Existing Condition

Insects and Disease

The primary insects and disease in Douglas-fir stands include Douglas-fir beetle (DFB), western spruce budworm (WSB) and root diseases. Other more minor agents, such as secondary beetles, stem decays, canker diseases, needle blights and casts, coneworms, and defoliators may be present but would be expected to cause less substantial impacts.

- DFB, *Dendroctonus pseudotsugae*, has not been detected with Aerial Detection Surveys (ADS) in the Project Area in the last few years, and forestwide it is at endemic levels. However, several trees infested by DFB were found during site visits. This insect has the potential to increase,

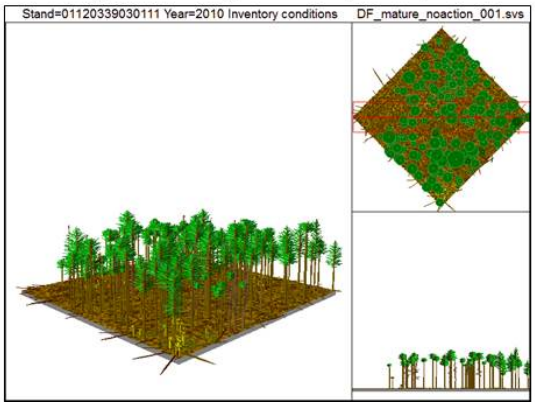
taking advantage of the stress caused by WSB and dense stocking of large Douglas-fir. DFB hazard is determined by tree size, age, and basal area. Higher stand density results in higher mortality, with basal area a driver (Negron et al, 1999). DFB feeds on Douglas-fir greater than 14 inches diameter, and is most successful in dense, mature stands (Furniss et al. 1981). BA/ac of Douglas-fir is the best predictor variable for basal area killed; mortality levels are an indication of stress which may be caused by overstocking (Negron et al. 1999). Factors involved in the susceptibility of dense stands are moisture stress and shaded stem environment (Furniss et al. 1981). The oldest, largest trees are the most susceptible (Furniss et al. 1981) because of the abundance of food and lower defense mechanisms. Heat injury from burned trees attracts DFB, and insect defoliation is also linked with susceptibility (Furniss et al. 1981). The level of DFB activity in the analysis area today is not static; as long as stands are susceptible mortality may occur if and when population levels elevate. Weather and disturbance (fire, defoliation, or wind-throw) increase the likelihood of outbreaks.

- WSB, *Choristoneura occidentalis*, has been at outbreak levels across the HNF for a decade and is present throughout the Project Area. This insect has been causing stress in larger trees, and mortality in younger trees where dense and layered under the main canopy. The current outbreak has likely been prolonged due to warm, dry conditions and an abundance of susceptible Douglas-fir. This insect is present in proposed treatment areas wherever Douglas-fir, subalpine fir, and/or spruce occur. Stands are most susceptible to WSB when they are multi-layered and dense (Carlson and Wulff 1989). WSB tends to cause the most extensive mortality in small trees.
- Root diseases, including Armillaria root disease (*Armillaria ostoyae),* Annosus root disease (*Heterobasidion annosum),* Schweinitzii root and butt rot (*Phaeolus schweinitzii),* laminated root rot (*Phellinus weirii),* Tomentosus root disease (*Inonotus tomentosus),* and Blackstain root disease (*Leptographium wageneri)* may all occur in Douglas-fir. Annosus has not been found to date on the HNF. Armillaria has been found, but not in the Project Area. Tree species most susceptible to root disease on the HNF is Douglas-fir, subalpine fir second; the most tolerant species are pines (USDA 2006). Schweinitzii root and butt rot primarily affects mature and over-mature Douglas-fir and may pre-dispose affected trees to Armillaria or DFB (Hoffman 2004). Infection occurs through the roots of trees, and damage consists of butt decay and windthrow potential.

FVS Example Stand

The stand which is used as an example of Douglas-fir types is **33903111**, in proposed Unit 5, on habitat type 291 (*Douglas-fir/twinflower, snowberry phase*). This stand had an exam in 2010. This is mature, 2-storied stand where the second story is made up of pole-sized Douglas-fir. It is dominated by Douglas-fir with a very minor lodgepole pine component and rare aspen clones in the understory. Tree density is high. While the quadratic mean diameter is only 6.7 inches, the largest trees in the stand are greater than 12 inches.

SVS Image of Existing Condition, Example Stand



Photograph of Stand 33903111, taken June 2013

Figure 25. Example Images, Douglas-fir Dominated Mature Stand Existing Condition

Table 23. Composition and Structure, FVS, Mature Douglas-fir Example Stand Existing Condition

Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
<6" dbh: 444 >6" dbh: 155	147 ft^2/ac	6.7"	2-storied	62'	95% DF, 5% LP, trace aspen	1,568 ft^3/acre

The volume production in 2013 is within but on the low end for what is expected on this habitat type. Based on the FVS projections, this stand has basically reached CMAI, as the merchantable MAI is flattened out for this and all cycles in the future.

Table 24. Volume Attributes, FVS, Mature Douglas-fir Example Stand Existing Condition

Merchantable Volume / Acre	MAI (total ft^3 volume/stand age)
11,493 MBF	23.8 ft^3/ac

Because of density and the presence of larger diameter trees along with some smaller trees, the stand is currently at high hazard to both DFB and WSB. Both agents were present during the exam in 2010.

Table 25. Insect Hazard, FVS, Mature Douglas-fir Example Stand Existing Condition

DFB Hazard	WSB Hazard
3, High	3, High

Group 3: Subalpine fir dominated stands

Diagnosis Summary

Treatment units dominated by subalpine fir make up **1 percent** of the areas proposed in the Proposed Action, but additional small subalpine fir stands or pockets occur in large treatment areas coded as lodgepole pine, so this type is analyzed to capture this fine-scale variability. Forests dominated by subalpine fir are primarily growing on habitat types *subalpine fir/ dwarf huckleberry* or *subalpine fir/beargrass*. Lodgepole generally dominates (Pfister et al. 1977), but in these stands the climax

subalpine fir has become dominant as lodgepole unraveled in the absence of fire due to agents such as dwarf mistletoe, which created canopy gaps that filled in with shade-tolerant fir. The subalpine fir dominated stands are generally 100 to 200 years old, and 2-storied trending towards continuous vertical layering. Basal areas are greater than 120 square feet per acre, and the average diameter is 9 to 10 inches. Most of these forests contain components of Engelmann spruce, lodgepole, and occasionally Douglas-fir. Scattered whitebark pine may also occur.

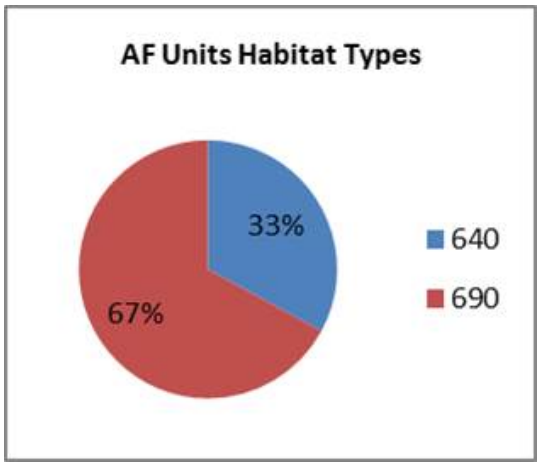


Figure 26. Habitat Types for Subalpine fir Dominated Units

Only a few stands proposed for treatment are dominated by subalpine fir, and therefore diagnoses data do not show much variability. Stand density is high, commonly averaging 200 BA per acre, and diameters relatively small at 9 to 10 inches. The vertical structure was 2-storied, approaching a more continuous structure. The stands range from 100 to 200 years old, and contained a lodgepole pine components killed by MPB. There are no stocking charts for subalpine fir.

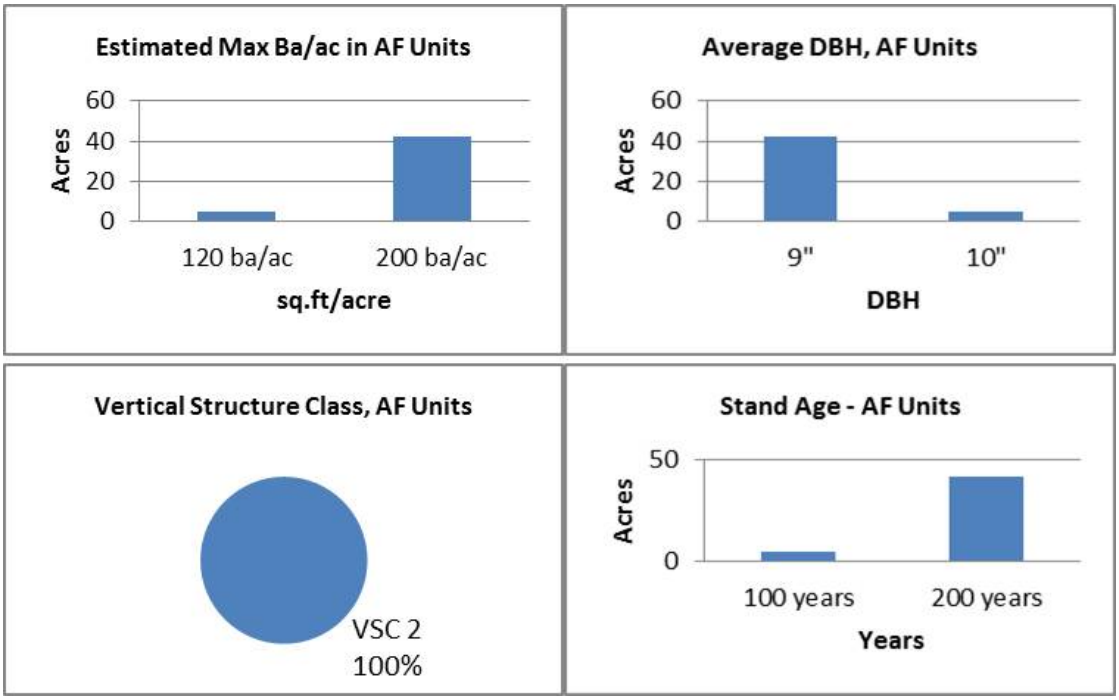


Figure 27. Basic Characteristics, Douglas-fir dominated units, Proposed Action Existing Condition

Figure 28. Representative Photos, Subalpine dominated units, Existing Condition

Insects and Disease

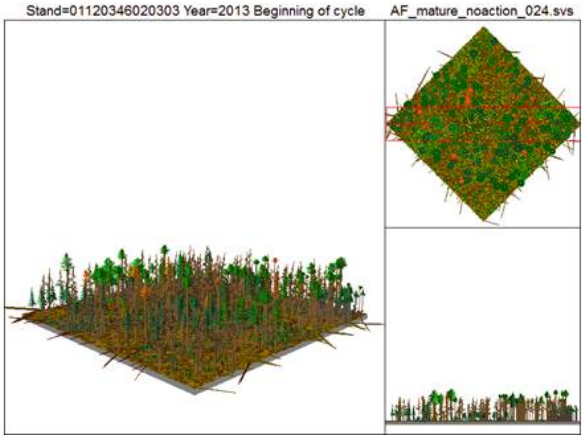
The primary insects and disease in subalpine fir are MPB (in pine components), fir broom rust, western balsam bark beetle (WBBS), WSB, and root diseases. Please refer to the discussion for MPB under the lodgepole pine group. Other more minor agents, such as secondary beetles, stem decays, needle casts or blights, and defoliators may be present but cause less substantial impacts and are not highlighted for analysis. Additionally, white pine blister rust (WPBR) is present if and where whitebark pine occurs; refer to the *Habitats of Special Concern Specialist Report*.

- Fir broom rust, *Melampsorella caryophyllacearum,* can infect subalpine fir branches, creating witches brooms and resulting in growth loss and stunted yellow needles that shed in the fall (USDA 2003). This fungal disease was not noted during diagnoses but is likely present at low levels.
- Western balsam bark beetle (*Dryocoetes confuses)* infests and kills subalpine fir, and has been mapped on the HNF at endemic levels. At such low population levels, trees may be strip attacked rather than killed outright (USDA 2003). Root diseases are often associated with WBBS (USDA 2003). This insect was not noted during diagnoses, but is likely present at low levels.
- Root diseases, including Armillaria root disease (*Armillaria ostoyae),* Annosus root disease (*Heterobasidion annosum),* Schweinitzii root and butt rot (*Phaeolus schweinitzii),* and laminated root rot (*Phellinus weirii)* may all occur. Please refer to the discussion provided for Douglas-fir.
- WSB, *Choristoneura occidentalis*, is also common in subalpine fir stands. Please refer to the discussion provided for Douglas-fir.

FVS Example Stand

The stand which is used as an example of subalpine fir forests is **34602303** in proposed Units 80 and 89. The stand exam was taken in 2010. The stand is supporting a continuous structure and contains a component of dead lodgepole, with abundant downed wood that will be increasing as these trees fall. There are many trees per acre less than 6 inches in diameter, although the average live basal area is low (67 square feet per acre) because there are few large diameter trees after the MPB outbreak. The stand is dominated by subalpine fir along with small lodgepole pine, spruce, Douglas-fir, and a trace of whitebark pine.

SVS Image of Existing Condition, Example Stand



Photograph near stand 34602303, fall 2008

Figure 29. Example Images, Subalpine fir Stand Existing Condition

Table 26. Composition and Structure, FVS, Subalpine fir Example Stand Existing Condition

Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
<6” dbh: 2434 >6” dbh: 81	67 ft^2/acre	2.1”	Continuous	41’	74% AF, 15% LP, 8% ES, 2% DF, 1% WB	2,301 ft3/ac

The merchantable volume production is quite low as it is dominated by small diameter subalpine fir and is rebounding from the loss of the lodgepole component.

Table 27. Volume Attributes, FVS, Subalpine fir Stand Example Existing Condition

Merchantable Volume / Acre	MAI (total ft3 volume/stand age)
3,064 MBF	7.0 ft3/ac

The current hazard to MPB has dropped to moderate due to the recent outbreak, but the hazard to WSB is high due to high density and layering of small fir and spruce trees.

Table 28. Insect Hazard, FVS, Subalpine fir Stand Example Existing Condition

MPB Hazard	WSB Hazard
2, Mod	3, High

Group 4: Previously harvested stands

Diagnosis Summary

Stands established from previous harvest make up over 26 percent of the units in the Proposed Action. Many habitat types are represented, with *subalpine fir/beargrass* and *subalpine fir/blue huckleberry* the most common. Subalpine fir climax types dominate, but some units occur on Douglas-fir and spruce climax types. Lodgepole pine is the most common forest type, with some

Douglas-fir, subalpine fir, spruce, and aspen. Many of the lodgepole pine units contain a mix of these species, and vice versa.

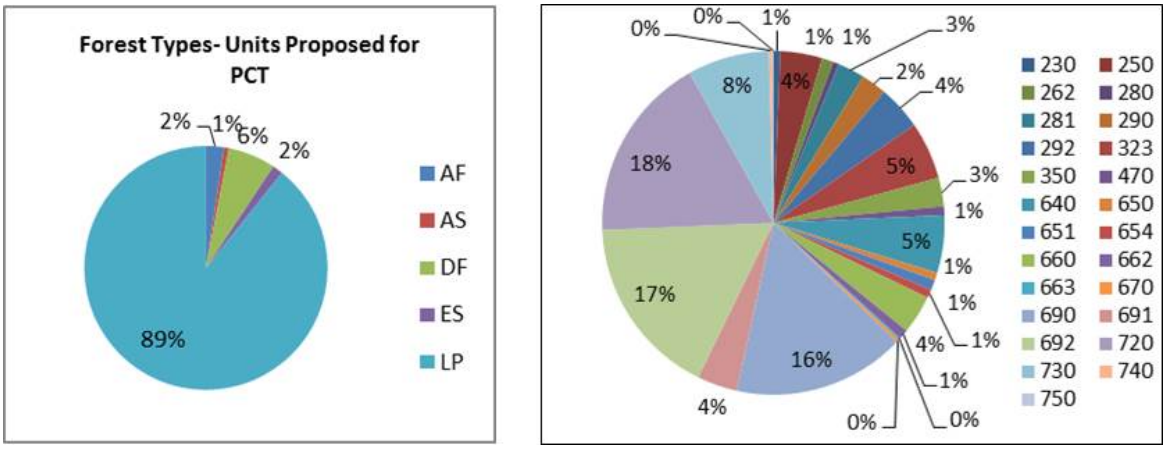


Figure 30. Forest Type and Habitat Types in Previously Harvested Stands

These sites are even-aged, single-storied, and generally less than 30 years old. Trees per acre (TPA), rather than basal area, is a meaningful metric of density due to the small tree size. Most stands contain 400-800 TPA, with average of 1-3 inches diameter the most common. Using stocking charts developed for young lodgepole pine stands, a stand averaging 3 inches dbh, at 600 TPA is within the management zone for timber productivity.

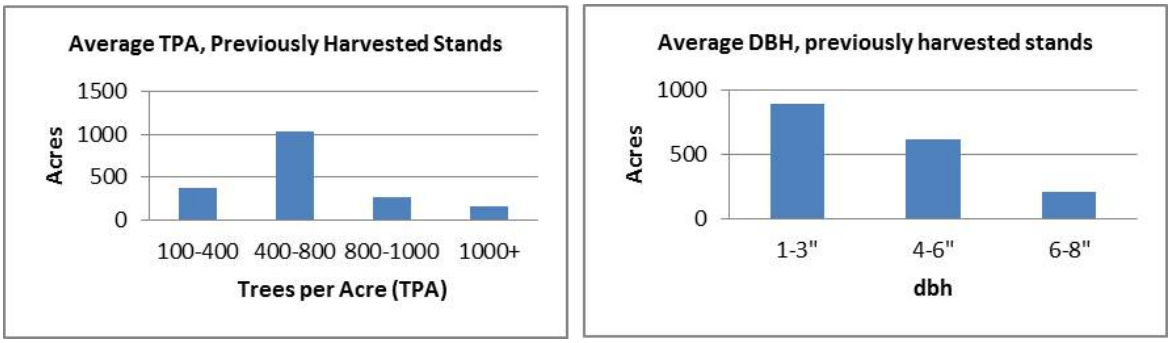


Figure 31. Basic Characteristics, Previously Harvested units, Proposed Action, Existing Condition

Figure 32. Representative Photos, Previously Harvested units, Existing Condition

Insects and Disease

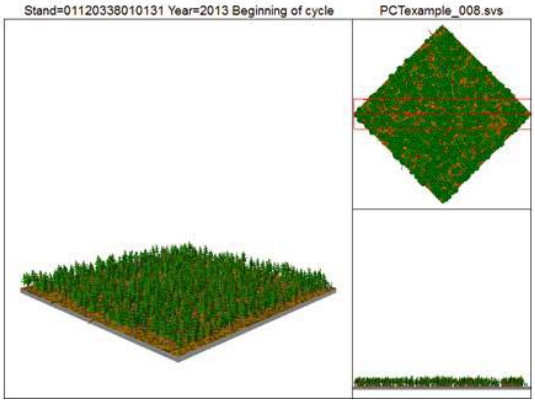
The primary insects and diseases in the previously harvested stands are MPB, lophodermella, and western gall rust (WGR). Other minor agents, such as secondary beetles, stem decays, needle casts or blights, and defoliators may be present but cause less substantial impacts and are not highlighted for analysis.

- Mountain pine beetle (MPB): While these stands are mostly too young and small in diameter to be highly susceptible, some of the largest trees did sustain MPB-caused mortality especially when adjacent to highly susceptible areas. Please refer to the discussion for MPB under the lodgepole pine analysis group.
- Lophodermella and lodgepole pine needle casts (*Lophodermella spp)* are common needle diseases found particularly in young, dense stands dominated by lodgepole. These pathogens infect either the current year or 1- to 3-year-old foliage mostly in the lower crown, causing primarily growth loss although chronic infections can kill trees (USDA 2003). This pathogen does best in dense stands and under moist climate conditions.
- Western gall rust (WGR) (*Endocronatrium harknessii)* was noted, generally minor in abundance and affecting branches rather than tree boles. WGR is a stem disease found in pine species; the disease causes galls to form on branches or stems. Branches and small stems can be killed, and galls can weaken the stems of large trees and wind breakage is common (USDA 2003).

FVS Example Stand

The stand used as an example of previously harvested stands is **33801131,** in proposed Unit 053, on habitat type 281 (*Douglas-fir/blue huckleberry, blue huckleberry phase*). The exam was taken in 1985. The harvest that established this stand (seed-tree cut, with seed trees removed) was simulated in FVS and the stand grown to depict match the data taken in a survey in 1998, and from there grown to 2013. There are over 1,600 TPA, 1-3 inches in diameter and 20’ tall, dominated by lodgepole with some subalpine fir and spruce. Due to harvest practices (likely excavator piling/burning), there is very little downed wood volume.

SVS Image of Existing Condition, Example Stand



Photograph of stand 33801131, taken June 2013

Figure 33. Example Images, Young Stand Previously Harvested Existing Condition

Table 29. Composition and Structure, FVS, Previously Harvested Example Existing Condition

Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
<6" dbh:1,687 >6" dbh: 0	57	2.5"	Single-Storied	19'	82% LP, 9% AF, 9% ES	14 ft^3/acre

Although growth is occurring, the *merchantable* volume is low because most of the trees are small. However, the MAI is trending toward what is expected for productivity on this habitat type.

Table 30. Volume Attributes, FVS, Previously Harvested Stand Example Existing Condition

Timescale	Merchantable Volume / Acre	MAI (total ft^3 volume/stand age)
2013	0 MBF	19.7 ft^3/ac

Due to the young age and small diameter of the trees, the MPB hazard is low. The recent outbreak affected only rare trees, primarily near the stand edges adjacent to highly impacted mature stands.

Table 31. Insect Hazard, FVS, Young Previously Harvested Stand Existing Condition

MPB Hazard
1, Low

Forested Vegetation Environmental Consequences

Effects Common to All Alternatives

Project Area Composition, Patch, and Pattern

Climate change, fire, insect, and disease disturbances may occur and forested stands would progress through successional processes regardless of alternative. Large proportions of the Project Area would remain untreated in all alternatives. The MPB outbreak caused a large disturbance, potentially to a greater extent than would have been typical because of landscape homogeneity of age class. This event has diversified species composition and densities in many areas. At the landscape scale the age class has shifted but remains fairly homogeneous. In untreated areas, forests would slowly change over time through succession and other natural events. Dead and dying trees would eventually fall to the ground. Shade tolerant advance regeneration would likely persist and grow to dominate mixed sites where lodgepole has died. In openings and areas without shade tolerant species established, lodgepole natural regeneration may establish as serotinous cones open in the sun. Without fire, reforestation may take longer in these areas. Because the bulk of the landscape is dominated by small to medium trees, there would be a period with few old forests. Eventually if no disturbance enhances heterogeneity, this young landscape may again grow mature forests susceptible to large scale stand replacing disturbances over large areas.

Fire suppression is likely to continue with all alternatives, limiting the extent to which natural fire can restore the disturbance regimes of the area. With MPB all of the trees killed remain onsite and are recruited to downed fuels over time. The extent of downed fuels expected in the near future in untreated areas would be continuous across a large area; this condition would be perpetuated on untreated areas on some proportion of the landscape regardless of alternative. Elevated fuel loads would persist for more than a century, which could increase the extent and duration of wildfire

events through prolonged smoldering and by serving as receptors for firebrands from adjacent stands (Collins et al. 2012). If a severe wildfire were to occur after germination of the serotinous cone source, before the young forests begin producing serotinous cones again, the seedbank could be lost within some stands and convert the area to grass/shrubland for the foreseeable future. Some of the surviving forests currently provide high cover and density; where untreated, these are susceptible to bark beetles and fire and may not persist until new old forests develop. Over time the patchwork of previously harvested areas would generally progress into the medium and potentially the large tree class, although growth may be slow in untreated areas due to high tree densities. Further, abundant subalpine fir that would likely regenerate in untreated beetle-killed stands is predicted to form a stratum of ladder fuels more likely to allow future fires to spread into the forest canopy (Collins et al. 2012).

Productivity

Regardless of alternative, establishment and growth of some sort of conifer composition is likely to continue on this productive landscape; that is, the MPB would not likely result in long term "deforestation" unless a severe wildfire were to occur after new forests have germinated but before they begin producing serotinous cones. In untreated mature forests, the material killed by MPB would fall to the forest floor over time, and the increased role of shade tolerant advance regeneration would result in generally slower growing forests. The ecosystem response following MPB outbreak seems to be slower than to fire, with seedlings establishing over several decades (Axelson et al. 2009). Still, regeneration layers which survive the outbreak will provide important ecological legacies and will contribute to the mid-term timber supply (Axelson et al. 2009). In past harvest areas that are untreated, the current levels of stocking, health, and growth would be maintained in the short term and translate to lower growth and resilience in the long term. All alternatives contain a proportion of untreated areas in all forest types.

Insects and Disease

All the insects and diseases currently present on the landscape would remain in some amount, generally functioning at endemic levels. Some agents, notably the WSB, have been at outbreak levels and are likely to continue to cause damage. The MPB outbreak has by in large passed, and no alternative would alter the levels of mortality that have occurred. The abundance and potential damage caused most agents would vary by alternative within treated areas; however, no alternative would remove them from the landscape and they would continue to function as part of the natural disturbance regime of the area.

Effects Common to All Action Alternatives

Project Area Composition, Patch, and Pattern

All action alternatives would include treatments on some proportion of the landscape which would alter vegetation conditions. Post-disturbance conditions following harvest differ from those following most natural disturbances in terms of the types, levels, and patterns of structural legacies (Franklin et al. 2002). Remnant trees have important influences on stand development (ibid). While traditional clearcutting left few to no remnant trees, all proposed treatments with the Telegraph project would leave some remnants where living trees are available. Treatments would generally promote seral species composition (lodgepole pine) over shade tolerant competitors (spruce and fir), and promote more open structures.

Logging dead and dying trees would promote regeneration of lodgepole pine and aspen as opposed to subalpine fir, and would alter the behavior and severity of potential future wildfires (Collins et al. 2012). The action alternatives create patches and patterns that to some extent emulate natural fire

which has been excluded from this ecosystem for a century. The restoration of *fire adapted ecosystems* does not involve simply the maintenance of open, late seral stands, but also promoting a mosaic of conditions on the landscape on all forest types. Proposed treatments would promote resilience to disturbances by creating a mosaic of conditions in densities, species composition, and age class that differ from untreated areas that would help ensure that not all forests are equally susceptible to the same disturbances at the same time.

Harvesting would remove some of the biological legacies left behind after the MPB outbreak; in these areas, habitat conditions would be altered from the no-action alternative. The loss of these habitat components would be ameliorated through the retention of untreated areas, retention of remnants within harvested areas, focusing harvest on forests with high pine composition, and avoiding riparian zones (Lewis 2008).

Productivity

The utilization of timber products from the generation of trees recently killed would occur with the action alternatives. Also, treatments would alter the rate/vigor/composition of tree growth in suitable timber areas as compared to No Action by balancing volume production with individual tree growth, diversity, and stand resilience. All action alternatives would assure rapid reforestation to provide for timber productivity in the long term on some proportion of the landscape that generally favors fast growing seral species over slower growing shade tolerant species. Both action alternatives include some amount of pre-commercial thinning. Pre-commercial thinning is critical for growth and yield and has clear ties to vigor and sustainability; this treatment can have drastic impacts on desired values such as mature habitat structure, watershed function, recreation, and aesthetics. Specific volume, growth, and stocking trends are assessed for each forest type analysis group in subsequent sections.

Insects and Disease

The abundance and potential damage caused by insects and disease would be altered in treated areas.

- *Mountain pine beetle (MPB)*: There would be no impact to the effects of the recent outbreak. In the long term treated areas would eventually again become susceptible to the MPB; however, the hazard of treated stands may be slightly less than untreated areas due to density management which results in stands at the low end of density thresholds for MPB.
- *Lodgepole pine dwarf mistletoe (DMT)*: The abundance of DMT within treated areas would be lowered by removing infected survivors and selecting against infected trees when thinning.
- *Douglas-fir beetle (DFB)*: Stand susceptibility to DFB within treated areas would be lowered. Preventative management is the key to reducing outbreak potential (USDA 2007b). Methods of making stands less susceptible include lowering density, managing for diversity in species and ages across the landscape, and managing fuels to make the likelihood of fire scorch lower.
- *Western spruce budworm (WSB*): Stand susceptibility to WSB in treated areas would be lowered. Stand vulnerability can be reduced using silviculture or prescribed burning (Bulaon and Sturdevant 2006). Common methods to reduce susceptibility to WSB include manipulating composition, density, height-class structure, vigor, maturity, and the nature of the surrounding forest (Carlson and Wulff 1989).
- *Root Disease*: The root disease most likely to be present is Schweinitzii root and butt rot. Increasing vigor and promoting seral species would make stands more resilient (USDA 2005c). Management strategies also include preventing over-maturity, preventing basal stem damage to residual trees, maintaining growth and vigor, and favoring less-susceptible species whenever

possible. Generally, however, in Telegraph mature Douglas-fir is a desirable component and would be retained with treatments even when over-mature; therefore, the main effect of the action alternatives is to increase growth and vigor. If Armillaria is present, the creation of stumps could exacerbate infection (Wargo and Shaw III 1985); however, this disease has not been found.

- *Fir broom rust and western balsam bark beetle*: These agents primarily impact shade tolerant components (spruce and subalpine fir) in high elevation stands. Some of these components would be retained in treated areas; however, some trees affected by these pathogens would be removed and therefore lower their abundance within treated areas.
- *Lophodermella and Western gall rust*: These pathogens are primarily present in young previously harvested stands, and management strategies include selecting against infected individuals when stands are thinned. By selecting against infected individuals during thinning, the action alternatives would lessen the impacts of these pathogens.

Proposed Treatments

At a landscape scale, proposed treatments would utilize ***variable retention*** concepts; that is, retention of biological legacies in a mosaic fashion would occur. Visually, tree retention would gradate within units and into adjacent units, blending into untreated adjacent forests, to somewhat mimic the variability that would be expected naturally. For example, intermediate harvests would result in clumpy tree distribution, generally retaining the best individuals from multiple size classes. Regeneration harvests would follow variable retention concepts for moist forests, which involve the retention of structures, organisms, and conditions from a pre-harvest forest stand for incorporation into the post-harvest ecosystem and, ultimately, forest stand (Franklin and Johnson 2011). This allows for retention of windfirm individuals and clumps from the previous stand, while creating open conditions desirable for the establishment of early successional forest (ibid). Given wide-scale mortality of dominant lodgepole pine, mature tree reserves would often be relatively sparse and consist of individual or clumps of Engelmann spruce, subalpine fir, or Douglas-fir. Forest aggregates including dead lodgepole pine would be retained in riparian areas, inoperable areas such as seeps and rock outcrops, and the mosaic of untreated areas across the landscape. Some amount of other biological legacies such as windfirm snags and downed wood would also be retained.

Within this broad scale variability, treatments at the finer scale (*implementation units*) are defined utilizing standard silvicultural terminology. An even finer allocation of terminology may be applied in site-specific prescriptions in large units that encompass multiple *stands*, but would fit within the planned “umbrella” of effects described for the unit. While treatments must be defined as one term or another, all silvicultural systems incorporate variable retention concepts and contribute to the desired landscape mosaic.

Silvicultural terminology is based on the *function* of the system, rather than its appearance. For example, generally even- or 2-aged regeneration harvests (clearcutting, seed-tree cutting, or shelterwood cutting) leave behind few residual trees because of high mortality or the tree species to be regenerated require open, sunny conditions. However, these treatments may visually appear similar to one another. For example, a clearcut with reserves may contain many residual trees that are not retained to provide seed or shelter, but rather to provide snag recruitment or diversity. Similarly, shelter and seed tree harvests retain trees to provide seed and/or shelter as required by the desired regeneration species, and may contain additional remnants for other purposes. In some cases, these may look like thinning, but because new regeneration is established they are regeneration harvests. Conversely, an intermediate treatment such as an improvement harvest may result in an open forest, but regeneration is not desired or required as part of the treatment goal. Further, uneven-aged regeneration harvesting such as group selection or individual tree selection result in substantial

remnants and the regeneration cohort represents only a proportion of the stand. The descriptions of each treatment provide more information on prescriptions for this Project Area.

Terminology is based on FSM 2470, FSH 2409.21e, and FACTS, with refinements that apply to the Telegraph project. Logging plans are designed to provide for long-term management with consideration to topography, slope, economics, and resource concerns. No regeneration harvest is proposed where successful regeneration is questionable. Detailed silvicultural prescriptions would be developed based on the Decision prior to implementation. The following terms are used to describe silvicultural treatments:

- *Advance Regeneration*: Seedlings or saplings that develop or are present in the understory.
- *Residuals*: Trees left after harvest. With regeneration, these are *Reserves* or *Leave Trees*.
    - *Reserves*: Live trees greater than 10 percent of stocking left for goals other than regeneration; this component is substantial enough to create a 2-aged stand.
    - *Leave trees*: Live trees less than 10 percent of stocking left for reasons other than regeneration; this component is minor and the stand considered even-aged.

Other generic terms are often used in resource management discussions. *Commercial harvest* indicates that the harvest results in commercial utilization of products. Any of harvest systems defined below, with the exception of pre-commercial thinning, would likely be “commercial”; but other non-commercial mechanisms could be utilized if the material is not valuable commercially. Similarly, the term *salvage* is loosely used to describe the cutting of dead trees. Silviculturally, however, this term is only used if the result is intermediate. When reforestation is a goal after salvage, the appropriate functional terminology (such as “clearcut”) is utilized. Proper terminology is based on the outcome and goals of the treatment.

Treatment Category 1: Intermediate Harvest

Intermediate harvests are designed to enhance growth, quality, vigor, and composition of a stand after establishment and prior to final harvest (Helms 1998). Density, structure, and/or composition of the stand are altered, and the stand maintains a forested appearance. A final harvest may or may not be conducted in the future depending on goals. In Telegraph, these treatments result in 2-aged or even-aged stands.

- ***Improvement Harvest***: The removal of less desirable trees of any species in a stand of poles or larger trees, primarily to improve composition and quality (Helms 1998). This is proposed in mature stands dominated by healthy Douglas-fir and/or aspen along with varying amounts of dead lodgepole pine, where an increase in tree quality and an open structure is emphasized. Diameters cut would generally range from 7 to 20 inches dbhand rare seral species such as ponderosa pine and aspen would be favored where they occur. This treatment would be followed by an underburn.

Treatment Category 2: Pre-commercial thinning

Pre-commercial thinning is the felling in an immature stand to accelerate growth and improve the form of residual trees. This is proposed in young stands established after previous harvest. Seral species such as ponderosa pine, whitebark pine, and aspen would be favored where they occur, and a contribution toward landscape diversity is a goal. Target TPA is generally 150 to 400 depending on species, habitat type, stand health, and other site conditions. Most of these treatments would occur by hand, and cut material left onsite to decompose. In some units, due to large tree size, removal of material with equipment is desired to mitigate fuel loading.

Treatment Category 3: Regeneration Harvest

Regeneration harvesting removal of trees intended to assist regeneration already present or to make regeneration possible (Helms 1998). Treatment may result in uneven-aged, 2-aged, or even-aged stands. For 1- or 2-aged systems, most of the overstory is removed and the stand is dominated by new regeneration. For 3-aged systems, only single trees or small groups are removed, with regeneration established in gaps. The Telegraph Project proposes to use 1 and 2-aged systems.

- ***Clearcut***: A stand in which essentially all trees have been removed in one operation and may or may not have reserve trees left to retain goals other than regeneration (Helms 1998). This is proposed in lodgepole pine stands with high levels of mortality. ***Leave trees or reserves*** would be retained for snags and diversity, and would consist of scattered patches of other species (and in some cases lodgepole where it is mixed with other species), contributing less than 10 percent of the stocking. Overall, less than 10 BA/ac average would be retained. In most cases the resulting stand would be even-aged. Generally, at a minimum live Douglas-fir and spruce would be retained. Lodgepole pine, Douglas-fir, and/or whitebark pine natural regeneration is expected depending on the unit. A site preparation or jackpot burn would occur after harvest in some areas to stimulate regeneration, reduce advance regeneration competition, and/or lower surface fuel loads.
- ***Seedtree***: The cutting of all trees except for a small number of widely dispersed trees retained for seed production to produce a new age class in a fully exposed microclimate (Helms 1998). This is proposed in lodgepole pine dominated stands killed by MPB that have adequate healthy trees (Douglas-fir or Engelmann spruce) to provide seed. A mix of lodgepole pine, Douglas-fir, Engelmann spruce, and/or whitebark pine regeneration is expected depending on the unit. Seed trees would be left as reserves to create 2-aged stands. Overall, less than 30 BA/ac average would be retained. A site prep burn is proposed in some stands to stimulate desired regeneration.
- ***Shelterwood***: The cutting of most trees, leaving those needed to produce sufficient shade to produce a new age class in a moderated microenvironment (Helms 1998). This is proposed in lodgepole stands killed by MPB that have a heavier mix of Douglas-fir and/or spruce to provide shade for Douglas-fir and spruce dominated regeneration. Most live trees would be retained, and the shelter trees would be left as reserves for a 2-aged stand. Overall, less than 40 BA/ac average would be retained. A site prep burn is proposed in some stands to stimulate desired regeneration.

Treatment Category 4: Prescribed Burning

Prescribed burning may be part of any silvicultural system. In Telegraph, it is proposed as a treatment tool to accomplish a variety of goals, including fuels reduction, regeneration stimulation, and vegetation restoration. Prescribed fire alone is proposed in some areas, as well as post-harvest in some units. No ignition buffers would be required adjacent to stream courses. Hand-lines would be constructed as needed.

- ***Slashing***: Cutting small diameter trees (generally less than 6 inches dbh) mechanically or with chainsaws. Slashing is used to reduce ladder fuels to lower crown fire potential; to create a sufficient surface fuels to carry a fire; and/or to meet woody debris goals for nutrient cycling. Undesirable advance regeneration may also be thinned with slashing in some units. Prescriptions may require retention of certain species and/or a desired spacing to meet target conditions.
- ***Pile/Burn***: Hand or mechanical piling of fuels, generally follows slashing or harvest where slash disposal is needed but broadcast burning is not feasible or desirable. Slash would generally be burned when conditions are favorable, after curing. Target amounts of slash may be left to meet woody debris and nutrient cycling goals.

- ***Jackpot Burn***: Burning focused on concentrations of natural fuels accumulations and/or slash, generally after harvest or slashing. May involve burning loose piles or areas of slash where fuels are not generally continuous and/or overstory mortality not a concern (as in a natural opening). A minimal amount of mortality may occur in nearby trees greater than 6 inches dbh.
- ***Site Prep burn***: Burning following harvest where the bulk of the canopy was removed. The goal is to reduce logging slash and prepare the site for regeneration. It is a low to moderate intensity fire where direct and indirect mortality of leave trees is less than 5 percent (reserve, shelter, or seed trees left are minimal and a high priority to protect). The goals are to reduce fine woody debris (less than 3 inches diameter), reduce duff fuel loadings, expose 5 to 25 percent mineral soil, and retain most coarse woody debris (greater than 3 inches diameter) for nutrient cycling, seedling microsites, and wildlife habitat. Additional objectives include generating heat to open serotinous cones and reduce competing vegetation. Units targeting whitebark pine regeneration will have mixed severity effects; units targeting other species will have low severity effects.
- ***Broadcast Burning***. This is ecosystem burning with goals of reducing hazardous fuels and restoring appropriate fire regimes to the landscape. These may include areas of:
- ***Low Severity Burn***: The purpose is to reduce ladder fuels and reduce overstory tree density to a minor extent. Slashing as needed would occur to create the desired fuelbed and fire intensity needed to accomplish objectives. An additional purpose is the re-introduction of fire to the ecosystem. Direct mortality less than 5 percent, indirect mortality less than 10 percent, and less than 1 acre mortality patches may occur in the overstory. Objectives include reducing fine woody debris (less than 3 inches diameter), reducing duff fuel loading while minimizing exposure of soil (less than 10 percent), and retaining most coarse woody debris (greater than 3 inches diameter) for nutrient cycling and wildlife habitat.
- ***Mixed Severity Burn***: Fire is used as a tool to achieve stand objectives with mixed severity. The purpose is to reduce ladder fuels and overstory tree density – heterogeneity in structure is desired. Overall mature tree mortality is generally 30 to 50 percent, occurring in patches. Mortality patch size and distribution are dictated by stand and burning conditions. Patches will generally not exceed 5 to 10 acres in large units (greater than 50 acres) or 20 percent of the unit size in units less than 50 acres. Slashing would occur as needed to create a fuelbed for burning and reduce ladder fuels. Natural openings would be favored by eliminating small tree encroachment. Other objectives include reduction of fine woody debris (less than 3 inches diameter) and duff fuel loadings. Limited amounts of mineral soil would be exposed (5 to 25 percent). Up to 30 percent of coarse woody debris (greater than 3 inches diameter) may be consumed but the remainder would be retained for nutrient cycling and wildlife habitat.

Regeneration

Timely reforestation is assured within 5 years of regeneration harvest. All proposed regeneration harvests would occur in stands dominated by lodgepole pine with high MPB-caused mortality. The success of regeneration would be monitored with stocking surveys.

Lodgepole pine and Douglas-fir are the desired regeneration species, with some diversity of aspen, subalpine fir, Engelmann spruce, or whitebark pine on some sites. Natural regeneration should be successful due to the mix of both open and serotinous lodgepole cones (approximately 60 to 80 percent serotinous cones in mature stands), and Douglas-fir/spruce seed/shelter trees. Cones in the soil and attached to logging debris would provide adequate seed, and logging activity should provide for adequate site preparation. Site preparation burns may be utilized immediately after harvest to provide for cone opening, preparation of the seed bed, and elimination of undesirable subalpine fir

regeneration, but would not occur after germination has taken place. The retention of little overstory would provide the direct sunlight needed to regenerate and promote shade-intolerant species.

Stocking goals in nearly pure lodgepole stands would be 150 to 300 well-established trees per acre, dominated by at least 80 percent lodgepole pine. Douglas-fir/spruce would potentially be a minor component, up to 20 percent. Regeneration would be considered acceptable when it covers 70 to 80 percent of the area. In lodgepole stands with a minor Douglas-fir component, stocking goals would be 150 to 200 well-established trees per acre over 70 to 80 percent of the area, with up to 60 percent Douglas-fir depending on seed availability. Where available, Douglas-fir seed would be provided from reserves and surrounding live trees. In all cases, WSB damage is not expected to materially impact regeneration stocking, especially due to the high expected success of lodgepole pine seedlings. Logging operations would strive to protect healthy advance regeneration. If natural regeneration fails, tree planting would be employed to achieve timely re-stocking utilizing locally adapted stock. The potential for animal damage control would be assessed with site-specific prescriptions.

Several units are designed to promote whitebark pine. Operations would strive to protect whitebark advance regeneration and the rare mature trees would be left as a seed source. No whitebark pine would be cut. Jackpot burns may be utilized to prepare seedbeds in units containing advance regeneration. Natural regeneration of whitebark pine would be promoted due to the open nature of residual stands, and where no advance regeneration is present site preparation burns would further aid in its establishment. It is hoped that whitebark seed colonizes openings via dispersal by wildlife. If available, rust-resistant whitebark seedlings could be planted. It is likely that a mixed-species stand would be established on many sites. Stocking goals would be 100 to 200 well-established trees per acre, at least 30 percent whitebark pine with the remainder of species composition being comprised of lodgepole pine, subalpine fir, and Douglas-fir. Over time pre-commercial thinning could aid in promoting and increasing the percentage of whitebark pine.

Cumulative Effects of Action Alternatives

The action alternatives are analyzed together for cumulative effects because many of the trends are similar. The following table addresses the activities pertinent to the cumulative effects analysis for Forested Vegetation. Indicators and measures are also addressed following the table. Refer to the Project File for the full cumulative effects list, and rationale for the selection of activities included here for detailed analysis.

Table 32. Action Alternative Cumulative Effects

Activity/Name	Decade/ Year	Scope of Activity (Project Area)	Cumulative Effect – Forested Vegetation
Past Activities			
Forest Service Timber Harvest	Pre 1960 1960–1969 1970–1979 1980–1989 1999–1999 2000–2009 2010–2011	Regeneration: 25 acres Regeneration: 880 acres Intermediate:180 acres Regeneration: 1,019 acres Intermediate: 50 acres Regeneration: 1,007 acres Intermediate: 65 acres Regeneration: 825 acres Intermediate: 87 acres Regeneration: 0 acres Intermediate: 0 acres Regeneration: 48 acres Intermediate: 188 acres	Generally, intermediate harvest retained forest canopies and regeneration harvest replaced stands. The results of these treatments are part of the existing condition. The bulk of treatments were regeneration harvest which established dense stocking of lodgepole, with spruce, Douglas-fir, subalpine fir, and aspen. These young forests survived the MPB outbreak. The action alternatives would add to the area impacted by harvest, promoting rapid re-stocking and seral species. Utilization and timber productivity would be managed for. These alternatives would add to the area where downed fuel loadings are relatively low. Cumulatively, adding past harvest but eliminating pre-commercial thinning duplication and subtracting prescribed fire only treatments, alternative 2 results in 33 percent of the area being treated with harvest and alternative 3 26 percent.
Fuels Activities	1960–1969 1970–1979 1980–1989 1990–1999 2000–2009 2010–2011	329 acres 268 acres 552 acres 1,453 acres 19 acres 236 acres	Fuel treatments opened the forest canopy, reduced fuels and/or reduced small trees. Total these activities occurred on 12 percent of the Project Area. Some treatment areas may have “grown back” to pre-treatment condition. The action alternatives would add to these effects, treating 4 percent of the Project Area in alternative 2 and 3 percent in alternative 3 with prescribed fire only.
Timber Harvest on non FS (acres approx. GIS)	2005–2011	74 acres	This small area of harvest on private ground was likely regeneration in nature. The effects would be as described for FS Timber harvest, increasing them to a miniscule degree.
Ongoing Activities			
Timber Harvest on Private or other non FS lands.	Ongoing	Timber harvest may occur on private lands on unspecified acres, primarily tractor logging within the planning area	Although known harvest has been addressed in Past Activities, there is potential for private land owners to conduct additional harvest. There is potential to add to the effects as described for past private land harvests but it is not quantifiable.

Activity/Name	Decade/ Year	Scope of Activity (Project Area)	Cumulative Effect – Forested Vegetation
Noxious Weed Treatment on National Forest Lands	Ongoing	Herbicide treatment primarily along roads and patches accessible to mechanized equipment (spraying with ATVs) and/or by hand, biological, goats/sheep, and aerial spraying.	Weed treatments have minimal to no effect forested vegetation, as the primary effect would be to small trees in near roadways. Damage to seedlings is likely limited to roadsides, and practices would be modified to ensure weed treatments do not negatively impact conifer regeneration in harvest areas. To the extent that weed mitigations are applied to proposed harvest and burning activities, the action alternatives would likely increase the area treated for weeds in the Project Area.
Grazing Activities on Private Lands	Ongoing	Grazing of cattle, sheep and horses on private lands within the Telegraph Project boundary.	Grazing may result in miniscule impacts where small trees may be trampled, but these effects are not substantial. The action alternatives may increase forage availability and the potential for grazing damage to seedlings by creating open stands with low fuels. These potential impacts would be mitigated to ensure seedling survival.
Hat Creek C&H Grazing Allotment	Ongoing	74 acres in the Project Area.	
Slate Lake C& H Grazing Allotment	Ongoing	827 acres in the Project Area.	
Tenmile Priest Pass C&H Grazing Allotment	Ongoing	1,730 acres in Project Area	
Fire Suppression	Ongoing	Fire suppression (appropriate management response) would impact potential wildfires.	Fire suppression in the past, present and future will continue to have long lasting impacts on vegetation structure and process. To an extent, the action alternatives ameliorate these effects by reducing the landscape homogeneity that has been perpetuated in part by fire suppression.
Public Firewood Gathering	Ongoing	Personal use firewood permits are issued for NFS lands, under which dead trees may be cut. This occurs adjacent to open roadways.	Firewood cutting of dead trees is allowed from open roads. This activity reduces snags adjacent to open roads. This activity would have no measurable impact to living vegetation. The action alternatives would increase the amount of dead and dying trees cut in the Project Area, and reduce the availability of firewood for the public within treated areas.

Note: Reasonably Foreseeable - No activities identified applicable to forested vegetation in the Project Area.

Cumulative effects are considered as follows relative to the Indicators and Measures.

- ***Indicator 1a***: Reforestation has been assured in past harvest areas, most of which occurred in the suitable timber base. Additional areas would have reforestation assured with alternative 2. Together these activities cumulatively represent 19 percent of the suitable based in the Project Area for alternative 2 and 10 percent for alternative 3. Regeneration should also occur in

untreated areas, although it may take longer and/or be dominated by slow growing shade tolerant species.

- ***Indicator 1b***: Economic utilization of timber products occurred on the acreage of past harvest. Additional value recovery would occur with the action alternatives. Together these activities cumulatively represent 20 percent of the suitable base in the Project Area in alternative 2 and 12 percent in alternative 3. This is more than the areas with reforestation assured (Indicator 1a) due to the inclusion of intermediate harvests.
- ***Indicator 1c:*** Alternative 2 would pre-commercially thin 47 percent of the stands established after past harvest, and alternative 3 would thin 34 percent, helping ensure that the investment placed in treatment and reforestation in the past is realized in terms of long term stand growth or resilience.
- ***Indicator 1d*****:** The general timber productivity trends resulting from past harvest would have likely been similar to those modeled for proposed harvests, but generally higher because no slower growing remnants were retained and dense stocking was emphasized over resiliency. The action alternatives add to the amount of area where productivity is altered through management, alternative 2 to a greater extent than alternative 3.
- ***Indicator 2a***: Previous harvest occurred on 16 percent of the Project Area to impact stand structure and composition. Cumulatively, the action alternatives add to these effects, resulting in a cumulative impact to 37 percent of the landscape with alternative 2 and 29 percent with alternative 3. 63 percent and 71 percent of the Project Area respectively would remain in an untreated condition, subject to all natural processes with the important exception of natural fire.
- ***Indicator 2b:*** Few intermediate harvests in Douglas-fir occurred in the past; in these areas, it would be expected that hazard to DFB and WSB was reduced. Some stands may have grown back to the pre-treatment condition. Fuels activities may also have altered hazard. Both action alternatives would add to these effects on 434 acres.
- ***Indicator 2c:*** Past harvest reduced MPB hazard by creating a new age class too young to be susceptible. Depending on species composition, it may not have had much impact on WSB hazard as dense forests were established. The action alternatives do not add to the MPB hazard effect because treated areas have already been infested. However, they do would add to the area where WSB hazard is reduced – all treatment types would have this effect in spruce, fir, and Douglas-fir forests. Alternative 2 would treat more of these areas than alternative 3.
- ***Indicator 2d:*** Based on stand data, downed woody debris was greatly reduced in past harvest areas, resulting in 16 percent of the landscape having very low surface fuel loadings. Alternatives 2 and 3 add to these effects, cumulatively resulting in 37 percent and 29 percent of the landscape respectively containing lower surface fuel loadings. On the untreated areas of the landscape, downed woody debris is expected to be high as the lodgepole pine forests killed by MPB unravel.
- ***Indicator 2e:*** Past harvest and fuel treatments would have had effects similar to those modeled for the action alternatives, in terms of providing growing space for individual trees, increasing the species composition of lodgepole pine, lowering densities, etc. This created a mosaic of different conditions on 16 percent of the Project Area. Alternatives 2 and 3 would add to these effects cumulatively resulting in these changes on 37 percent and 29 percent of the Project Area respectively. The remaining untreated portions of the landscape would be characterized by forests recovering from the MPB, trending toward dense conditions and an increased composition of shade tolerant species.

Alternative 1, No Action

Direct and Indirect Effects

Project Area Composition, Patch, and Pattern

The current distribution of age classes, species mixes, and within-stand and across-landscape structural diversities would be maintained in the short term. Forests would develop as described for untreated areas in *Effects Common to All Alternatives.* MPB may advance succession toward stands of more shade tolerant species, provided fire does not intervene (Nigh et al. 2008). The sustained homogeneity of age/size class and the extent of high amounts of downed woody fuels may result in conditions not resilient to landscape level disturbances. In the event of a severe wildfire, the seed source currently provided by MPB-killed trees in some areas could be lost. Existing high density forests could be replaced by fire or bark beetles. The likelihood of these interactions is highest with the no-action alternative because it perpetuates the existing condition on the landscape.

Group 1: Lodgepole pine Dominated Mature Stands

Prior to the MPB, most stands in the Proposed Action had little to no understory re-initiation or mid-canopy layers. In these areas, the likely successional trajectory would be natural regeneration of lodgepole pine as the dead trees fall. Other stands would shift in dominance to younger surviving or shade tolerant components. Because the MPB has replaced the stands, they are in a re-initiation phase and currently below the stocking zone of management. Generally, due to high productivity, most stands should be within the zone of management and potentially progress toward the upper limit of stocking. In the short and mid-term, these areas are not highly susceptible to MPB. The stands may again become susceptible after new forests have established and grown to greater than 5 inches diameter; the highest future susceptibility would occur after stands have reached about age 80. DMT would persist in remnants and re-infect the new seedlings as the sites regenerate, reducing growth and vigor.

In the FVS example stand, the dead and dying lodgepole are standing in the short term, but soon begin to fall. Remnant survivors persist (11 TPA), but not enough to be considered a second cohort, and the stand becomes dominated by advanced and new regeneration of mixed species. The downed wood volume increases markedly in 2018 from 2013 as the dead lodgepole fall (with the volume peaking in 2025 at over 3,000 cubic feet per acre), but then decreases again by 2063 as the material decomposes into “soft” debris.

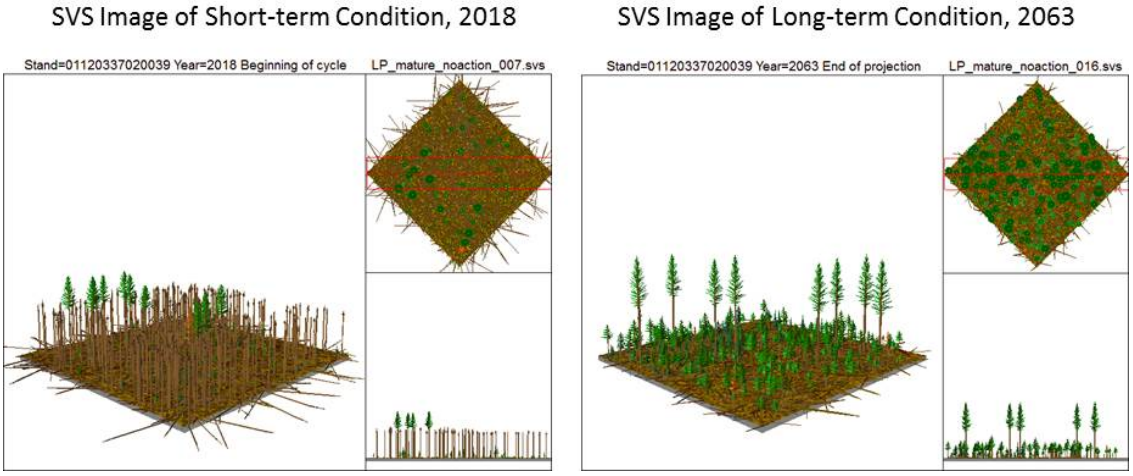


Figure 34. Example Images, Lodgepole Pine Dominated Mature Stand No Action

Based on the FVS metrics, this stand would be below the Zone of Management for stocking in both 2018 and 2063 due to the patchy establishment of regeneration and shade-tolerant components.

Table 33. Composition and Structure, FVS, Mature LP Example Stand No Action

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6" dbh: 302 >6" dbh: 11	9 ft^2/ac	2.3"	Single-storied	31'	38% LP, 22% DF, 35% AF, 5% ES	2,429 ft^3/ac
2063 (50 yrs)	<6" dbh: 509 >6" dbh: 34	34 ft^2/ac	3.4"	Single-storied	38'	39% LP, 24% DF, 32% AF, 5% ES	488 ft^3/ac

*QMD = quadratic mean diameter

The MAI of merchantable volume remains low in the short term. FVS estimates the merchantable volume to be low based on how long it has been since the trees died. The stand does not culminate in the next 50 years; it is expected based on habitat type and productivity that this would occur in 100 to 120 years. FVS does not project that growth would be within expected productivity levels; at age 100, the stand is producing only an MAI of 14 ft^3/ac.

Table 34. Volume Attributes, FVS, Mature LP No Action Stand Trajectory

Timescale	Merchantable Volume / Acre	MAI (total ft^3 volume/stand age)
2018 (5 yrs)	1,183 MBF	2.8
2063 (50 yrs)	2,334 MBF	13.32

Because of the outbreak which killed most susceptible hosts, the MPB hazard dropped. The moderate rating remains based on the survivors. This rating does not change for the 50-year projection because the stand will not yet have reached an age to be highly susceptible.

Table 35. Insect Hazard, FVS, Mature Lodgepole Pine Example Stand No Action

Timescale	MPB Hazard
2018 (5 yrs)	2 (Mod)
2063 (50 yrs)	2 (Mod)

Group 2: Douglas-fir dominated stands

The Douglas-fir dominated stands are mature and densely stocked, at or near culmination of growth, and contain variable amounts of ladder fuels. Over time, as diameters increase, without disturbance these areas would likely progress above the upper limit of management and be subject to stress related mortality. The stands are currently highly susceptible to DFB, and the factors that contribute to hazard would be maintained and increased over time in terms of tree size, age, and stand density. It is relatively likely that DFB would cause mortality. These stands are moderately to highly susceptible to WSB, and the factors that contribute to hazard would be maintained and increased over time (layering of small trees and stand density). It is relatively likely that WSB would continue to cause defoliation, killing small trees and pre-disposing larger ones to DFB. The most likely root disease is Schweinitzii root and butt rott. This pathogen affects primarily older, stressed Douglas-fir, and would be expected to maintain and increase its extent.

In the FVS example, the average age is over 120 and growth has culminated. Over time, the 2-storied condition persists and basal areas increase as do diameters. The stand remains dominated by Douglas-fir with a minor amount of lodgepole pine and small amount of aspen. Over time, the downed wood volume decreases as the current levels decompose and few additional dead trees are added (assuming no disturbance).

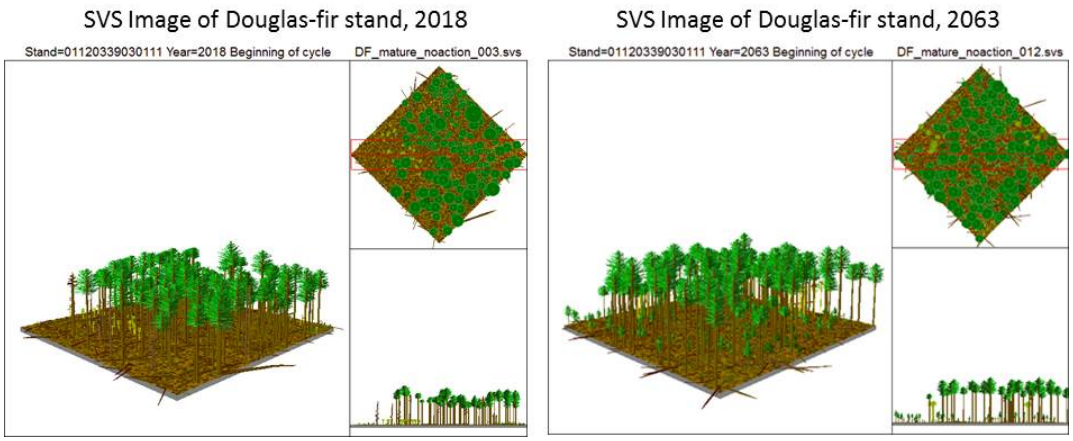


Figure 35. Example Images, Douglas-fir Mature Stand No Action

Based on FVS metrics, this stand would be at the Upper Limit of the Zone Management for stocking in 2018, and above by 2063 due to the high density of large trees.

Table 36. Composition and Structure, FVS, Douglas-fir Mature Stand No Action

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6" dbh: 449 >6" dbh: 160	149 ft^2/ac	6.7"	2-storied	63'	89% DF, 7% LP, 4% Aspen	1,332 ft^3/ac
2063 (50 yrs)	<6" dbh: 449 >6" dbh: 162	176 ft^2/ac	7.3"	2-storied	73'	89% DF, 9% LP, 2% Aspen	422 ft^3/ac

This stand had reached CMAI as of the exam in 2010. The MAI values do not change from the existing condition to 5 or 50 years in the future. This is at the low end of the expected productivity for this type.

Table 37. Volume Attributes, FVS, Douglas-fir Mature Stand No Action

Timescale	Merchantable Volume / Acre	MAI (total ft^3 volume/stand age)
2018 (5 yrs)	12,211 MBF	23.8 ft^3/ac
2063 (50 yrs)	17,601 MBF	23.6 ft^3/ac

Because of density and the presence of larger diameter trees along with smaller trees, the stand is at high hazard to both DFB and WSB on both timescales. Both agents were present at the time of the exam. In the future, this hazard is sustained in both the long and short term assuming no natural disturbance.

Table 38. Insect Hazard, FVS, Mature DF Example Stand No Action

Timescale	DFB Hazard	WSB Hazard
2018 (5 yrs)	3 (high)	3 (high)
2063 (50 yrs)	3 (high)	3 (high)

Group 3: Subalpine fir dominated stands

Small areas dominated by subalpine fir are an important variation on the landscape. These stands are dense and layered in structure. Fir broom rust would be expected to persist where present, creating stress and deformity of affected trees. Western balsam bark beetle would have the potential to cause mortality in mature subalpine fir. Root diseases would be most likely to affect subalpine fir in these areas, and would persist over time where present. There are no stocking charts for subalpine fir, but with a component of lodgepole pine the lodgepole pine can be used for a general comparison. Considering only the small trees as an “even aged stand,” these sites would generally be at or above the management level of stocking simply due to very high trees per acre. However, the stands actually contain multiple layers and ages.

In the example FVS stand, the continuous and high density structure of the 150-year old stand is maintained, with the small trees present in 2013 growing into larger size classes. The downed wood volume increases in the short term as dead lodgepole pine fall, but over the 50 year timeframe decreases as this material decomposes. Species composition does not alter greatly over time, but basal area fills in.

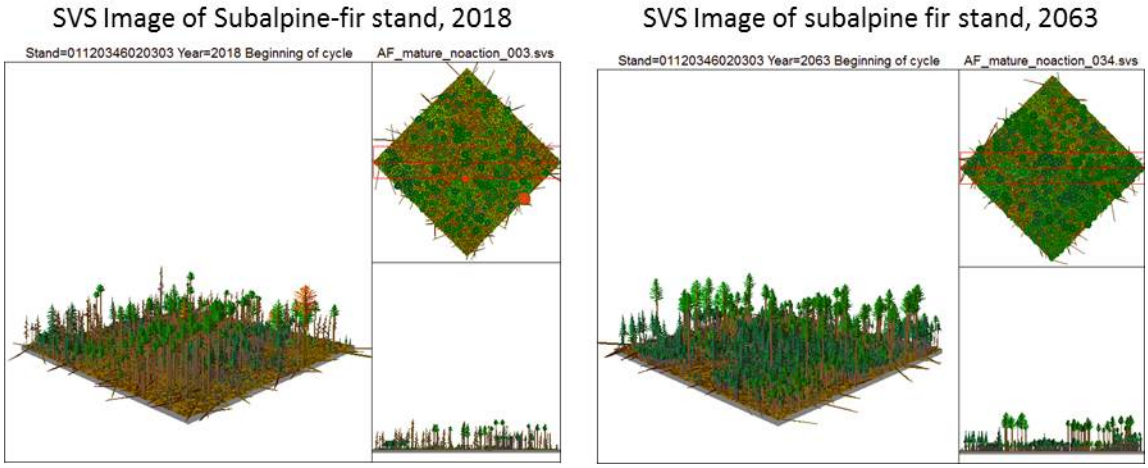


Figure 36. Example Images, Subalpine fir dominated Stand, No Action

Using the lodgepole chart, and considering trees less than 6 inches diameter as an “even-aged stand,” the stand is well above the upper limit of the stocking management zone, indicating that growth would not be maximized. In reality the stand is also occupied by older remnants and may develop multi-aged character, and therefore contains more variability than was intended for stocking charts (which are based on even-aged stands).

Table 39. Composition and Structure, FVS, Subalpine fir dominated Stand No Action

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6" dbh: 2,486 >6" dbh: 75	71 ft^2/ac	2.3"	Continuous	42'	72% AF, 15% LP, 7% ES, 4% WB, 2% DF	2,367 ft^3/ac
2063 (50 yrs)	<6" dbh: 2,269 >6" dbh: 139	129 ft^2/ac	3.1"	Continuous	49'	73% AF, 14% LP, 8% ES, 3% WB, 2% DF	550 ft^3/ac

Over time, MAI slowly increases in the FVS projection, but does not approach the potential for this habitat type due to dominance by slow growing shade-tolerant species and site occupancy of small tree layers. However, MAI is also an even-aged concept and so not perfectly suited for this stand.

Table 40. Volume Attributes, FVS, Subalpine fir dominated Stand No Action

Timescale	Merchantable Volume / Acre	MAI (total ft^3 volume/stand age)
2018 (5 yrs)	3,303 MBF	7.3 ft^3/ac
2063 (50 yrs)	5,891 MBF	10.3 ft^3/ac

MPB and WSB hazard remain moderate in the short term, but both increase to high within 50 years due to continued dense layering and component of lodgepole pine that grows into a susceptible size.

Table 41. Insect Hazard, FVS, Subalpine fir dominated Stand No Action

Timescale	MPB Hazard	WSB Hazard
2018 (5 yrs)	2 (mod)	2 (mod)
2063 (50 yrs)	3 (high)	3 (high)

Group 4: Previously harvested stands

These stands are important components on the landscape, providing patches of young, living forests. These stands are generally within the management zone for timber productivity. Lophodermella would be expected to be present through time in these dense stands, causing stress and slowing growth. Western gall rust would be expected to persist and increase, killing some trees and slowing the growth of others. In the FVS example, structure remains single storied and dense, and the species composition (lodgepole with minor spruce and subalpine fir) is maintained. Hard downed wood remains low, but does increase by year 50 due to density related mortality. Basal area rapidly increases as the trees grow greater than 6 inches dbh.

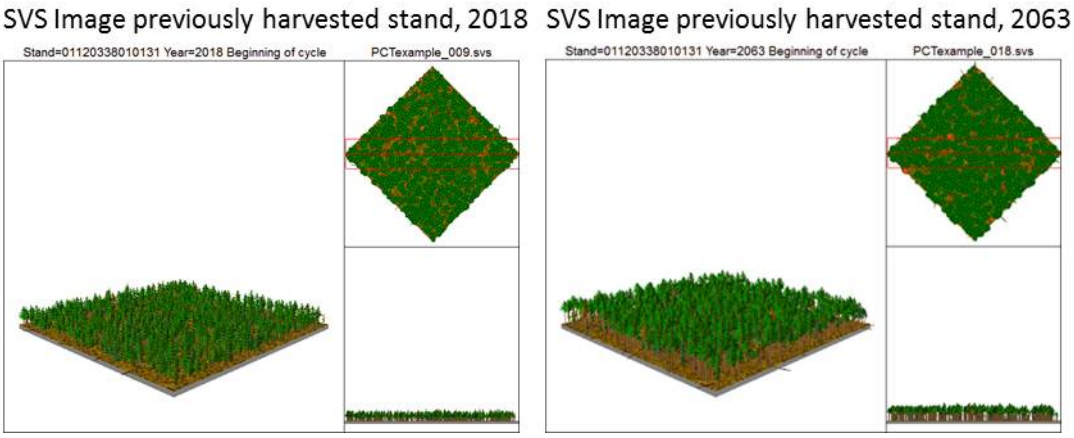


Figure 37. Example Images, Young Stand Previously Harvested No Action

The lodgepole pine stocking charts are appropriate for use in this even-aged, managed stand. Using the FVS metrics, the stand is above the upper limit of the management zone for stocking at both timescales, indicating that density-related mortality is imminent and individual tree growth is low.

Table 42. Composition and Structure, FVS, Young Previously Harvested Stand No Action

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6” dbh:1645 >6” dbh: 0	72 ft^2/ac	2.8”	Single-storied	21’	82% LP, 9% ES, 9% AF	20 ft^3/ac
2063 (50 yrs)	<6” dbh: 1040 >6” dbh: 333	207 ft^2/ac	5.3”	Single-storied	31’	80% LP, 10% ES, 10% AF	110 ft^3/ac

Although growth is occurring, the *merchantable* volume is low for the 5-year timeframe. However, once the trees are large enough the volume begins to accumulate rapidly. The MAI at year 50, when the stand is nearly 80 years old, is within but at the lower end of the expected productivity for this type.

Table 43. Volume Attributes, FVS, Young Previously Harvested Stand No Action

Timescale	Merchantable Volume / Acre	MAI (total ft^3 volume/stand age)
2018 (5 yrs)	716 MBF	21.7 ft^3/ac
2063 (50 yrs)	5,698 MBF	32.9 ft^3/ac

The MPB hazard remains low for the short term due to small tree size, but increases to moderate in 50 years as the trees grow larger and denser. This would eventually be expected to increase to high.

Table 44. Insect Hazard, FVS, Young Previously Harvested Stand No Action

Timescale	MPB Hazard
2018 (5 yrs)	1 (low)
2063 (50 yrs)	2 (mod)

Irreversible and Irretrievable Commitments

There are several irreversible and irretrievable commitments associated with the no-action alternative. With this alternative, no economic recovery of trees killed by MPB would occur. As these trees fall over time they would have no economic value, at which point this foregone opportunity becomes irretrievable. The future continued homogeneity in forest structures, particularly the abundance and extent of downed fuels, may result in severe surface fire effects in the event of a wildfire. If such a fire occurs between the time seed from serotinous cones germinations and the trees again produce cones, there could be an irreversible loss of seed source and thereby long term loss of conifer cover in some areas. An irreversible effect could be a species composition shift toward shade tolerants (subalpine fir and Engelmann spruce) at the expense of lodgepole pine, aspen, and whitebark pine in some areas; however this loss would not likely be irretrievable in the event of future natural disturbances which would again favor seral species. The slower and more variable natural regeneration mechanisms may result in an irreversible loss of growth rates and future timber volume production and/or resiliency on timber management emphasis areas.

Cumulative Effects – No Action

The following table addresses activities pertinent to the cumulative effects analysis for Forested Vegetation with the no-action alternative. Indicators and measures are also addressed. Refer to the Project File for the full cumulative effects list, and rationale for the selection of activities included for analysis.

Table 45. Cumulative Effects, No Action

Activity/Name	Decade/ Year	Scope of Activity (Project Area)	Cumulative Effect – Forested Vegetation
Past Activities			
Forest Service Timber Harvest	Pre 1960	Regeneration: 25 acres	Generally, intermediate harvest retained forest canopies and regeneration harvest replaced stands. The results of these treatments are part of the existing condition. The bulk of treatments were regeneration harvest which established dense stocking of lodgepole, with spruce, Douglas-fir, subalpine fir, and aspen, with very low surface fuel loadings. These young forests survived the MPB outbreak. These effects occurred on 16% of the landscape. Alternative 1 would not add to these effects; 84 percent of the landscape would remain in an untreated condition. Re-stocking and species composition trends would generally be somewhat slower and contain more shade tolerant components with high surface fuel loadings.
	1960–1969	Regeneration: 880 acres Intermediate:180 acres	
	1970–1979	Regeneration: 1,019 acres Intermediate: 50 acres	
	1980–1989	Regeneration: 1,007 acres Intermediate: 65 acres	
	1999–1999	Regeneration: 825 acres Intermediate: 87 acres	
	2000–2009	Regeneration: 0 acres Intermediate: 0 acres	
	2010–2011	Regeneration: 48 acres Intermediate: 188 acres	

Activity/Name	Decade/ Year	Scope of Activity (Project Area)	Cumulative Effect – Forested Vegetation
Fuels Activities	1960–1969 1970–1979 1980–1989 1990–1999 2000–2009 2010–2011	329 acres 268 acres 552 acres 1,453 acres 19 acres 236 acres	Fuel treatments opened the forest canopy, reduced fuels and/or reduced small trees. Total these activities occurred on 12 percent of the Project Area. Some treatment areas may have “grown back” to pre-treatment condition. Alternative 1 would not add to these effects.
Timber Harvest on non FS (acres approx. GIS)	2005–2011	74 acres	This small harvest was likely regeneration in nature. The effects would be as described for FS Timber harvest, increasing them to a miniscule degree. Alternative 1 would not add to these effects.
Ongoing Activities			
Timber Harvest on Private or other non FS lands	Ongoing	Timber harvest may occur on private lands on unspecified acres, primarily tractor logging within the planning area	Although known harvest has been addressed in Past Activities, there is potential for private land owners to conduct additional harvest. There is potential to add to the effects as described for past private land harvests but it is not quantifiable.
Noxious Weed Treatment on National Forest Lands	Ongoing	Herbicide treatment primarily along roads and patches accessible to mechanized equipment (spraying with ATVs) and/or by hand, biological, goats/sheep, and aerial spraying.	Weed treatments have minimal to no effect forested vegetation, as the primary effect would be to small trees in near roadways. Damage to seedlings is likely limited to roadsides. Alternative 1 would not add to nor detract from these effects. This alternative would not add to the need for weed spraying mitigations.
Grazing Activities on Private Lands Hat Creek C&H Grazing Allotment Slate Lake C& H Grazing Allotment Tenmile Priest Pass C&H Grazing Allotment	Ongoing Ongoing Ongoing Ongoing	Grazing of cattle, sheep and horses on private lands within the Telegraph Project boundary. 74 acres in the Project Area. 827 acres in the Project Area. 1,730 acres in Project Area	Grazing may result in miniscule impacts where small trees may be trampled, but these effects are not substantial. Alternative 1 would neither add to nor detract from these effects. The high fuel loadings in MPB-killed areas may inhibit cattle movement; this would occur to the greatest extent with alternative 1.
Fire Suppression	Ongoing	Fire suppression (appropriate management response) would impact potential wildfires.	Fire suppression in the past, present and future will continue to have long lasting impacts on vegetation structure and process. Alternative 1 does not add to nor detract from these effects.

Activity/Name	Decade/ Year	Scope of Activity (Project Area)	Cumulative Effect – Forested Vegetation
Public Firewood Gathering	Ongoing	Personal use firewood permits are issued for NFS lands, under which dead trees may be cut. This occurs adjacent to open roadways.	Firewood cutting of dead trees is allowed from open roads. This activity reduces snags adjacent to open roads. This activity would have no measurable impact to living vegetation. Alternative 1 would not add to nor detract from these effects.

Note: Reasonably Foreseeable - No activities identified applicable to forested vegetation in the Project Area.

Cumulative effects are considered as follows relative to the Indicators and Measures specified in table 45.

- ***Indicator 1a***: Reforestation has been assured in past harvest areas in the suitable timber base. No additional areas would have reforestation assured with the no-action alternative. Although regeneration should eventually occur, it may take longer and/or be dominated by slow growing shade tolerant species.
- ***Indicator 1b***: Economic utilization of timber products occurred on the acreage of past harvest. No additional value recovery would occur with alternative 1.
- ***Indicator 1c:*** Alternative 1 would not pre-commercially thin any stands established after past harvest. By not tending these young forests, the investment placed in treatment and reforestation in the past may not be realized in terms of long term stand growth or resilience.
- ***Indicator 1d*:** The general timber productivity trends resulting from past harvest would be similar to those modeled for proposed regeneration harvests. Alternative 1 does not add to nor detract from these effects. No additional areas of harvest would occur with alternative 1.
- ***Indicator 2a***: Previous harvest occurred on 16 percent of the Project Area to impact stand structure and composition. Cumulatively, alternative 1 does not add to these effects and 84 percent of the landscape remains in an untreated condition, subject to all natural processes with the important exception of natural fire.
- ***Indicator 2b:*** Few intermediate harvests in Douglas-fir occurred in the past; in these areas, it would be expected that hazard to DFB and WSB was reduced. Some stands may have grown back to the pre-treatment condition. Fuels activities may also have altered hazard. The no-action alternative would not add to these effects, and generally maintain a high hazard to DFB and WSB, reducing the likelihood that late-seral stands would persist.
- ***Indicator 2c:*** Past harvest reduced MPB hazard by creating a new age class too young to be highly susceptible. Depending on species composition, it may not have had much impact on WSB hazard as dense forests were established. The no-action alternative does not add to these effects. MBP hazard would be low to moderate in most areas due to the recent outbreak. WSB would generally be moderate to high due to stand densities.
- ***Indicator 2d:*** Downed woody debris would have been greatly reduced in past harvest and fuels areas, resulting in 16 percent of the landscape having low surface fuel loadings. The no-action alternative does not add to these effects. On the remaining 84 percent of the landscape, downed woody debris is expected to become high as the dominating lodgepole pine forests killed by MPB unravel and fall to the ground.
- ***Indicator 2e:*** Past harvests and fuel treatments would have had effects similar to those modeled for the action alternatives, in terms of providing growing space for individual trees, increasing

the species composition of lodgepole pine, lowering densities, etc. This created a mosaic of different conditions on 16 percent of the Project Area. The no-action alternative would neither add to nor detract from these effects. The remaining 84 percent of the landscape would be characterized by forests recovering from the MPB, trending toward dense conditions and an increased composition of shade tolerant species.

Alternative 2

Direct and Indirect Effects

Alternative 2 would result in treatment on 6,754 acres in the Project Area as shown in the table below. These treatments would result in vegetation changes that affect the Project Area composition, patch, pattern, insects, and diseases as well as forest structure and development within treated areas. Please refer to the detailed treatment descriptions in the *Effects Common to All Action Alternatives* section.

Table 46. Proposed Vegetation Treatments, Alternative 2

Treatment Type	Prescription	Acres
Intermediate Harvest	Improvement Cut, Slashing, Jackpot Burn	434
Pre-commercial thinning 1,786 Acres	Pre-commercial Thin	1,758
	Pre-commercial Thin, Underburn	28
Prescribed Fire 1,050 Acres	Slashing, Broadcast Burn	1,039
	Slashing, Hand-piling, Burning Piles	11
Regeneration Harvest 3,484 Acres	2-Aged Seedtree with Reserves	16
	2-Aged Seedtree with Reserves, Site Prep Burn	166
	2-Aged Shelterwood with Reserves, Site Prep Burn	155
	Clearcut with Leave Trees	651
	Clearcut with Leave Trees, Jackpot Burn	1,046
	Clearcut with Leave Trees, Site Prep Burn	1,355
	Clearcut with Reserves, Site Prep Burn	95
Grand Total		6,754

Project Area Composition, Patch, and Pattern

Alternative 2 would create patches where species composition and structure is altered on about 29 percent of the Project Area; eliminating the duplication in past harvest areas/proposed PCT units, but otherwise adding the areas treated previously, this results cumulatively in affecting about 37 percent of the Project Area with management. The effects to areas untreated would be the same as described under *Effects Common to All and No-Action Alternative*. Within treated areas, impacts would occur to type/size/density.

- **Type:** In lodgepole areas impacted by MPB, many dead lodgepole would be removed, and while some shade tolerant components would be retained vigorous restocking of lodgepole would occur. Surface fuel loadings would generally be below 20 tons per acre based on expected

yarding techniques while meeting minimum woody debris requirements. Reforestation would be assured. Species components of Douglas-fir, aspen, and whitebark pine would be promoted. Overall, over time landscape dominance types would more likely contain intolerant types (PICO, PSME) with less ABLA and PIEN than with No Action, although a mosaic of all types would be maintained.

- **Size:** The landscape would remain dominated by small trees. Over time, size class would progress into medium and potentially large trees. Growth in treated areas would generally be faster than untreated areas due to stocking control and encouragement of seral species, and therefore give rise to some diversity in size class. Still, overall without disturbance the landscape would be relatively homogenous in terms of age class, and therefore similar in size class. Intervening management/disturbance in the future may help further diversify this attribute.
- **Density:** Due to MPB, many areas have shifted to low or moderate cover. Alternative 2 would additionally lower density in intermediate harvest and pre-commercial thinning areas, adding to the proportion of the area in a more open and resilient condition. In lodgepole forests, the MPB enhanced landscape heterogeneity by distributing canopy cover across classes. Since regeneration harvests are mainly focused on removing dead/dying lodgepole, this characteristic would not be drastically different from No Action. Over time these areas would be expected to increase in density as trees grow larger and/or gaps fill in with trees. Due to gains in growth rates and seral species composition, treated areas would generally be expected to yield larger trees.

Over time the previously harvested areas that would be treated would be lower in density, grow more quickly into the medium and potentially the large tree classes, and be more likely to be sustained in the low/moderate canopy cover classes. This would provide a contrast to the untreated past harvest areas which would grow more slowly and be in the higher density classes with smaller individual tree sizes.

Group 1: Lodgepole pine dominated mature stands

These areas make up the bulk of alternative 2, and are proposed for regeneration harvesting. Variable amounts of residuals would be left, but the stands would become dominated by seedlings. The result in structure varies from the No Action in that dead/dying trees would be removed rather than falling to the ground over time. Seral regeneration would establish and grow more quickly in the open condition where serotinous cones are distributed immediately to the surface. While some shade tolerant components would be retained, advance regeneration would make up a lower percentage of the composition through time. The stands would be established as 1- or 2-aged and maintain that structure until they are again replaced through disturbance or management. Development of a continuous structure would be less likely to occur.

The short-term hazard and risk to MPB is low because the outbreak has already occurred. Lodgepole pine dominated stands would again become susceptible after trees reached at least 5 inches dbh, and high risk could occur after age 80 in stands that grow in a dense condition. Treated areas would be more likely to have a slightly lower density than other treatments which could help mitigate this hazard; conversely, by promoting lodgepole composition over shade tolerant species, the overall resulting hazard is not likely substantially different than No Action. By removing lodgepole survivors infected with DMT, treated areas would have a lower occurrence and risk of re-infecting regeneration as compared to the No Action. This would translate to less loss of growth and stress in new seedlings. This pathogen would still be present on the landscape and could slowly re-infect areas without future management or natural disturbance.

In the FVS example stand, two potential treatments were modeled to represent alternative 2: A clearcut with reserves followed by a site preparation burn, which is the most common treatment

proposed; and a prescribed fire only, to capture the variability present within large burn units where this stand type occurs.

Treatment Type: Clearcut with Reserves, Site Prep Burn

The dead and dying lodgepole killed by MPB within treatment units are removed, leaving behind remnants of other species. Natural regeneration establishes quickly. The quadratic mean diameter and basal area by year 50 is substantially higher with alternative 2, as the density tending promotes fewer, but larger, trees. The composition of lodgepole pine is also higher. The downed wood volume is about half of that in the No Action, as dead trees are removed rather than falling to the forest floor.

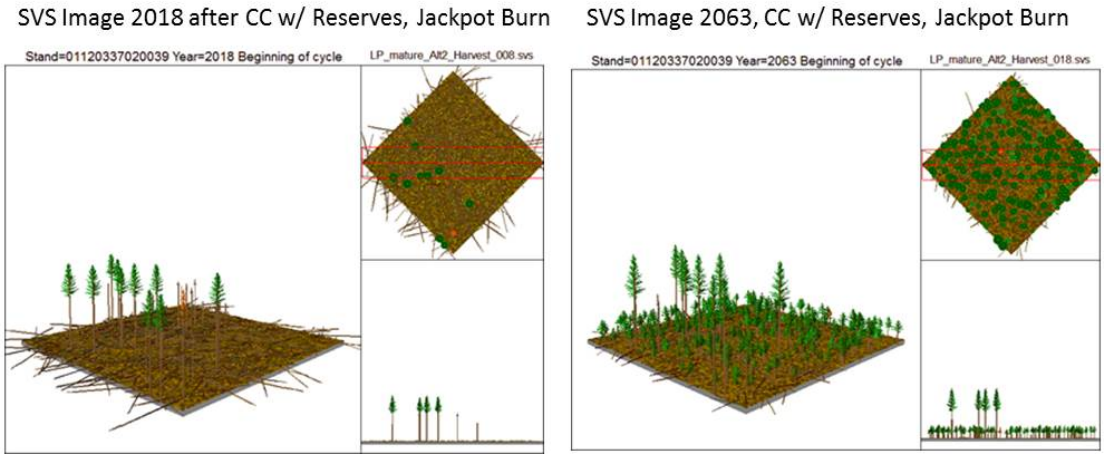


Figure 38. Example Images, Lodgepole Pine Alternative 2, Clearcut w/ Reserves Site Prep Burn

The FVS metrics were compared to the lodgepole pine stocking charts. The stand is below the management zone in 2018 as the trees are just getting established, but by 2063, the stand is almost exactly in the middle of the management zone based on tree size and density.

Table 47. Composition/Structure, FVS, Mature Lodgepole Alternative 2, Clearcut w/ Reserves Site Prep Burn

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6” dbh: 630 >6” dbh: 11	8 ft^2/ac	1.5”	Single-storied	21’	67% LP, 33% DF	1,236 ft^3/ac
2063 (50 yrs)	<6” dbh: 118 >6” dbh: 168	47 ft^2/ac	5.5”	Single-storied	36’	87% LP, 13% DF	161 ft^3/ac

*QMD = quadratic mean diameter

After harvest in, volume production is higher due to density management. Individual tree growth has been promoted as evidenced by QMD, but fewer trees are present which provides for enhanced resiliency but does not maximize timber production. Nevertheless, MAI at year 50 is higher than no nction.

Table 48. Volume Attributes, FVS, Mature LP Stand Alternative 2, Clearcut w/ Reserves, Site Prep Burn

Timescale	Merchantable Volume / Acre	MAI (total ft^3 volume/stand age)
2018 (5 yrs)	1,192 MBF	2.7 ft^3/ac
2063 (50 yrs)	2,709 MBF	15.88 ft^3/ac

This stand is not highly susceptible as it enters a regeneration phase, but a moderate hazard is maintained due to lodgepole composition. These effects are the same as no action. However, within the moderate rating, the hazard is expected to be somewhat lower with alternative 2 due to a more open condition.

Table 49. Insect Hazard, FVS, Mature LP Stand Alternative 2, Clearcut w/ Reserves, Site Prep Burn

Timescale	MPB Hazard
2018 (5 yrs)	2 (mod)
2063 (50 yrs)	2 (mod)

Treatment Type: Prescribed Fire Only, Mixed Severity

In large burn units, forests similar to the lodgepole example occur. Therefore, a mixed severity fire was also modeled in this stand to depict potential effects. No trees would be harvested and removed. Some dead lodgepole are consumed but mostly remain onsite. Some additional residual trees are killed, resulting in slightly lower basal area per acre, but scattered remnants survive. The downed wood volume is in the 5-year timeframe is similar to No Action. However, the 50-year projected downed wood is lower than the No Action due to fire enhancing the decomposition. The species composition is similar to the no-action alternative, with shade tolerant components adding higher within-stand diversity. At the landscape scale this contributes less overall diversity because a preponderance of untreated areas may proceed on a similar trajectory. However, with burning there would also be a diversity of results in lodgepole stands with no other species components; in these cases, lodgepole regeneration may be prolific.

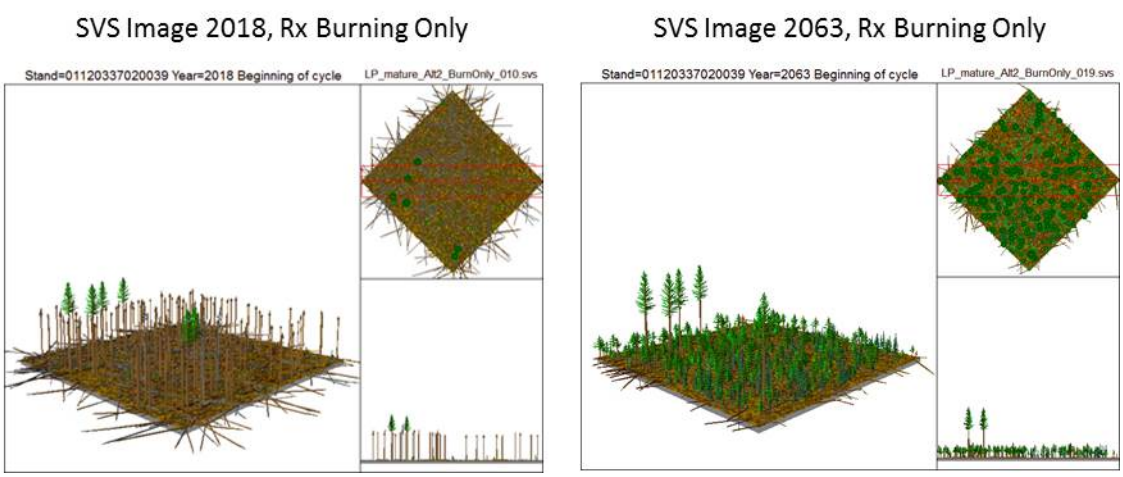


Figure 39. Example Images, Lodgepole Pine Dominated Stand Alternative 2, Prescribed Fire Only

The FVS metrics were compared to the lodgepole pine stocking chart. Similar to harvest, the stand is below the management zone for stocking in 2018. It moves into management zone, but remains near the lower limit, by 2063 due to more small trees present than with the harvest scenario.

Table 50. Composition and Structure, FVS, Mature Lodgepole Stand Alternative 2, Prescribed Fire Only

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6" dbh: 508 >6" dbh: 6	5 ft^2/ac	1.3"	Single-storied	16'	38% AF, 37% LP, 23% DF, 2% ES	2,388 ft^3/ac
2063 (50 yrs)	<6" dbh: 667 >6" dbh: 113	43 ft^2/ac	3.2"	Single-storied	31'	39% AF, 33% LP, 27% DF, 1% ES	369 ft^3/ac

The volume growth following prescribed fire only is lower than both the No Action and the harvest scenario because some remnants are killed and regeneration is more dominated by slow growing shade tolerant components. However volume production is not paramount in areas proposed for prescribed burning only, which are primarily in inaccessible areas.

Table 51. Volume Attributes, FVS, Mature Lodgepole Stand Alternative 2, Prescribed Fire Only

Timescale	Merchantable Volume / Acre	MAI (total ft^3 volume/stand age)
2018 (5 yrs)	673 MBF	1.54 ft^2/ac
2063 (50 yrs)	1,681 MBF	12.34 ft^2/ac

Although prescribed fire alone results in a more variable stand, the MPB hazard rating at both timescales remains moderate due to a lodgepole pine component, similar to the No Action and the harvest treatment.

Table 52. Insect Hazard, FVS, Mature Lodgepole Pine Stand Alternative 2, Prescribed Fire Only

Timescale	MPB Hazard
2018 (5 yrs)	2 (mod)
2063 (50 yrs)	2 (mod)

Group 2: Douglas-fir dominated stands

The Douglas-fir dominated stands in the proposed action are mature and densely stocked. These stands are generally at or near culmination of growth, and contain variable amounts of ladder fuels. Utilizing standard stocking charts for Douglas-fir in this area, a theoretical stand containing the most common characteristics found during diagnoses would be approaching the upper limit of the management zone of stocking (FSH 2409.17). Considering the desire for resiliency to disturbances, however, the desired zone of management is likely lower than this. Alternative 2 would generally result in a thinning of these areas with improvement harvests. Even though the stands have reached CMAI, the retention of some mature forest structure on the landscape is more critical than utilizing timber productivity currently. Future timber productivity is not precluded by extending the rotation on these few limited areas. Generally, where it occurs aspen would be promoted by treatments.

Resiliency of these stands to provide late-seral habitat is enhanced by reducing density and ladder fuels. DFB and WSB hazard would be reduced, as would the likelihood of a stand replacing wildfire.

In the FVS stand representing Douglas-fir mature stands, the average age in 2010 was 120, and growth has culminated. Two potential treatments were modeled to represent alternative 2: An improvement harvest followed by an underburn, which is the most common treatment proposed in this type; and a prescribed fire only, to capture the variability present within large burn units where this stand type occurs.

Treatment Type: Improvement Harvest, Underburn

With improvement harvest and underburn, an open single-storied stand is created in the short term. The overstory component contains trees 14 to 34 inches in diameter; however, QMD is low because small seedlings have begun to establish. Over time, the 2-storied condition develops and basal areas increase, but remain below the density of No Action. The stand remains dominated by Douglas-fir with a minor amount of lodgepole pine and a composition of aspen similar to the No Action. The short term downed wood is less than with No Action due to the removal of some dead lodgepole and burning existing fuels. Over time, the downed wood volume further decreases as the current levels decompose and few additional dead trees fall (assuming no disturbance). The aspen component is not measurably different between Action and No Action in FVS due to the inability to spatially modify; in practice, conifers would be removed around aspen and this special species would be expected to increase to some degree.

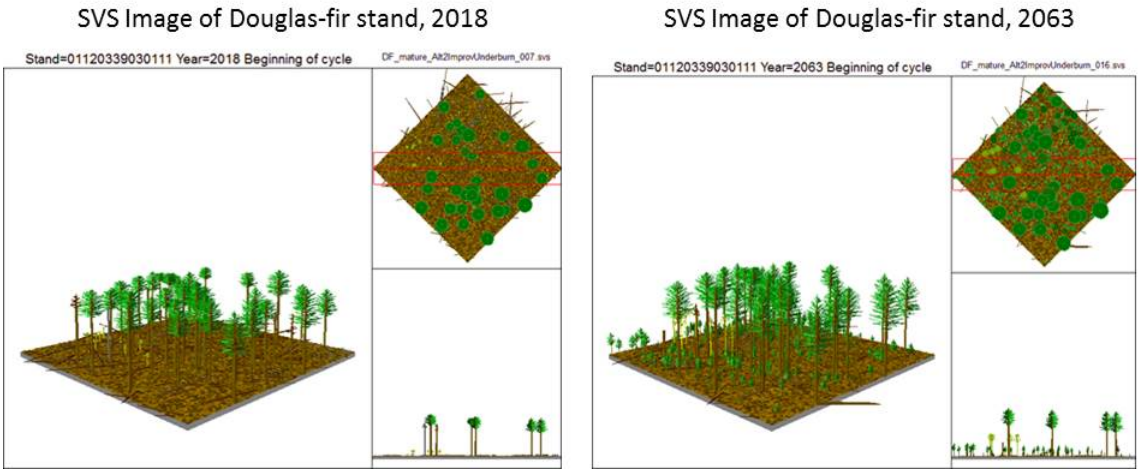


Figure 40. Example Images, Douglas-fir Stand Alternative 2, Improvement Harvest/Underburn

After improvement harvest, the stand is within and slightly toward the lower end of the management zone in the Douglas-fir stocking chart. It moves toward the middle of the zone by 2063. Although appropriate stocking is being maintained, overall growth would not increase much due to stand age.

Table 53. Composition and Structure, FVS, Douglas-fir Stand Alternative 2, Improvement Harvest/Underburn

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6" dbh: 280 >6: dbh: 36	68 ft^2/ac	6.3"	1-storied	58'	80% DF, 16% LP, 4% Aspen	996 ft^3/ac
2063 (50 yrs)	<6" dbh: 414 >6: dbh: 38	84 ft^2/ac	5.9"	2-storied	64'	85% DF, 13% LP, 2% Aspen	277 ft^3/ac

This stand had already reached CMAI. The rotation is extended due to a desire to provide open forest habitat because this is a limiting feature on the landscape. Reducing density to enhance resiliency in this old stand reduces the volume and MAI, which is also reduced by advanced stand age. In short, this treatment does not enhance the volume production for this rotation.

Table 54. Volume Attributes, FVS, Mature Douglas-fir Stand Alternative 2, Improvement Harvest/Underburn

Timescale	Merchantable Volume / Acre	Mean Annual Increment
2018 (5 yrs)	6,260 MBF	11.5 ft^3/ac
2063 (5 yrs)	9,093 MBF	11.7 ft^3/ac

Treatment reduces the DFB hazard from high to moderate in both the short and long term by reducing density. In the short term WSB hazard is moved to low by removing small trees. This moves up to moderate in the 50 year timeframe (without additional disturbance) as a second cohort establishes. Underburning could increase susceptibility of scorched trees to DFB in the short term.

Table 55. Insect Hazard, FVS, Mature Douglas-fir Stand Alternative 2, Improvement Harvest/Underburn

Timescale	DFB Hazard	WSB Hazard
2018 (5 yrs)	2 (mod)	1 (low)
2063 (50 yrs)	2 (mod)	2 (mod)

Treatment Type: Prescribed Fire Only, Low Severity

In large burn units, forests similar to the Douglas-fir example occur. The mixed severity conditions used in the lodgepole stand were applied in FVS, although due to species composition and structure the site burns appropriately with low severity. No trees would be harvested, but slashing of small trees may occur.

Stand density is decreased compared to No Action but far less than with the harvest. Basal areas remain high. The short-term downed wood is slightly higher than the No Action and much higher than the harvest scenario because the fire adds dead trees to the loading and removes none. This quantity decreases over time assuming no disturbance. The overall amount of trees less than 6 inches diameter (new seedlings) is similar to the improvement harvest scenario, but with burning only the stand is generally 2-storied due to many suppressed trees in the 6 to 10 inches diameter classes which would have been removed with the improvement harvest. The species composition is similar to both the No Action and harvest scenarios.

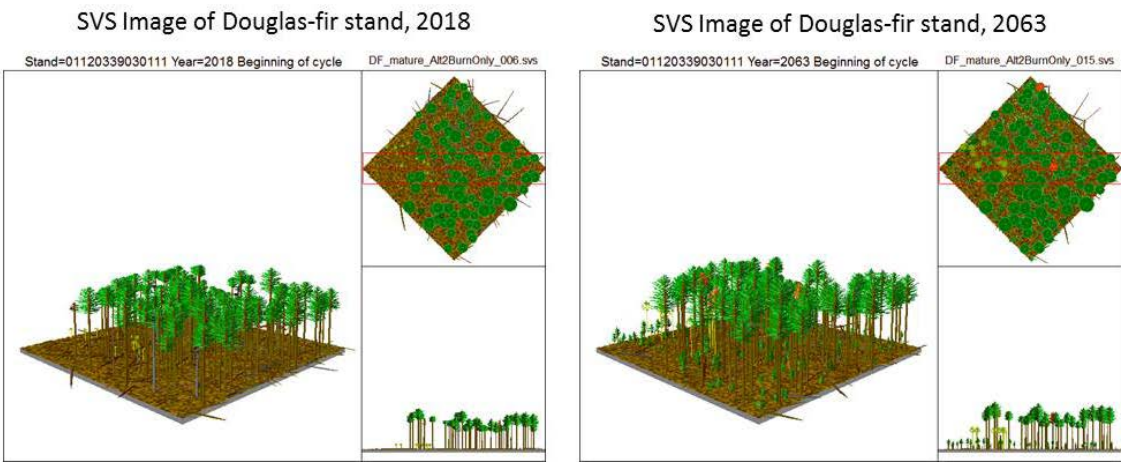


Figure 41. Example Images, Douglas-fir Dominated Stand Alternative 2, Prescribed Fire Only

After prescribed burning, the stand is right at the upper limit of the management zone in the Douglas-fir stocking chart. It moves slightly above of the zone by 2063. This is similar to the No Action.

Table 56. Composition and Structure, FVS, Douglas-fir Stand Alternative 2, Prescribed Fire Only

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6" dbh: 215 >6" dbh: 145	129 ft^2/ac	8.1"	2-storied	63'	88% DF, 8% LP, 5% Aspen	1,568 ft^3/ac
2063 (50 yrs)	<6" dbh: 379 >6" dbh: 134	155 ft^2/ac	7.4"	2-storied	73'	89% DF, 8% LP, 2% Aspen	377 ft^3/ac

This stand has already reached CMAI. The rotation is extended due to a desire to provide open forest habitat, as this is a limiting feature on the landscape dominated by dead/dying lodgepole. Burning only retains more merchantable volume on the site over time than the improvement harvest scenario and slightly less than the No Action. Nevertheless, MAI remains relatively flat and similar to No Action.

Table 57. Volume Attributes, FVS, Mature Douglas-fir Stand Alternative 2, Prescribed Fire Only

Timescale	Merchantable Volume / Acre	Mean Annual Increment
2018 (5 yrs)	10,726 MBF	20.6
2063 (50 yrs)	15,782 MBF	20.8

The stand is less resilient following fire only compared to harvest. The burn scenario maintains high DFB and WSB hazard, similar to No Action. In addition, burning could increase susceptibility of scorched trees to DFB in the short term. Although given the same general rating, the hazard should be slightly lower than No Action because stand basal area is lower, and therefore somewhat more resilient to disturbances.

Table 58. Insect Hazard, FVS, Mature Douglas-fir Stand Alternative 2, Prescribed Fire Only

Timescale	DFB Hazard	WSB Hazard
2018 (5 yrs)	3 (high)	3 (high)
2063 (50 yrs)	3 (high)	3 (high)

Group 3: Subalpine fir dominated stands

Small areas dominated by subalpine fir occur in units in the proposed action. These stands are typically dense and layered and contain components of other species. Alternative 2 would generally reduce density, increase the composition of seral species, and enhance growth in these stands. The abundance of fir broom rust, western balsam bark beetle, and root diseases would be reduced to a certain extent through tree removal selection and/or burning, but would likely remain present to some degree. Where it occurs in these areas, whitebark pine would be promoted because competing conifers would be cut and openings created for new regeneration. No whitebark pine would be cut. Many remnants would be retained in these areas to provide structural diversity and habitat features.

In the FVS example stand, two potential treatments were modeled to represent alternative 2: A clearcut followed by a jackpot burn, which is the most common treatment proposed in this type; and a prescribed fire only, to capture the variability present within large burn units where this stand type occurs.

Treatment Type: Clearcut with Reserves, Jackpot burn

This treatment is modeled similar to the lodgepole example, but with a patchier burn (jackpot rather than site prep) designed to reduce woody accumulations. Substantial remnants of other mature trees (spruce, subalpine fir, and Douglas-fir) are left. The advance regeneration would also be tended by slashing to reduce the density of small subalpine fir and promote whitebark pine, while retaining components of Douglas-fir, whitebark pine, and spruce. Stand density is greatly reduced and the species composition of seral components—lodgepole and whitebark pine—is increased. The structure is altered from continuous to 2-storied due to retention of generally the largest remnants. This would contrast similar areas that would be untreated. Downed wood volume is only slightly lower than the No Action at both timescales due to the amounts already present (not related to the recent mortality).

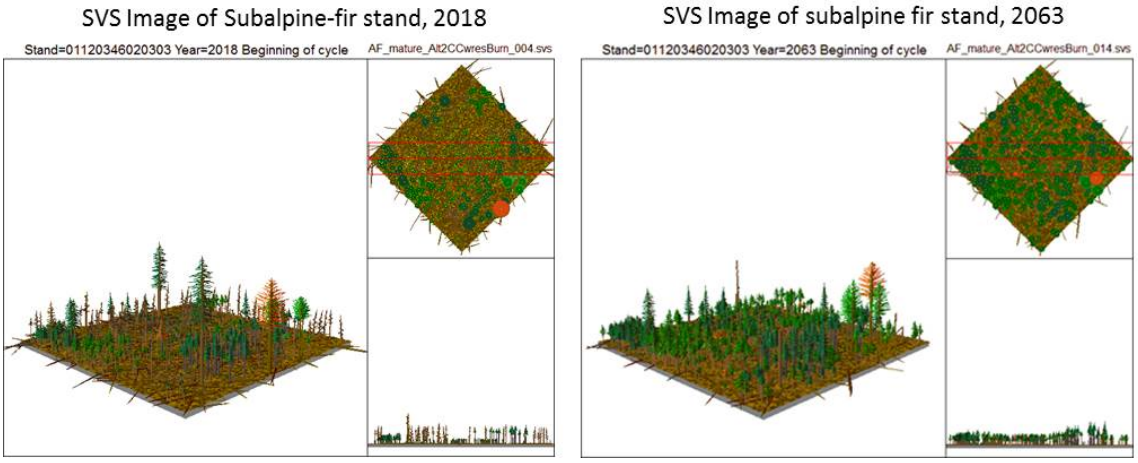


Figure 42. Example Images, Subalpine fir stand Alternative 2, Clearcut with Reserves, Jackpot Burn

Using the lodgepole chart, and considering trees less than 6 inches diameter as an "even-aged stand," the stand is brought below the lower limit of the stocking management zone in the short term (2018), but it grows to the midrange of the zone of management by 2063 indicating that is generally appropriately stocked for timber production. In reality the stand is also occupied by older remnants and may develop multi-aged character, and therefore contains more variability than was intended for stocking charts (which are based on even-aged stands).

Table 59. Composition/Structure, FVS, Subalpine fir Example, Alternative 2, Clearcut with Reserves, Jackpot

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6" dbh: 1037 >6" dbh: 58	37 ft^2/ac	2.5"	2-storied	35'	63% LP, 17% ES, 9% AF, 8% WB, 3% DF	2,352 ft^3/ac
2063 (50 yrs)	<6" dbh: 689 >6" dbh: 129	83 ft^2/ac	4.3"	2-storied	42'	54% LP, 21% ES, 11% AF, 10% WB, 4% DF	499 ft^3/ac

Through density management, removal of some of the remnant overstory and promotion of a lodgepole component, the volume and MAI becomes more than double that of the No Action by 2063. This is still at the low end of expected productivity for this habitat type, and volume production is not maximized due to the retention of remnant stand components and shade tolerant species components to provide other resource values such as habitat. However, MAI is an even-aged stand concept; this stand contains some remnants from multiple age classes so MAI is not perfectly suited for this stand.

Table 60. Volume, FVS, Subalpine fir dominated Stand Alternative 2, Clearcut with Reserves, Jackpot Burn

Timescale	Merchantable Volume / Acre	Mean Annual Increment
2018 (5 yrs)	1,676 MBF	3.6 ft^3/ac
2063 (50 yrs)	2,955 MBF	24 ft^3/ac

The resiliency of the stand relative to insects is improved compared related to WSB, which is maintained at a moderate rather than high hazard due to more open densities and a component of lodgepole pine which is not susceptible. MPB is also moderate over time due to mixed species composition.

Table 61. Insect Hazard, FVS, Subalpine fir Example Alternative 2, Clearcut with Reserves, Jackpot Burn

Timescale	MPB Hazard	WSB Hazard
2018 (5 yrs)	1 (low)	2 (mod)
2063 (50 yrs)	2 (mod)	2 (mod)

Treatment Type: Mixed Severity Rx Fire

In large burn units, forests similar to the subalpine fir example occur. Therefore, a mixed severity fire was also modeled in this stand to depict potential effects. No trees would be harvested and

removed. Stand density is greatly reduced, to a similar degree as the harvest scenario, but there are different remnants than what occurs after harvest. With fire, because precise management of the advance regeneration cohort does not occur, the stand is dominated by subalpine fir with less lodgepole and whitebark. Basal areas are lower because the site is more densely occupied by slower growing small trees rather than more openly spaced larger, faster growing trees as with the harvest option. Basal areas are far below the No Action alternative. The stand is generally 2-storied, made up of pre-fire remnants and regeneration. The downed wood volume is greatly reduced in the short term compared to the No Action and the harvest options, as some of the material on the ground is consumed by the fire.

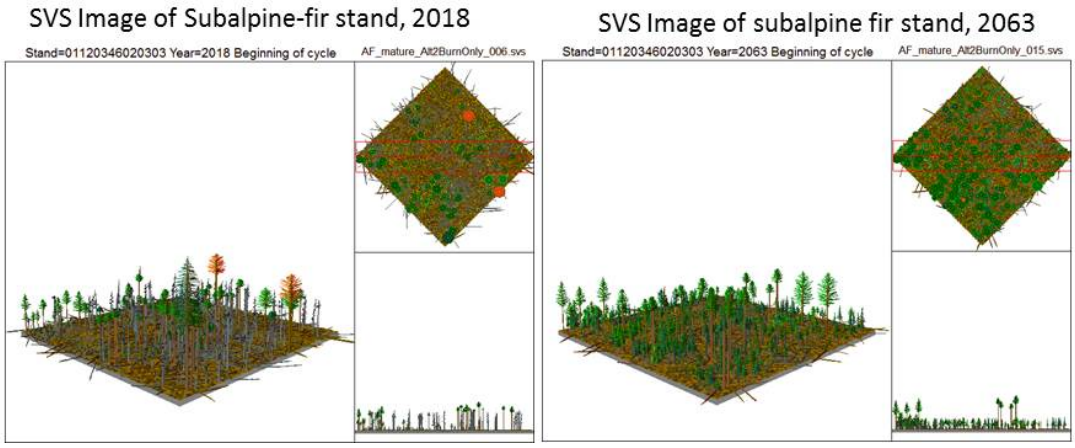


Figure 43. Example Images, Subalpine fir dominated Stand Alternative 2, Prescribed Fire Only

Using the lodgepole chart, and considering trees less than 6 inches diameter as an "even-aged stand," the stand is brought below the lower limit of the stocking management zone in the short term (2018), but it grows to the midrange of the zone of management by 2063, similar to the harvest scenario. In reality the stand is also occupied by older remnants and may develop multi-aged character, and therefore contains more variability than was intended for stocking charts (which are based on even-aged stands).

Table 62. Composition and Structure, FVS, Subalpine fir Stand Alternative 2, Prescribed Fire Only

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6" dbh: 755 >6" dbh: 41	23 ft^2/ac	2.3"	2-storied	40'	71% AF, 18% LP, 6% DF, 3% WB, 3% ES	1,866 ft^3/ac
2063 (50 yrs)	<6" dbh: 1032 >6" dbh: 75	54 ft^2/ac	3.0"	2-storied	47'	66% AF, 20% LP, 10% DF, 3% ES, 2% WB	447 ft^3/ac

The volume and MAI for the stand is higher than that of the No Action by 2063 due to the removal of stagnant remnants and establishment of regeneration, but lower than the harvest option because there is no additional density management. However, MAI is an even-aged stand concept; this stand contains some remnants from multiple age classes so MAI is not entirely appropriate for this site.

Table 63. Volume Attributes, FVS, Subalpine fir dominated Stand Alternative 2, Prescribed Fire Only

Timescale	Merchantable Volume / Acre	Mean Annual Increment
2018 (5 yrs)	1,542 MBF	2.8 ft^3/ac
2063 (5 yrs)	2,720 MBF	18.06 ft^3/ac

The resiliency of the stand relative to insects is improved compared to the No Action primarily related to WSB, which drops to low in the short term and then is maintained at a moderate rather than high hazard in the longer term due to more open densities. MPB is also moderate over time due to mixed species composition.

Table 64. Insect Hazard, FVS, Subalpine fir dominated Stand Alternative 2

Timescale	MPB Hazard	WSB Hazard
2018 (5 yrs)	2 (mod)	1 (low)
2063 (5 yrs)	2 (mod)	2 (mod)

Group 4: Previously harvested stands

All of these areas are proposed for pre-commercial thinning, which would establish more open densities, desired species compositions, and retain the healthiest trees. Lophodermella and western gall rust would be reduced in these areas by selecting against them during thinning. Individual tree growth and resiliency would be increased after treatment. These areas would be expected to produce larger, more open-grown trees by the time of stand culmination, and be potentially longer-lived than their more densely growing counterparts due to tree vigor and lower susceptibility to insects and disease.

In the FVS example stand, only one treatment type, pre-commercial thinning, was modeled, to a typical target trees per acre of 400. In this example, lodgepole pine and spruce were favored over subalpine fir. Pre-commercial thinning results in a more open stand, less than half that of the no-action alternative at both time scales. The structure remains single storied and new regeneration is inhibited because the site remains fully occupied. Individual trees grow larger, resulting in a larger QMD than with No Action. The downed wood is increased because the cut material remains onsite.

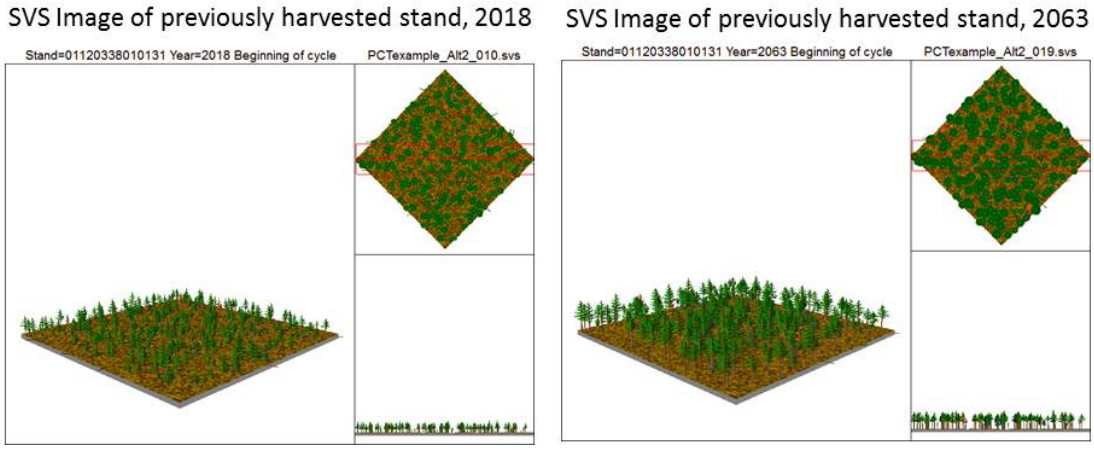


Figure 44. Example Images, Young Previously Harvested Stand, Alternative 2, Pre-commercial thin

Based on the FVS metrics below, the lodgepole pine stocking charts shows that this stand is brought down below the management zone of stocking in the short term (2018); and progresses to about the lower limit of the zone in 50 years at age 80. While overall stand volume production is therefore not maximized, an appropriate level is provided while also promoting individual tree growth and resiliency.

Table 65. Composition and Structure, FVS, Previously Harvested Stand, Alternative 2, Pre-commercial thin

Timescale	Live Trees per Acre	Live BA/ac	QMD	Structure	Top Height	Species Composition	Hard Downed Wood Volume
2018 (5 yrs)	<6" dbh: 390 >6" dbh: 0	20 ft^2/ac	3.1"	1-storied	19'	87% LP, 13% ES	163 ft^3/ac
2063 (50 yrs)	<6" dbh: 171 >6" dbh: 157	82 ft^2/ac	6.8"	1-storied	31'	85% LP, 15% ES	53 ft^3/ac

Although growth is occurring, *merchantable* volume does not exist in the short term because the trees are small. Volume builds by 2063. MAI after treatment is lower than with No Action in 50 years because of the removal of trees. It may take longer to culminate but it would also be more resilient and produce larger trees. At age 80 (in 50 years), the stand is approaching the lower end of expected productivity. This is a managed even-aged stand, and therefore the MAI concept is ideal to depict this site.

Table 66. Volume Attributes, FVS, Previously Harvested Stand, Alternative 2, Pre-commercial thin

Timescale	Merchantable Volume / Acre	Mean Annual Increment
2018 (5 yrs)	0 MBF	6 ft^3/ac
2063 (50 yrs)	2,483 MBF	19 ft^3/ac

Hazard in MPB is within the same categories as No Action – low in the short term due to small tree size, and moderate in the long term due to lodgepole composition. The lower stand density would be expected to result in slightly lower hazard within the moderate category, however.

Table 67. Insect Hazard, FVS, Young Previously Harvested Stand, Alternative 2, Pre-commercial thin

Timescale	MPB Hazard
2018 (5 yrs)	1 (low)
2063 (50 yrs)	2 (mod)

Irreversible and Irretrievable Commitments

The primary irreversible effect of alternative 2 is that trees would be cut and removed from the landscape; the loss of these specific trees in the ecosystem could not be undone. However, from a stand perspective these trees would be replaced by new seedlings or, in the case of thinning, residual trees would remain and generally increase in health and vigor. Removal of dead and dying trees would reduce the amount of downed woody debris available on treated areas; this too would be irreversible.

Cumulative Effects

Please refer to Effects Common to All Action Alternatives.

Alternative 3

Direct and Indirect Effects

Alternative 3 proposes fewer vegetation treatments than alternative 2, as shown in the table below. Please refer to the discussion under alternative 2 for general effects. Within treated areas, alternative 3 would have similar effects. The difference between the alternatives is the proportion of the landscape treated. Alternative 3 would treat about 18 percent of the Project Area. Similarly, the effects described for each forest type are similar under alternative 2, but would occur on fewer areas. The example FVS modeling would be the same as depicted for alternative 2 for the acres impacted in alternative 3.

Table 68. Proposed Vegetation Treatments, Alternative 3

Treatment Type	Prescription	Acres
Intermediate Harvest 434 Acres	Improvement Cut, Slashing, Jackpot Burn	434
Precommercial thinning 1,289 Acres	Precommercial Thin	1,261
	Pre-commercial Thin, Underburn	28
Prescribed Fire 606 Acres	Slashing, Broadcast Burn	595
	Slashing, Handpiling, Burning Piles	11
Regeneration Harvest 1,856 Acres	2-Aged Seedtree with Reserves	16
	2-aged Seedtree with Reserves, Broadcast Burn	29
	2-Aged Shelterwood with Reserves, Site Prep Burn	132
	Clearcut with Leave Trees	
	Clearcut with Leave Trees, Jackpot Burn	288
	Clearcut with Leave Trees, Site Prep Burn	547
	Clearcut with Reserves, Site Prep Burn	838
		6
Grand Total		4,185

Irreversible and Irretrievable Commitments

Please refer to the analysis for alternative 2. The irreversible and irretrievable commitments with alternative 3 would be the same, only proportionate to the lesser treatment areas being affected.

Cumulative Effects

Please refer to Effects Common to All Action Alternatives.

Conclusions

The purpose and need translates in a general sense to providing multiple ecosystem services related to sustainable forest cover. This suite of values would best be provided by a landscape that is ***resilient*** with respect to natural disturbance regimes. To analyze how each alternative moves the

landscape from the existing to desired condition indicators and measures are used. These are displayed for the short term (within 5 years) and where applicable, long term (50 years). Encouraging a mosaic of reforestation and downed-fuel conditions would increase the potential that natural wildfires would burn at sizes and intensities more consistent with historic regimes. This would help ensure that a full range of ecological and social values are provided through time. Further, timber utilization and productivity could be enhanced by harvesting dead and dying trees and rapidly establishing new seedlings of seral species. Finally, thinning some of the stands established after past harvest could promote resilience, individual tree growth, and density diversity of these younger forests that provide the primary green forests on a regenerating landscape. Untreated areas in all alternatives would remain unchanged in the short term, and generally over time develop into denser forests with higher components of shade tolerant species. Treated and untreated areas together provide a mix of forest and habitat conditions.

Table 69. Forested Vegetation Indicators and Measures

Indicator	Measure	Alt 1	Alt 2	Alt 3
1: Regeneration & Timber Production	1a. Suitable Acres killed by MPB with regeneration assured / % of Total Suitable Area infested by MPB in the Project Area.	0 0%	3,115 19%	1,730 10%
	1b. Suitable Acres treated with commercial harvest / % of Total Suitable Area in the Project Area.	0 0%	3,548 20%	2,164 12%
	1c. Acres of past harvest treated (pre-commercial thin) / % of total areas of past harvest in the Project Area	0 0%	1,786 47%	1,289 34%
	1d. FVS Productivity – MAI in 2063 in Example Stands (ft^3/ac/yr)			
	LP – Regeneration Harvest	13.32	15.88	15.88
	Pre-commercial Thin	32.9	19.0	19.0
	DF – Intermediate Harvest	23.6	11.7	11.7
	AF- Regeneration Harvest	10.3	24.0	24.0
2: Resilience & Diversity	2a. % Project Area Treated by Type, with Qualitative Discussion of impacts to Landscape Resiliency (Patch and Pattern)			
	Regeneration	0%	15%	8%
	Intermediate	0%	2%	2%
	Pre-commercial Thin	0%	8%	5%
	Rx Fire	0%	4%	3%
	Cumulative (w/ past act)	16%	37%	29%
	2b. DFB Hazard / WSB Hazard in Example DF Stand (FVS) By Treatment Type			
	Intermediate, Year 5	3 / 3	2 / 1	2 / 1
	Intermediate, Year 50	3 / 3	2 / 2	2 / 2
	Rx Fire Only, Year 5	3 / 3	3 / 3	3 / 3
	Rx Fire Only, Year 50	3 / 3	3 / 3	3 / 3
	2c. MPB Hazard / WSB in Example AF Stand (FVS) By Treatment Type			
	Regeneration, Year 5	2 / 2	1 / 2	1 / 2
	Regeneration, Year 50	3 / 3	2 / 2	2 / 2
	Rx Fire Only, Year 5	2 / 2	2 / 1	2 / 1
	Rx Fire Only, Year 50	3 / 3	2 / 2	2 / 2

Indicator	Measure	Alt 1	Alt 2	Alt 3
	2d. Total ft^3/ac hard downed woody material			
	LP: Regen, Year 5	2,429	1,236	1,236
	LP: Regen, Year 50	488	161	161
	LP: Rx Burn Only Year 5	2,429	2,388	2,388
	LP: Rx Burn Only, Year 50	488	369	369
	DF: Intermediate Year 5	1,332	996	996
	DF: Intermediate Year 50	422	277	277
	DF: Rx Fire Only Year 5	1,332	1,568	1,568
	DF: Rx Fire Only Year 50	422	377	377
	AF: Regen Year Year 5	2,367	2,352	2,352
	AF: Regen Year 50	550	499	499
	AF: Rx Fire Only Year 5	2,367	1,866	1,866
	AF: Regen Year 50	550	447	447
	Precom. Thin, Year 5	20	163	163
	Precom Thin, Year 50	110	53	53
	LP: Regen	39% LP, 24% DF, 32% AF, 5% ES. **34** ft^2/ac.	87% LP, 13% DF. **47** ft^2/ac.	87% LP, 13% DF. **47** ft^2/ac.
	LP: Rx Burn Only	89% DF, 9% LP, 2% Aspen. **176** ft^2/ac.	39% AF, 33% LP, 27% DF, 1% ES. **43** ft^2/ac.	39% AF, 33% LP, 27% DF, 1% ES. **43** ft^2/ac.
	DF: Intermediate	39% LP, 24% DF, 32% AF, 5% ES. **34** ft^2/ac.	85% DF, 13% LP, 2% Aspen. **84** ft^2/ac.	85% DF, 13% LP, 2% Aspen. **84** ft^2/ac.

Indicator	Measure	Alt 1	Alt 2	Alt 3
	2e. Species Composition and BA/ac in Example Stands by Treatment Type in 2063			
	DF: Rx Fire Only	89% DF, 9% LP, 2% Aspen. **176** ft^2/ac.	90% DF, 8% LP, 2% Aspen. **155** ft^2/ac.	90% DF, 8% LP, 2% Aspen. **155** ft^2/ac.
	AF: Regen Year	73% AF, 14% LP, 8% ES, 3% WB, 2% DF. **129** ft^2/ac.	54% LP, 21% ES, 11% AF, 10% WB, 4% DF. **83** ft^2/ac.	54% LP, 21% ES, 11% AF, 10% WB, 4% DF. **83** ft^2/ac.
	AF: Rx Fire Only	73% AF, 14% LP, 8% ES, 3% WB, 2% DF. **129** ft^2/ac	66% AF, 20% LP, 10% DF, 3% ES, 2% WB. **54** ft^2/ac.	66% AF, 20% LP, 10% DF, 3% ES, 2% WB. 54 ft2/ac.
	Precom. Thin	80% LP, 10% ES, 10% AF. **207** ft^2/ac.	85% LP, 15% ES. **82** ft^2/ac.	85% LP, 15% ES.**82** ft^2/ac.

- ***Indicator 1a*** shows the area where post-MPB regeneration would be assured in management areas designated for timber production. Reforestation would be assured within 5 years of harvest. The impact of MPB in suitable timber areas is estimated using the infestation at the peak of the outbreak in 2009, when 22,152 acres were infested in the Project Area (94 percent), 16,780 acres (71 percent) of which were in the suitable base. Mortality was substantial in all stands proposed for harvest. Alternative 1 does not assure regeneration; although regeneration should eventually occur, it may take longer and/or be dominated by slow growing shade tolerant species. Action alternatives assure rapid regeneration and future timber production on a proportion of suitable acres impacted by MPB, alternative 2 to the greatest extent (19 percent) compared to alternative 3 (10 percent).
- ***Indicator 1b*** displays the suitable timber area that would be treated with commercial harvest, thereby recovering economic value of MPB-killed trees. Because the MPB impacted even Douglas-fir stands to some extent due to components of pine, some dead/dying trees would be utilized in all areas proposed for harvest. A total of 76 percent of the Project Area, 17,909 acres, is considered suitable. Alternative 1 would not conduct commercial harvest or utilize dead/dying trees. Action alternatives would conduct harvest and recover economic value on suitable acres, to the greatest extent alternative 2 (20 percent of the Project Area) compared to alternative 3 (12 percent).
- ***Indicator 1c*** displays the acres of past harvest that would be pre-commercially thinned to improve individual tree growth and species composition, and the proportion of those areas to the total acreage previously harvested in the Project Area. Past regeneration harvest has been recorded on 3,804 acres. Alternative 1 would treat none of these areas. The action alternatives would treat a proportion of these stands, to the greatest extent alternative 2 (47 percent) as compared to alternative 3 (34 percent). Density, species composition, and growth would be altered as shown in 1d, 2d, and 2e.
- ***Indicator 1d*** compares timber productivity in example stands based on FVS modeling. The No Action is compared to action alternatives as a single value because the same prescription would be applied at the stand level; the difference in the action alternatives is the amount of area affected (*Indicator 2a)*. The examples provide a basis for relative trends, and do not statistically represent all stands. In dead and dying lodgepole stands, with the action alternatives the volume production in 50 years is slightly higher than No Action due to rapid establishment and higher composition of lodgepole pine. Conversely, in the previously harvested stand example, volume production is actually lower with the action alternatives in the 50-year time frame because thinning has enhanced individual tree growth but lowered density and site occupancy. However, growth is still increasing and the stand would be expected to be more resilient, and produce more volume and larger trees at culmination than with No Action. The intermediate treatment in the Douglas-fir example stand reduces growth substantially, because this stand is old and has already culminated in growth. If productivity were paramount, it is time to regenerate this stand; however, because mature Douglas-fir structures are rare, it is valuable to extend the rotation in these types to provide habitat in the short to mid-term. Reducing density increases resiliency, but does not enhance volume production. Finally, in the subalpine fir stand, volume growth is nearly doubled in 50 years with the action alternatives because the stand contains more fast-growing seral lodgepole pine and less slow-growing subalpine fir, which dominates in the No Action.
- ***Indicator 2a***: This indicator displays the percentage of the Project Area that would be affected by treatment that would change forest structure and composition. Alternative 2 treats more area than alternative 3. The bulk of proposed treatments are regeneration harvests which would occur in stands killed by MPB; there is no impact to age class, but rather to the qualities of regeneration

and amount of coarse woody debris. Variable retention concepts to provide remnant components would be employed, but there would be fewer remnants than with No Action. Intermediate harvests and pre-commercial thinning lower density and alter species composition. Prescribed fire would have a wide variety of effects. Regardless of alternative, age class diversity potential in the short term is low due to existing mortality. Still, treatments would increase heterogeneity by reducing the amount of downed fuels over time (*Indicator 2d)*; establishing regeneration that differs from untreated forests; and creating diversity in density, composition, and vigor in green stands. The action alternatives add to the impact of previous harvest that occurred on 16 percent of the Project Area. For the total impact, pre-commercial thinning acres are excluded because these areas overlap with the past harvest. Cumulatively, alternative 2 would result in treatment on **37 percent** of the Project Area; alternative 3 would result in **29 percent**. It is not possible to know exactly how well the alternatives emulate natural fire. However, promoting a mosaic of patches similar to small intervening disturbances, while leaving a matrix of untreated areas, would introduce a level of diversity not currently present which may contribute to enhanced resiliency.

- ***Indicator 2b:*** This indicator provides compares the FVS modeled hazard ratings for DFB and WSB in the Douglas-fir example stand. Both Intermediate Harvest and Prescribed Fire Only treatments are modeled to represent the action alternatives. The intermediate harvest scenario that would occur with the action alternatives lowers hazard to both DFB and WSB by reducing density and small tree layering. Hazard remains moderate over time due to a composition of Douglas-fir. Prescribed fire achieves other stand objectives, but due to less of a stand density reduction does not materially alter DFB or WSB hazard compared to the No Action. With No Action, hazard to DFB and WSB is high and would contribute to low stand resiliency, reducing the likelihood that late-seral stands; such as this would persist on the landscape.
- ***Indicator 2c:*** This indicator compares the FVS modeled hazard ratings for MPB and WSB in the example subalpine fir stand. Both Regeneration Harvest and Prescribed Fire Only treatments are modeled to represent the action alternatives. With the action alternatives, both treatment types reduce the hazard to MPB and WSB by promoting lower stand densities and less layering of small shade tolerant trees. With No Action, hazard to these insects remains high. Hazard ratings for MPB in lodgepole and previously harvested stands were also compared, but did not show any difference between alternatives so were not included as an Indicator. For these areas, hazard is low in the short term due to small tree size, and moderate in the long term due to a sustained lodgepole pine component regardless of alternative.
- ***Indicator 2d:*** To provide a link with potential fire effects due to downed woody debris, the expected loading of “hard” debris was compared between alternatives for all forest types, as modeled by FVS. The results vary by forest and treatment type, but in all cases are different from the No Action. In lodgepole stands, regeneration harvest greatly reduces surface fuels because dead trees are removed which would fall to the ground with No Action. Prescribed burning in these areas only slightly reduces fuels compared to No Action. In the mature Douglas-fir example, harvesting reduces the buildup of downed fuels because of the removal of a lodgepole component. With fire in this stand, downed fuels are increased compared to No Action because some trees are killed by fire. In the subalpine fir stand, harvest only minimally reduces fuels because abundant fuels are already on the ground. Prescribed fire reduces the fuel loading more by consuming some of this material. Finally, in previously harvested stands, fuels are actually increased in the short term because the small trees cut would generally be left onsite. However, in the long term fuels are lower compared to No Action because this material decomposes and additional dead trees are not added due to enhanced stand resilience.

- ***Indicator 2e:*** This indicator compares the species composition and basal area per acre of example stands in 50 years modeled in FVS as a basis to compare forest diversity and resiliency. In lodgepole pine stands, both regeneration harvests and prescribed fire only increase future basal areas by providing growing space for individual trees. Regeneration harvest greatly increases the species composition of lodgepole pine as compared to No Action. In Douglas-fir forests, basal areas are lower with treatments, to the greatest extent with harvest, providing for less susceptibility to DFB, but the species composition is not materially altered. In subalpine fir forests, treatments lower future basal areas and increase the composition of lodgepole and whitebark pine over the slower growing shade tolerant species. In the previously harvested stand example, density is lowered and species composition shifted to favor lodgepole pine and spruce over subalpine fir. Because treatments result in different densities and/or species compositions than the No Action, the landscape mosaic of forest conditions is generally increased.

Consistency with Regulatory Framework

National Forest Management Act (NFMA)

Consistency with NFMA with respect to the action alternatives is assessed as follows:

- Timber would only be harvested from National Forest Land where there is assurance that such lands can be adequately restocked within five years after harvest. All sites proposed for regeneration treatment occur on productive habitat types that are biologically suitable for timber production, on topography suited for harvesting without undue soil damage. The technology exists for reforestation. Monitoring of adjacent stands previously harvested in the area show a high probability of adequate desirable natural regeneration. In the event of a failure, seed and capability exists to plant these sites successfully. Of the over 15,000 acres of regeneration harvesting recorded in FACTS on the HNF from 1976 to 2009, over 93 percent are currently certified as re-stocked.
- Potential effects on residual trees and adjacent stands have been analyzed in this report.
- All stands proposed for harvest are biologically suitable for timber production and are designated as T-1 in the Forest Plan. Limited areas are not designated as suitable for timber in the Forest Plan; emphases such as wildlife habitat apply. These areas are not classified as unsuitable based on other resource objectives in the Forest Plan, not because the sites have limited growing capability. In these areas the harvesting is used to achieve other resource objectives, primarily related to providing diverse habitats, watershed values, and limiting potential severe fire behavior. The proposed harvesting is primarily considered salvage because most of the trees that would be removed are dead lodgepole pine.
- With the action alternatives, a determination has been made that even-aged harvesting systems are appropriate to meet the objectives and requirements of the Forest Plan. Regeneration harvesting utilizing clearcutting has been determined to be the optimum method in many areas due to the existing condition and forest type. The stands to be harvested with regeneration systems are dominated by dead lodgepole pine recently killed by MPB. There are no live trees to offer silvicultural system options with regard to residual trees. Further, lodgepole pine ecology dictates that even-aged management best mimics the natural stand replacing regimes of this species.
- The most appropriate vegetative manipulation and stocking levels for reforestation would be determined by a site-specific silvicultural prescription prepared by a certified USFS silviculturist.

- The proposed regeneration harvesting has been considered relative to maximum size limits for areas to be cut per FSM 2400 and 2470.3, as discussed below. However, “such limits shall not apply to the size of areas harvested as a result of natural catastrophic conditions such as fire, insect and disease attack, or windstorm...” (16 U.S.C. 1604 (g)(3)(F). The openings that would be created with alternative 2 occur in stands that have sustained catastrophic insect attacks and therefore the opening size limits do not apply.

Openings over 40 acres - (FSM 2470; Regional Forester’s Policy)

The size of harvest openings created by even-aged silvicultural systems will normally be 40 acres or less, and the creation of larger openings requires 60-day public review and Regional Forester approval. However, where natural catastrophic events such as fire, windstorms, or insect attacks have occurred, 40 acres may be exceeded without 60-day public review and Regional Forester approval, provided the public is notified and the environmental analysis supports the decision (USDA 2002). Many proposed treatments in the action alternatives would exceed 40 acres due to extensive MPB-caused mortality and a desired to emulate natural disturbance patch sizes, as supported by this analysis. The public is hereby notified of these areas as shown in the table and figures below. In these units and contiguous groups, prescriptions would include varying amounts of tree retention in surviving components, potentially buffering openings, leaving individuals and clumps throughout units, and including patches of inoperable areas. However, because the overstory is largely dead and reforestation is required, these are considered openings.

Table 70. Openings over 40 Acres, Action Alternatives

Alternative	Units & Adjacent Units of Regeneration Harvest	Total Acres
2	11 + 11s	113
	19	47
	22	65
	34 + 36 + 37	478
	56 + 59 + 60 + 61 + 63	374
	66	78
	73 + 75 + 76 + 77 + 80 + 81 + 84 + 85 + 87 + 88 + 89 + 93	600
	91	94
	101	78
	104 + 105 + 106 + 111 + 112 + 113	294
	116	76
	117	95
	143	70
	145	67
	152	115
	158 + 160 + 165 + 167	560
3	11 + 11s	113
	022a	48
	034a	203
	063a	70
	066a	63
	077 + 084a + 085a + 089a	178
	087 + 088 + 089c + 093	210
	091	94
	101a	71
	105	62
	143a	45
	145	55
	152	115
	160 + 165a	127

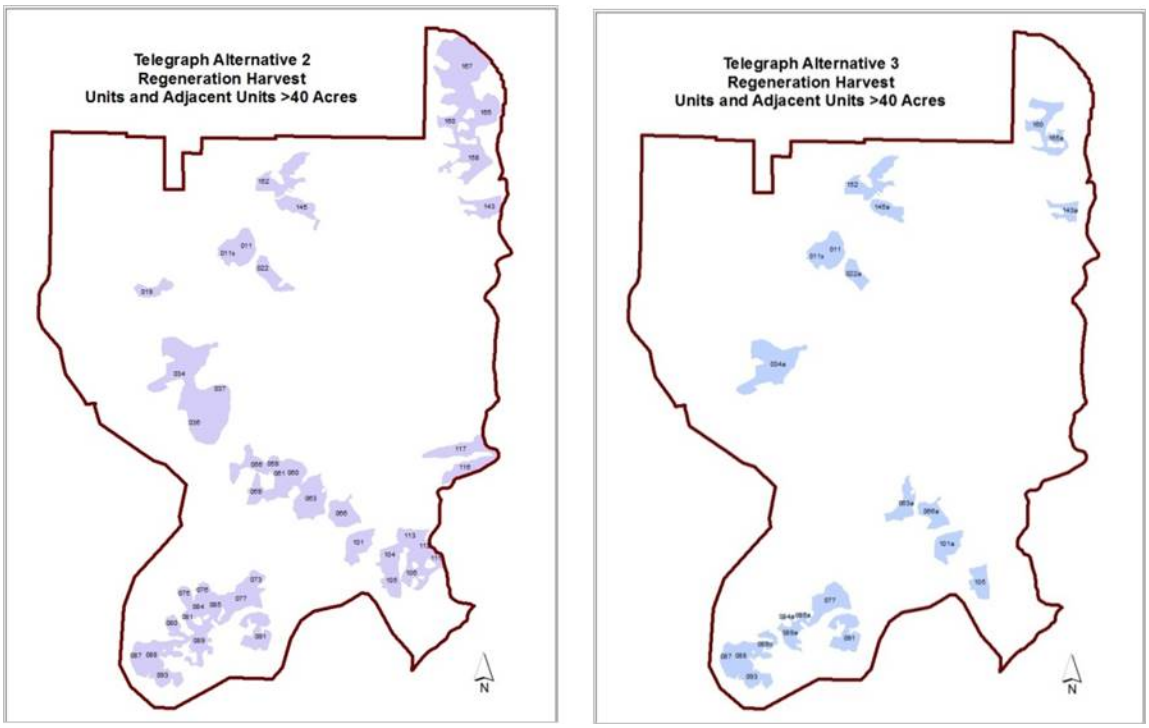


Figure 45. Openings over 40 Acres, Action Alternatives

The Helena National Forest Plan

The action alternatives are consistent with applicable *forestwide timber objectives* because productivity is enhanced on suitable land through utilization of economic recovery, establishment of vigorous regeneration, and promotion of individual tree growth; suitable acres would be managed with stocking control techniques; the project is coordinated with other resources through an interdisciplinary process; and treatments result in a sustained timber yield. The no-action alternative does not have these effects.

The action alternatives are consistent with applicable *forestwide timber standards* because silvicultural exams have occurred and prescriptions would be completed before any treatment takes place; clearcutting would only be used where it is the optimum method; the creation of openings with even-aged systems greater than 40 acres quality for an exception to the Regional Forester approval process due to widespread insect-caused mortality; silvicultural systems would improve species diversity, growth, and vigor for stands and increase the size diversity and class diversity between stands; cutting units would be located to break up contiguous natural fuel; prescribed burning would be used in suitable areas where it can maintain or enhance timber production; and burning would be coordinated with the silvicultural prescription. Because no treatment would occur with alternative 1, these standards do not apply to the no-action alternative.

The alternatives are consistent with the direction for management areas as follows:

- **T-1**: Most of the proposed treatments would occur in this MA. The action alternatives are consistent by providing healthy timber stands through establishment of regeneration and harvesting stands that have culminated in growth. Prescribed fire in these areas would not preclude future timber production. Alternative 1 does not necessarily preclude future timber production but would not improve stand resilience, nor would it harvest stands that have culminated.

- **M-1**: The action alternatives are consistent because timber harvest would occur where access exists and would consist of salvage of dead and dying trees. Prescribed burning is consistent as well. Only a minimal amount of treatment would occur in this MA. Alternative 1 would also be consistent because no treatment would occur.
- **W-1**: The action alternatives would be consistent because in the limited areas timber would be harvested only where it maintains or enhance wildlife habitat values. Only a minimal amount of harvest treatment would occur in this MA. Prescribed burning would be consistent because it would create diverse habitats. Alternative 1 would also be consistent.
- **L-1; T-5; P-3; Other Lands**: Treatments would not occur in these areas. All alternatives are consistent.

Fire and Fuels

Introduction

The proposed Telegraph Vegetation Project would help meet the Forest's Land and Resource Management Plan (HNF LRMP) goals and objectives to ensure diverse and sustainable forest stands and habitat in the future, improve conditions for fire suppression effectiveness as well as firefighter and public safety in the area in the event of a wildfire and to maintain or improve watershed values. Reducing current and expected fuel loadings within treatment units will result in modifying the existing fuel profile enhancing fire suppression capabilities as well as firefighter and public safety in the area. Another aspect of this project is the strategically placed prescribed fire units designed to modify fire behavior that would complement and assist our predetermined wildfire response strategies and tactics along the Continental Divide. The Tenmile watershed located just east of the project area provides a crucial water supply to the Helena valley. Treatment objectives for these units are to reduce the likelihood of a fire starting in the Telegraph project area moving east over the Continental Divide and into the Upper Tenmile watershed. This section provides an overview of the fire and fuels resource, discussing the existing condition, desired condition and provides an overview of the proposed fuel treatments and effects of the treatments by alternative

Assumptions

Fire Modeling/Fire Behavior Fuel Models - Based on biophysical setting, cover type and structural stage category from the Forested Vegetation Report, fire behavior fuel models were assigned to the project area. Standard fire behavior fuel models (Scott, Burgan 2005), like vegetation, are not static in nature. The assumptions underlying the surface fire spread model assume homogeneity in what is naturally a dynamic system. It is therefore crucial to combine model outputs with professional judgment to ensure the results are valid and believable (Williams and Rothermel 1992). All model outputs were validated by fire management personnel on the HNF and at the Rocky Mountain Research Station/Fire Science Lab (RMRS). All fuel models have been predicted based on best available existing vegetation, expected fire behavior, and professional expertise. Ground verification and professional judgment were used to determine which Fire Behavior Fuel Model (FBFM) best represented the majority of the proposed treatment units for each alternative. Detailed fuel model discussion including representative photos are presented in the affected environment section, fuel models with less than 50 acres in project area were not described in detail. Other fuel models, not described in this report, are present at the project level but are not present and/or have very low (less than 10 percent) representation in treatment units.

The following assumptions are essential when applying the surface fire spread model:

- The fire is free-burning. Hence, suppression actions are not accounted for and the ignition origin is not influencing the fire.
- Fine fuels less than 1 inch in diameter are more important to the fire's spread than larger fuels.
- Fire is predicted at the flaming front (direction of maximum spread). The surface area to volume ratio of the fuels determines the residence time of the flaming front.
- As stated above, fuels are continuous and homogeneous. The basic spread model is for a surface fire burning within surface fuels. Smoldering and long-range spotting are not considered as they are outside the scope of the surface fire spread model. The fire spread model can predict torching, crowning, or spotting if combined with other models.
- Weather is uniform and consistent.
- Topography is uniform.
- The model has been designed for peak fire season. July, August and September are the peak fire months for the HNF as the majority of acres have burned in these two months.

Application of prescribed fire in the future will be necessary to maintain vegetation conditions and retain fire as a process in fire-adapted ecosystems. Both maintenance of treated units and treatment of new units are important to optimize treatment patterns over the landscape (Finney et al. 2005; Finney et al. 2006; Reinhardt et al. 2008; Omi and Martinson 2004). Treatments are effective for about ten years as related to potential fire behavior (Finney et al. 2006b; Omi et al. 2007) and a rate of twenty percent treatment per decade has been found most effective (Finney et al. 2006b). Units proposed for prescribed burning only could also be proposed for maintenance burning in the future. Other units may also be proposed for prescribed fire in the future depending on stand conditions at that time. This may result in the need to perform maintenance treatments (as stated above) to maintain low surface fuel loading, post-fire monitoring will need to be performed to determine this need. Maintenance burning is not a consideration in this decision.

GIS/Mapping – The analysis associated with this project used Helena National Forest (HNF) existing Vegetation Mapping Program (VMap). The modeled *VMap* is used to depict current vegetation conditions because it incorporates the effects of the MPB outbreak.

Information Used

Inputs for fire behavior analyses were derived from a variety of sources including HNF VMap-, FIA grid intensification data, published literature, calibration analyses, and site visits. Refer to the vegetation introduction for more information regarding VMap and FIA inventory data.

- HNF VMap – Elevation, aspect, and slope were derived from a digital elevation model and were coupled with VMap data. VMap provides species dominance types and canopy cover data important for classifying fire behavior fuel models.
- FireFamilyPlus – The weather, wind, and fuel moisture were prepared in FireFamilyPlus using the Lincoln Remote Automated Weather Station (RAWS) data for August of 2003. Fuel moisture data was verified by fuel moistures gathered from established local sites and uploaded into National Fuel Moisture Database.
- Forest Inventory Analysis (FIA) – Statistically valid data is housed in the FSVeg database. Data includes landscape-level FIA plots and grid intensification plots. The Summary Database is a summary dataset of plots which provides statistically valid estimates. FSVeg also houses stand

examination data. These are statistical plot surveys taken at the stand-level, measuring stand characteristics such as species, heights, diameters, physical defects and insect and disease activity of trees. These data are used to statistically summarize vegetation conditions at appropriate scales. The data is also used for FVS modeling and provides surface fuel loading data and canopy data important for fire behavior analyses. Plot data and photos were utilized for checking the accuracy of fire behavior fuel models.

This report is based on results from model runs executed with BehavePlus 5.0.5 and the First Order Fire Effects Model (FOFEM) program. Personal knowledge and peer reviewed reports of fire behavior and characteristics in MPB killed timber were also used in determining fire effects. Fuel Models, as described in existing condition and alternatives, were determined by onsite evaluations of the project area and units and consultation with the Rocky Mountain Research Station/Fire Science Lab (RMRS). Fuel model and fuel model proportions are presented in this report and represent conditions within the project area as close as possible. Fuel loading was factored to determine which fuel model from the "Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model" best mimicked the expected fire behavior.

Telegraph Project Fire/Fuels NFMA Background Report – The NFMA Fire/Fuels detailed Report for the Telegraph Project (2009) summarized data and vegetation analyzed for the fire/fuels resource. The report also provided guidance on modeling and analysis approaches.

Scientific Accuracy/Methodology

This analysis is based on the best available science at the time of report completion and acknowledges that there may be incomplete and unavailable information. The spatial and temporal bounds of this analysis are designed to capture the existing condition and effects of action alternatives. Project area effects analysis focuses primarily on the treatment units. Temporally, the existing condition utilizes the most recent information available, and analyzes the effects over short (present to 10 years) and long term (11+ years) durations.

All tables presented in this section have acres and proportions rounded to the nearest whole number. In cases where rounding resulted in the outcome being slightly less or more than the actual total an acre(s) or percent was added to or taken away from the largest value. Fire behavior outputs have been rounded to the nearest 1/10th. Raw data are available in the project file.

Refer to the Forested Vegetation Report for additional information used, methodologies and scientific accuracies as it relates to VMAP, FIA, FS Veg and FRCC.

Refer to Air Quality Report for smoke emissions and Soils Report for burn severity and effects to soils.

This section outlines fuel model selection methods and a brief overview of inputs used in BehavePlus and FOFEM. Fire behavior analyses were conducted using weather and fuel moisture data from 2003 when multiple large fire growth days occurred (Studebaker's California Interagency Incident Management Team. 2003). The conditions modeled represent weather and fuel moisture under which wildfires exhibited large growth within and adjacent to the Divide Landscape in 2003 (Snow-Talon and Moose/Wasson Fire).The intention of the fire behavior analyses is to provide an evaluation of the potential fire behavior and fire effects if a wildfire occurs.

Live woody, live herbaceous, and 1-, 10-, and 100-hr timelag fuels (all dead fuels less than 3 inches in diameter, refer to glossary) represent fuel moistures during mid-July through August of 2003 when the Snow-Talon and Moose/Wasson fires started. These values came from the Lincoln RAWS (Remote Automated Weather Station) located at the Lincoln Ranger Station. The fuel moisture

values during late-September of 2009 when the MacDonald Pass Fire and late-June of 2012 when the Corral Fire occurred were examined as well, but these fires occurred under more moderate conditions with higher fuel moisture values.

It is impossible to forecast the fire suppression strategy that will be utilized when the next wildfire occurs in this landscape. Fire management options are outlined in Appendix R of the Forest Plan (1986) and offer a wide array of management possibilities. Therefore, an underlying intention of this analysis is to explore if post-implementation vegetation and fuels conditions increase fire management options and firefighter safety (appropriate management response) by modifying potential fire behavior and fire effects in line with the rationale set forth by Reinhardt et al. (2008).

Fuel Models

A fuel model is a set of fuelbed inputs needed by a particular fire behavior or fire effects model. (Scott and Burgan, 2005) "Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model" was used to best mimic the expected fire behavior within the treatment units for all alternatives. Mathematical surface fire behavior and fire effects models and prediction systems are driven in part by fuelbed inputs such as load, bulk density, fuel particle size, heat content, and moisture of extinction. To facilitate use in models and systems, fuelbed inputs have been formulated into fuel models. All fuel models have been predicted based on existing vegetation, expected fire behavior, and professional expertise.

BehavePlus

BehavePlus 5.0.5 (Andrews and Bevins 2008) was used for unit fire behavior predictions. Expected fire behavior can be compared between the alternatives and existing condition. The assumptions underlying the fire spread model assume homogeneity in what is naturally a dynamic system. It is therefore crucial to combine model outputs with professional judgment to ensure the results are valid and believable (Williams and Rothermel 1992). All model outputs were validated by the Helena Ranger District fire management personnel. Model inputs include fuel loadings, fuel moisture, foliar moisture, winds (20-ft windspeed plus wind adjustment factor), air temperature, slope, and vegetation information (canopy base height and canopy bulk density). Outputs include surface rate of spread, flame length, heat per unit area (Btu/ft2), and fireline intensity.

Fire Terminology

Fire frequency is defined as the average number of years between fires or the mean fire interval (Baker and Ehle 2001, Hann and Bunnell 2001)

Fire behavior includes many elements important to describing wildland fire, including: flame lengths, fireline intensity, rate of spread, type of fire, and fire effects including fire severity and burn severity. Flame lengths refer to the distance between the tip of the flame and the midpoint of the flame depth at the base of the flame (generally the ground surface) and serve as an indicator of fire intensity. Fireline intensity is a quantitative measure that describes the rate of heat release per unit time per unit length of the linear fire front (Agee 1993, p. 15; Davis and Holbeck 2001). Rate of spread refers to the speed of the moving fire front. As fuel moistures approach the moisture of extinction for that fire behavior fuel model, fire spread is affected as these fuels do not burn as readily (Anderson 1982). While rate of spread is a common term in fire management, rate of spread will be covered qualitatively as it is truly only applicable to fire suppression (Reinhardt et al. 2008).

Surface fire is a fire confined to surface fuels with minimal overstory mortality, edge, and patch size (Agee 1998; Arno et al. 2000). Mixed severity regimes are essentially a combination of fire intensities ranging from low intensity surface fire, group torching, and some amount of stand-replacing fire that create patches of intermediate size and an abundant amount of edge (Agee 1998;

Arno et al. 2000). Torching, or passive crown fire, is the specified fire type output from Behave that best represents the mixed severity fire category and often occurs with low canopy base height and sparse crown having low canopy bulk density (Van Wagner 1977). A conditional crown fire can burn as a crown fire in a stand if it enters as a crown fire from an adjacent stand. These stands often have suitable canopy bulk density to carry crown fire but the canopy base height is high enough that a surface fire cannot easily transition to a crown fire within that stand.

A crown fire or stand-replacing fire is a moderate to high intensity fire with nearly complete overstory mortality creating large patch sizes with an intermediate amount of edge (Agee 1998; Arno et al. 2000). Active crown fire often requires surface fuels that burn above a critical intensity and flame length, moderate to high canopy bulk density with continuous crown fuels, and average to below average foliar moisture content (Van Wagner 1977). Crown fire initiation is a complex phenomenon due to multiple interacting factors: topography, relative humidity, fuel moisture, atmospheric stability, surface fire intensity, length of the fire front, frontal passages, and vegetation structure including the presence of ladder fuels (Rothermel 1991). Cessation of a crown fire run is often linked to a significant change in weather such as decreased wind speed or increased relative humidity (Rothermel 1991).

Fire effects include such factors as vegetation mortality, scorch height, canopy consumption, burn mosaic, burn severity, and fire severity. Scorch height is the maximum vertical height at which lethal scorching of foliage occurs. Below this height, all needles are brown and dead; above it, live and green (Albini 1976). Burn mosaic refers to the patch dynamics created by a fire which can be influenced by the type of fire (surface, torching, or crowning), fuel loading, vertical and horizontal fuel continuity, weather, and topography in addition to numerous other variables. Fire severity can be judged as the effect of fire on the tree canopy, understory vegetation, soil surface organic debris, and mineral soil and includes three general categories of classification: low or light severity, moderate or mixed severity, and high severity (DeBano et al. 1998). Fire severity usually portrays fire effects to the resource of concern such overstory tree canopy. Fire intensity outputs are used to model burn severity. In the US Burned Area Emergency Response (BAER) assessments, the term burn severity has replaced fire severity, although the metric is very similar and is largely based on loss of organic matter in the soil and aboveground organic matter conversion to ash. In the recent ‘Glossary of Wildland Fire Terminology’ the term burn severity is restricted to the loss of organic matter in or on the soil surface, and in this respect represents what BAER assessments term ‘soil burn severity’ (Keeley 2009).

Fire behavior is intrinsically tied to vegetation. In general, dry forests dominated by ponderosa pine and Douglas-fir can variably burn as a surface fire or mixed severity with potential patches of high severity fire (Baker et al. 2007). Cold forests commonly include intermixed subalpine fir (*Abies lasiocarpa*), whitebark pine (*Pinus albicaulis*), and lodgepole pine (*Pinus contorta*) and are typified by the entire fire behavior spectrum. Moist forests on the HNF are not equivalent to the moist forests of Oregon, Washington, northern Idaho, and northwestern Montana that are influenced by a maritime climate. Moist forests in the Divide Landscape include Douglas-fir/lodgepole pine, lodgepole pine, Douglas-fir/shade-tolerant mixed conifer types, and the lower elevations of the subalpine zone represented mostly by subalpine fir and Engelmann spruce (*Picea engelmannii*).

Fire behavior parameters directly influence fire management strategies and fire effects to vegetation and thus serve as quantitative measures and indicators in this report. The fire behavior parameters examined include critical surface flame length, heat/unit, rate of spread, fireline intensity, type of fire, flame length, and scorch height for BehavePlus and FOFEM. The critical surface flame length represents the threshold when a surface fire will transition to a crown fire. Type of fire includes surface fire, torching or passive crown fire, conditional crown fire, and crown fire.

Firefighters can be effective with flame lengths up to 4 feet, so surface fires are generally able to be staffed with firefighters. Mechanized equipment can work on fires with flame lengths less than 8 feet while fires with flame lengths greater than 8 feet may only be safely attacked with aerial resources such as helicopters and airtankers. If flame lengths exceed 11 feet, all resources are fairly ineffective. Crown fire cannot be directly attacked with firefighters or equipment, leaving only indirect attack and aerial resources such as airtankers and helicopters. Indirect attack involves building fireline a fair distance away from the main fire front, usually utilized as a strategy when fire behavior is erratic or extreme and when there are safety concerns. This fireline is usually fired from to create a burned buffer between the fireline and the approaching fire front.

Fire and Fuels, Affected Environment

Introduction

This section describes the fire/fuels resources within the project area. Information included in this section is from field reviews by the HNF fire management staff and crews (NFMA reference 2009). The Project Area is located in the Little Blackfoot Watershed, west of the Continental Divide. This area is characterized by lodgepole pine forests which are even-aged stands that sustained high MPB-caused mortality growing on Douglas-fir and subalpine fir habitat types that were initiated by wildfire prior to 1900. Diversity within the project area includes stands mixed with Douglas-fir, subalpine fir, Engelmann spruce, and/or whitebark pine. Aspen clones are scattered across the landscape, in isolated pockets and non-forested meadows, typically along rolling ridge tops. In addition, this area has not experienced a fire of substantial size during the last 100 years. This project area is strategically located west of the Upper Tenmile Watershed, the major municipal water supply for Helena. Predominate wind along the Continental Divide range between south and west; therefore, the opportunity exists in the Little Blackfoot Watershed to implement vegetation treatments that modify fire behavior in both watersheds.

The incidence of fires in the project area and on adjacent lands, pertinent information from the Community Wildfire Protection Plan, and fuel model classification representing the existing condition are presented in greater detail in the following sections.

Analysis Area

The Telegraph proposed treatment units within the Telegraph project area serve as the analysis area for BehavePlus and FOFEM modeling for the action alternatives as well as a fire behavior discussion by fire behavior fuel model for the existing condition. Post-treatment fire behavior fuel model conditions have been predicted based on expected vegetative response and professional expertise. The analysis area for cumulative effects is the project area.

Fire Behavior

Fire behavior is driven by the combination of fuels, topography, and weather across the landscape. Surface fires spread according to the direction and speed of wind and the steepness of a slope. Surface fuels are an important factor in determining how fast a surface fire will spread and how hot it will burn. Surface fuels consist of needles, leaves, grass, forbs, branches, logs, stumps, shrubs, and small trees. Surface fire factors are also important to the initiation and spread of crown fires.

In general, lower surface fuel loading will reduce overall fire behavior, resulting in less intense surface fires. Lower surface fire intensity means that fires are less likely to transition to canopy fires which are generally the most severe and difficult to control. Anticipated weather conditions, fuel loading and associated fire hazard rating for the areas proposed for treatment within the project can

be used to compare the likelihood that proposed treatments would result in areas within the project that are more resistant and resilient to natural disturbances such as fires.

A visual indicator of fireline intensity is flame length (Rothermel 1983). Flame length is widely used as a means to relate visible fire characteristics and interpret general suppression strategies. These flame-length classes and interpretations are familiar to fire managers and are widely accepted as an intuitive communications tool. Insert below compares fireline intensity, flame length, and fire suppression difficulty interpretations.

- *Flame length less than 4 feet*: Direct attack at the head and flanks with hand crews; hand lines should stop spread of fire
- *Flame length less than 4 to 8 feet*: Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to stop fire spread. Equipment such as dozers, engines, and retardant aircraft can be effective.
- *Flame length less than 8 to 11 feet*: Fires may present serious control problems such as torching, crowning, and spotting. Control efforts at the fire head are likely ineffective. This fire would require indirect attack methods.
- *Flame length greater than 11 feet*: Crowning, spotting, and major fire runs are probable; control efforts at the head are likely ineffective. This fire would require indirect attack methods

Fire History and Occurrence

Fire has been the major influence on vegetation patterns, composition, structure, function, age and development of both individual stands and the larger landscape (Arno 2000). Agee (1993) added that changing land use patterns and attempts to exclude fire have succeeded in greatly reducing the scope of fire on the landscape.

Since 1920, 50 fires have occurred within the project area and approximately 60 percent have been caused by humans (figure 46). Although many fires had no accompanying written information and therefore were not included in fire occurrence maps, this data does give a glimpse of the fire suppression history in the area. Fires that escaped detection would not be included. Fire occurrence data (table 71) was digitized as point source data from historical maps that portrayed fires by year, size class, and cause for 1920 to 1969. For the period from 1970 to 2014, fire occurrence information was developed from Kansas City fire database (KCFast). Records from this period have detailed information including acreage, cost, and physical location. Based on the distribution of fires by size class, less than 184 acres burned during this time period across all ownerships within the project area. From 1970 to the present, more detailed records have been maintained that include acreage burned. In summary, less than 220 acres have burned since 1920, which is equivalent to less than 1 percent of the project area. The Sally Ann Fire of 2006 was a lightning-caused wildfire that occurred on the west side of the project area and has been the only recent fire to burn more than 10 acres. (Hollingsworth 2009)

Table 71. Fire Occurrence by size class and cause from 1920 through 2014 in the Telegraph project area

Decade	<0.25 acres	0.26–9 acres	10–99 acres	Lightning	Human Caused
1920–1929	2	1	1	0	4
1930–1939	8	4	0	8	4
1940–1949	4	1	0	1	4
1950–1959	2	0	0	2	0
1960–1969	1	2	0	2	1
1970–979	1	2	0	0	3
1980–1989	3	2	0	2	3
1990–1999	5	1	0	2	4
2000–2014	9	0	1	3	7
Total	35	13	2	20	30

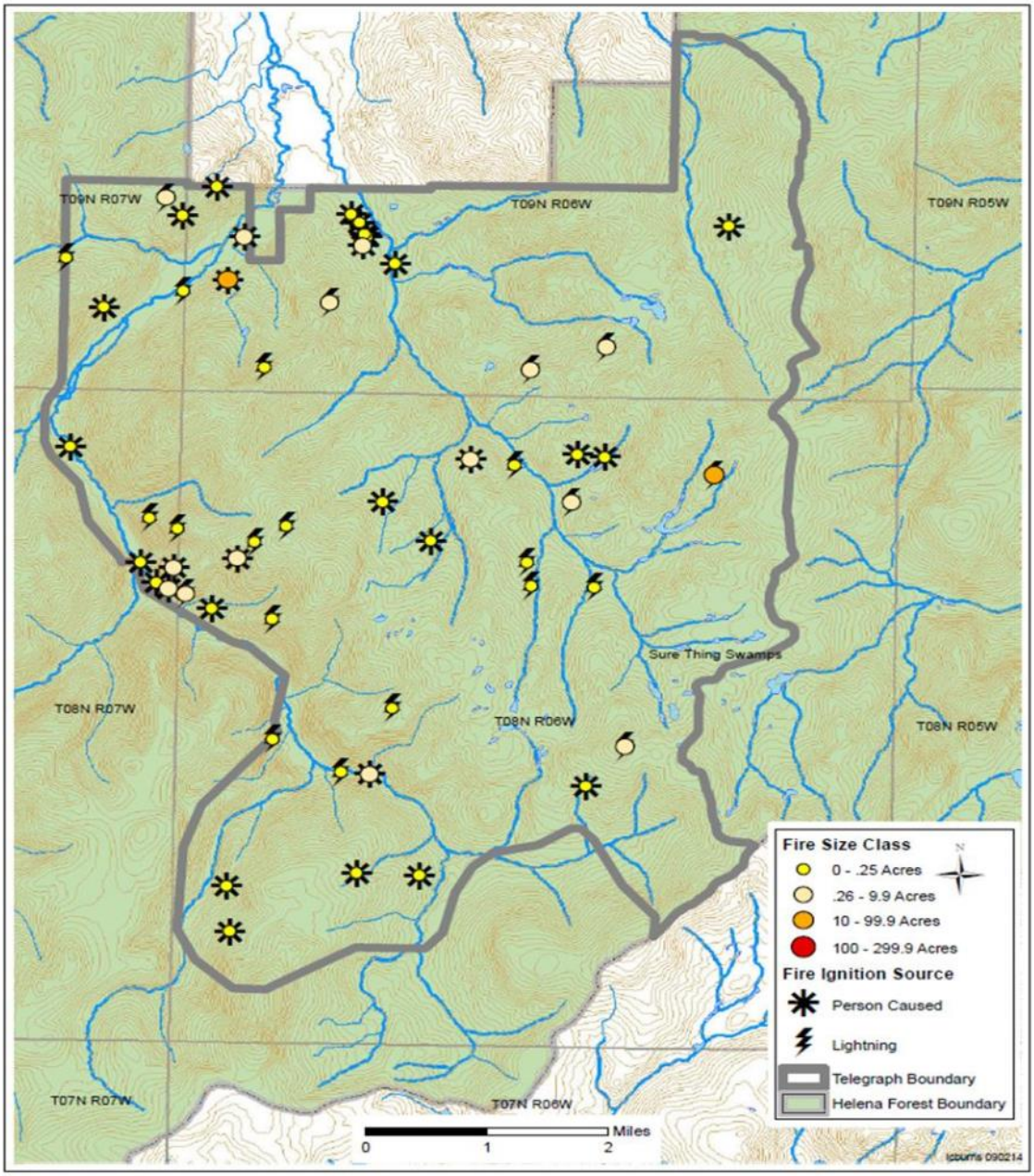


Figure 46. Map of fire occurrences within Telegraph Project Area

Fire Regimes

The natural or historic fire regime is a general classification of the role fire would play across the landscape in the absence of modern human intervention, but including the influence of burning by indigenous people. The natural or historical fire regimes are classified by numbers of years between fires (frequency) and fire severity, which reflects percent replacement on the dominant over story vegetation. The native fire regime is perhaps the most important ecosystem process altered by fire exclusion (Arno and Brown 1991). The historical fire regimes created shifting mosaics of patches, processes and habitats on the Rocky Mountain landscapes (Agee 1993). Keane et al. (1996) noted that these landscapes tend to become more homogeneous as fire is removed, because succession will

eventually advance all stands to similar communities dominated by shade tolerant species. Fires generally become less frequent and more severe with active suppression. Modern wildfires on late-seral landscapes tend to be larger, more intense and more severe because of high biomass loading and multi-layer stand structure. Elements within a late-seral forest include large trees, slowed tree growth, and occurrence of features such as snags, down logs, and mortality of overstory trees. Fires on fire-altered landscapes may burn more area in fewer years, meaning that rare fire years, like 1910, may be especially high in fire activity (Bessie et al. 1995). The increasing numbers of large, severe fires in 1 fire-year will make suppression and control increasingly difficult further risking human life and property (Keane 2002).

Biophysical Settings

Biophysical Settings (BpS) are land delineations based on the physical setting, (e.g., elevation and aspect) and the potential natural vegetation (PNV) community that can occupy the setting. A national team has established in the Fire Regime Condition Class (FRCC) system a set of descriptions for BpS found within regions of the United States (FRCC 2005). For this analysis area, the HNF spatially assigned BpS based upon data such as habitat type and elevation (table 72). There are eight vegetated biophysical settings that occur in the Telegraph Project area. The biophysical settings are discussed in terms of vegetation classes and are the types of vegetation that would be expected to exist in the reference condition (the condition that would be present if fire was occurring in a typical frequency on the landscape). Please refer to the Vegetation Introduction for more information regarding biophysical settings.

Table 72. Biophysical Settings in the Telegraph Project Area

Biophysical Setting	Project Area Acres	Percent of Project Area
Douglas-Fir Warm/Dry (DFIR2-D)	5,361	23%
Douglas-Fir Cool/Moist (DFIR2-M)	10,316	44%
Deciduous Woodland Oak-Aspen w/ Conifer (DWOA)	238	trace
Ponderosa Pine Douglas-Fir (PPDF1)	335	1%
Riparian (RIPA)	131	1%
Lower Subalpine Fir (SPFI1)	5,982	25%
Upper Subalpine Fir (SPFI2)	345	trace
Mountain Grasslands w/ Shrubs (MGRA3)	1,537	6%

The biophysical settings DFIR2-M and SPFI1 make up 44 percent and 25 percent of the project area respectively. The DFIR2-D biophysical setting is also well-represented with 23 percent of the project area. Douglas-fir generally dominates DFIR2-D, with some mix of ponderosa pine and/or lodgepole pine possible. Lodgepole pine is abundant as a seral dominant in DFIR2-M and SPFI1, although most mature lodgepole has recently been killed by mountain pine beetle (MPB); these areas make up 69 percent of the project area respectively. A more detailed discussion of each BpS can be found in the Vegetation Introduction and the FRCC Report.

Fire Regime Condition Class

Fire Regime Condition Class (FRCC) is an interagency, standardized tool for determining the degree of departure from reference condition vegetation, fuels and disturbance regimes (FRCC 2011). FRCC uses various parts of a biophysical setting (BPS) by comparing the current conditions to document reference conditions; then gives a rating for each BpS based on various factors including

succession conditions, fire frequency and fire severity. The three condition classes FRCC uses to describe a BpS departure from reference condition are defined in the following table.

- *Class 1 – Maintenance*: Fire regimes are within a historical range, and the risk of losing key ecosystem components is low. Vegetation attributes are intact and functioning within a historical range. No fire return intervals have been missed.
- *Class 2 – Restoration*: Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystems components is moderate. Fire frequencies have been interrupted in comparison to historical frequencies by one or more fire return intervals resulting in moderate changes to one or more of the following: fire size, intensity and severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.
- *Class 3 – Conversion*: Fire regimes have been substantially altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals resulting in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been substantially altered from their historical range (Laverty and Williams 2000).

FRCC analysis was completed for the project area including updates to the BpS classification. Data from that analysis was used for the Telegraph Vegetation project and is summarized in the Telegraph Forested Vegetation Report. Table 73 shows the current departure from reference condition for each biophysical setting located in the Telegraph Project area. The analysis shows the majority of the project area is classified as moderately departed from reference condition. The moderate departure rating could be a concern as it is likely these areas will continue to move further from reference condition without management or fire disturbance. Refer to the Telegraph FRCC Report or the Telegraph Forested Vegetation Report for more information on FRCC and Biophysical Settings.

Table 73. Current Condition of Fuel Class Ratings for the Telegraph Project Area

Biophysical Setting	% of Project Area	Vegetation-Fuel Class Rating
DFIR2-D	23%	49% Departure (Class 2, Moderate)
DFIR2-M	44%	52% Departure (Class 2, Moderate)
SPFI1	25%	18% Departure (Class 1, Low)
RIPA/DWOA*	1%	58% Departure (Class 2, Moderate)
PPDF1 *	1%	56% Departure (Class 2, Moderate)
MGRA3*	6%	26% Departure (Class 1, Low)

*The abundance of these settings is too small to be meaningful for this analysis (Telegraph Vegetation Project, Forested Vegetaion Report)

Wildland-Urban Interface

The project area lies within the area analyzed in the Powell County Community Wildfire Protection Plan (Powell County CWPP). The Powell County CWPP was completed in 2005 following implementation of the National Fire Plan and involved a collaborative process including Powell County, Headwaters Resource Conservation and Development Area (HRCD), Montana Department of Natural Resources, Forest Service and the Bureau of Land Management. The wildland-urban interface (WUI) data for the Powell County CWPP was developed by combining the Powell County wildland-urban interface zones and Forest Service Region One Healthy Forest Restoration Act (R1-

HFRA) WUI. Wildland-urban interface zones up to four miles from interface communities were identified by the Powell County fire planning group as important areas for reducing fuel hazards. Approximately 16,913 acres of the 23,669 acres project area are within the WUI. The CWPP objectives include:

- Propose and implement projects that will protect communities at risk from wildfire.
- Focus first on the wildland urban interface communities at risk.
- Encourage the Federal and State agencies to continue creating fire defensible space around homes that border agency land.

The CWPP defined the wildland-urban interface (WUI) as, "… the area within 4 miles from interface communities that possess a population density exceeding 250 people per square mile" (Powell CWPP 2005). (Figure 47) WUI boundaries were defined utilizing input from local residents, available GIS technology, known fuel hazards and fire history of the area, local topographic features, weather patterns and understanding the fire response and suppression capabilities in the area. Proposed projects in the WUI would become a priority for accomplishment and would be assigned a numerical value of risk based on the existing fuel hazard, number of people in the immediate area and past history of wildland fires starting in the immediate area.

The Tri-County Fire Working Group (TCFWG), which is composed of representatives from Broadwater, Jefferson and Lewis and Clark counties, including individual citizens, local government, state and federal agencies, interested contractors and fire suppression departments developed the Tri-County Community Wildfire Protection Plan and also noted treatment needs in the Telegraph Project area vicinity. Specifically identifying several "potential" project areas for fuels reduction activities and said "The ridgeline between Minnehaha drainage and the Little Blackfoot drainage is a natural place for a fuel break" (Tri-County CWPP 2005). The area they describe lies within the Telegraph project area and has been identified as an area of concern due to the risk of wildfire impacting the City of Helena water supply if a wildfire were to move east over the Continental Divide into the Upper Tenmile Watershed and Minnehaha Creek drainage. The Minnehaha creek drainage "provides 2 million gallons of water per day into the system" (Tri-County CWPP 2005).

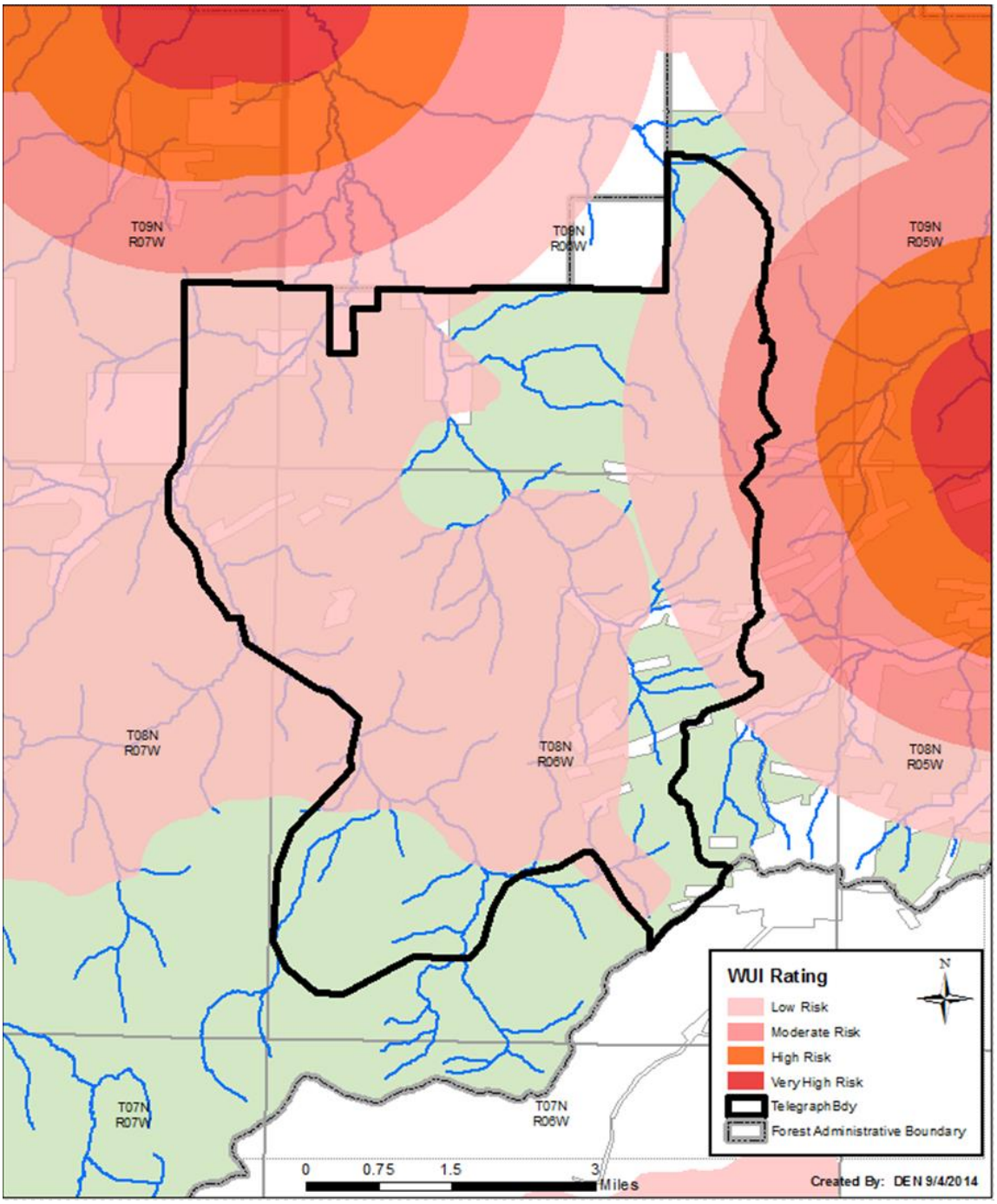


Figure 47. Map of wildland-urban interface in the Telegraph Project Area

Fire Behavior Fuel Models

Fire behavior fuel models (FBFM) are stratified into four groups: grass, shrub, timber, and slash. Each FBFM describes a unique set of conditions necessary for fire behavior modeling. Fire behavior fuel models are determined by the vertical and horizontal structure of the vegetation and reflect the primary carrier of fire through the system (Anderson 1982). The following fire behavior fuel model descriptions were obtained from Scott and Burgan (2005) and describe conditions relative to the Divide Landscape which includes the project area. (table 74 and figure 48) Detailed fuel model

discussion with representative photos are presented below, fuel models with less than 50 acres in project area were not described in detail. Other fuel models, not described in this section, are present at the project level but are not present and/or have very low (less than 10 percent) representation in treatment units. Ground verification and professional judgment were used to determine which FBFM best represented the majority of the proposed treatment units for each alternative.

Table 74. Fire behavior fuel model composition of existing conditions in the Telegraph project area (approximate proportions)

Fire Behavior Fuel Model	Descriptions	Acres	%
101	Short, sparse dry climate grass	1,151	5
102	Low load, dry climate grass	388	2
122	Moderate load, dry climate grass-shrub	131	<1
161	Low load, dry climate timber-grass-shrub	2,674	11
165	Very high load, dry climate timber-shrub	240	<1
182	Low load broadleaf litter	2	<1
183	Moderate load conifer litter	1,413	6
184	Small downed logs	10,308	44
185	High Load Conifer Litter	7,329	31
188	Long needle litter	33	<1
Total		23,669	100

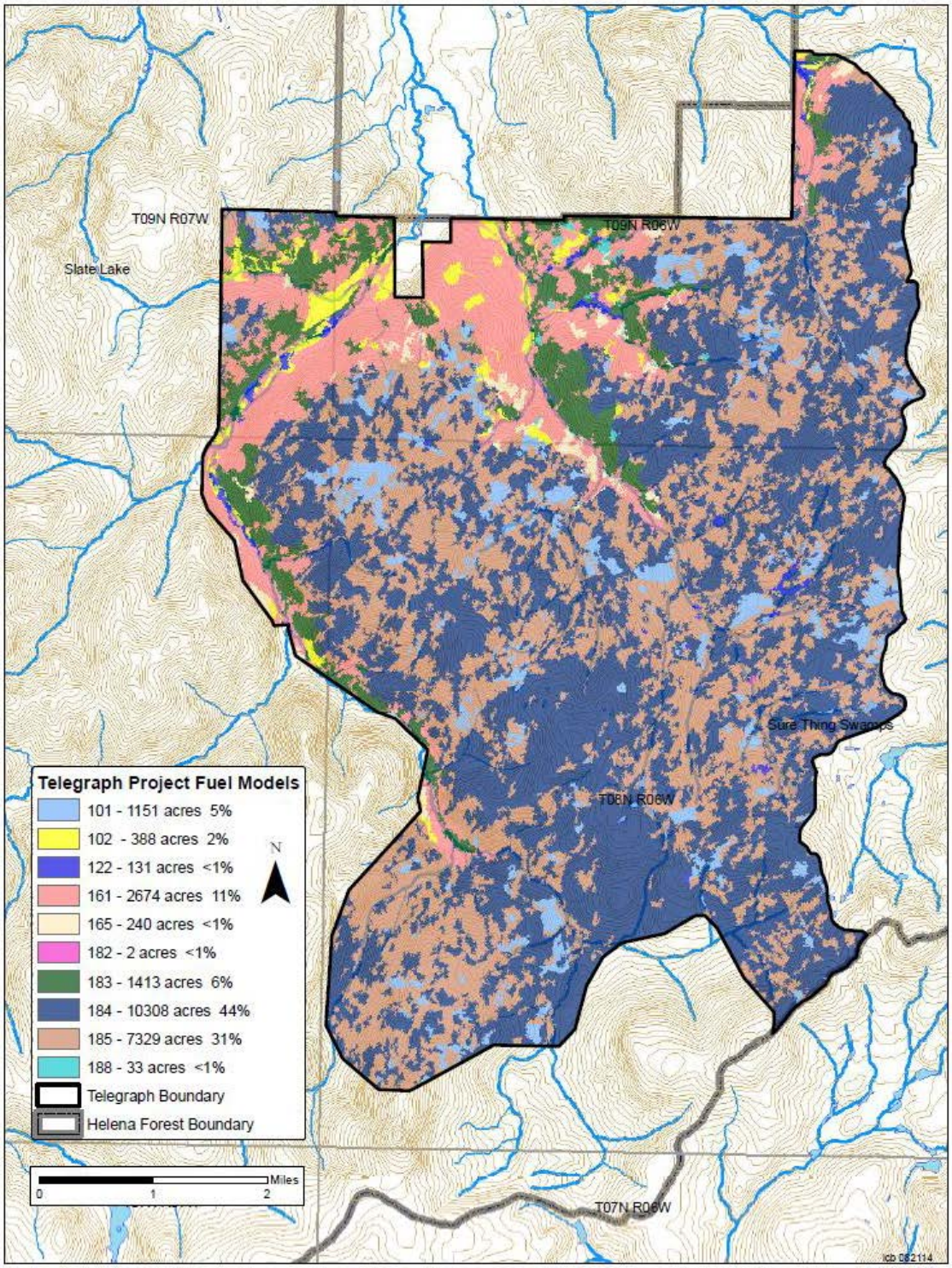


Figure 48. Map of fire behavior fuel models within Telegraph Project Area

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Fire Behavior Fuel Model 101, Short, Sparse Grass – FBFM 101 represents discontinuous sparse grasses within the upper elevations, Treasure Mountain as an example. Flame lengths of 2 feet are expected for wildfires burning in this fire behavior fuel model, much less than in fire behavior fuel model 102 which has continuous grass cover.

Fire Behavior Fuel Model 102, Grass – FBFM 102 consists of grass with small amounts of woody debris and shrubs. Grasses are categorized as fine fuels that have a high proportion of surface area. Fire effects to grasses depend on the growth form and the timing of fire during the growing season (Young 1983). The amount of heat exposure received by meristems is directly linked to moisture content (Miller 2000). Historically, fires occurred frequently in grasslands, which often killed conifer and shrub encroachment (Arno and Gruell 1986; Gruell et al. 1986; Paysen et al. 2000). Without fire, conifer and shrub encroachment in grasslands is common provided an adjacent seed source (Arno and Gruell 1986). Increase in the fire interval in grasslands has been attributed to livestock grazing, removal of Native Americans as an ignition source, and fire suppression (Arno and Gruell 1986; Heyerdahl et al. 2006; Paysen et al. 2000; Wrobleski and Kauffman 2003). Flame lengths vary from 4 to 10 feet.

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Fire Behavior Fuel Model 122, Grass-Shrub (Moderate Load) – FBFM 122 represents a fuelbed with a moderate amount of grass and shrubs that range in height between 1 to 3 feet. In the Telegraph area this fire behavior fuel model consists of mountain big sagebrush, common juniper and Rocky Mountain juniper interspersed with grasses. Live herbaceous fuel moisture has a strong effect on fire intensity and rate of spread for both FBFM 102 and 122. Flame lengths vary from 2 to 10 feet. The sagebrush community is dominated by late-seral age classes (refer to FRCC report). High sagebrush cover often indicates this vegetation type is beyond the historical fire return interval (Wrobleski and Kauffman 2003). Lack of fire has allowed encroachment by conifer species, such as Douglas-fir and Rocky Mountain juniper (*Juniperus scopulorum)* to invade shrublands. Historically these species were often killed by fire before reaching fire-resistant size; however, fires were not frequent enough to eradicate mountain big sagebrush (Gruell et al. 1986; Heyerdahl et al. 2006; Paysen et al. 2000). Heyerdahl et al. (2006) found that Douglas-fir cover has increased within historic Douglas-fir savannas and expanded into areas traditionally dominated by sagebrush-grass in Montana. Flame lengths of 8 feet are expected in this FBFM. Current fire severity has increased substantially due to greater canopy cover of sagebrush in many areas than historically would have been present.

Fire Behavior Fuel Model 161, Timber with Short Understory – FBFM 161 has low load of grass and/or shrubs with litter under a timber overstory. The understory can consist of grasses, forbs, or short shrubs or any combination thereof. The overstory is often Douglas-fir but can include lodgepole pine or whitebark pine. Ladder fuels are lacking. Flame lengths vary from 1 to 5 feet. Douglas-fir may have an understory consisting of pinegrass, various forbs, or short shrubs such as snowberry (*Symphoricarpos albus*) and kinnikinnick (*Arctostaphylos uva-ursi*). Historically, fire effects within Douglas-fir stands were variable due to differences in fuel loadings and stand structure combined with changes in weather and topography (Arno 1980). This gradient of fire effects created a diverse, heterogeneous mosaic on the landscape (Arno 1980). Ground and surface fuels, in the form of duff, litter, and fine woody debris were historically consumed by fires (Arno 2000). As the frequency of fires lengthened through the 1900s, due to efficient and effective fire suppression, accumulations of surface fuels

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have increased and allowed for fires with increased intensity (Martin et al. 1989; Mutch et al. 1993).

Lodgepole pine that has suffered low mortality is included in this fire behavior fuel model. As fire behavior fuel model 161 does not have a ladder fuel component, dry-site lodgepole pine with an understory consisting of pinegrass or grouse whortleberry (*Vaccinium scopulorum*) is common. Whitebark pine often survives fires as shown in studies collecting fire-scarred samples (Arno and Peterson 1983; Morgan and Bunting 1990). In some upper subalpine locations whitebark pine is maintained as the dominant conifer (whitebark pine habitat types). A common example for this fire behavior fuel model in upper elevations includes whitebark pine with a grouse whortleberry or elk sedge understory. Whitebark pine has experienced significant recent mortality in this area that has resulted in large tracts of standing dead trees. The red needles have already fallen and been compacted through numerous winters. As these snags fall over time fuel loadings will increase. The coarse woody debris will decay although the harsh weather within this zone will slow the process

Fire Behavior Fuel Model 165, Timber with Tall Understory – FBFM 165 has a timber overstory with heavy forest litter and a tall shrub or seedling/sapling understory. This fire behavior fuel model includes moist site Douglas-fir, mixed Douglas-fir/lodgepole pine, Engelmann spruce, subalpine fir, and whitebark pine/subalpine fir with an understory of tall shrubs and/or conifer regeneration. Additionally, this FBFM includes dry-site Douglas-fir with an understory of grasses mixed with common juniper (*Juniperus communis*). Historically, fire effects within Douglas-fir stands were variable due to differences in fuel loadings and stand structure combined with the influence of weather and topography (Arno 1980). This gradient of fire effects created a diverse, heterogeneous mosaic on the landscape (Arno 1980). Ground and surface fuels, in the form of duff, litter, and fine woody debris were historically consumed by fires (Arno 2000). In the absence of fire, dense understories choked with regeneration or overstocked pole stands have a tendency to develop (Habeck and Mutch 1973).

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Whitebark pine often survives fires as shown in studies collecting fire-scarred samples (Arno and Peterson 1983; Morgan and Bunting 1990). Natural succession lacking disturbance and management often promotes shade-tolerant subalpine fir and perhaps Engelmann spruce although whitebark pine may remain as a co-dominant (subalpine fir-whitebark pine habitat types, Morgan and Bunting 1990). Fire effects tend to be long-lasting in this zone (Habeck and Mutch 1973). Dense understories of subalpine fir regeneration augment the transition from a surface fire to a crown fire. Wildland fires have inherently dangerous fire behavior in subalpine fir due to the propensity for spotting and torching by this species (Hollingsworth - Davis Fire Report).

Lodgepole pine mortality from the mountain pine beetle may affect fire behavior in these stands (refer to the Forested Vegetation report for insect information). Fire intensity is expected to increase due to higher midflame windspeed, increase in 1-hr fuel size class of small branchwood and increase in litter loading in post-epidemic stands as compared to endemic stands (Page and Jenkins 2007).

Flame lengths range between 5 to 15 feet in this FBFM but the critical surface flame length is 2 feet so crown fire is expected. In stands dominated by pole and medium size class trees, torching is the expected fire type. If a wildland fire were to occur with the current vegetation conditions, the potential for overstory mortality is high due to dense stands with a high proportion of ladder fuels. These ladder fuels are conducive to allow a surface fire to transition to a crown fire (Arno 2000). High fire intensity augments overstory mortality due to the increased transfer of heat and scorch. Therefore, a greater percentage of the overstory dies as a direct effect of a wildfire.

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Fire Behavior Fuel Model 183, Conifer Litter – FBFM 183 combines moderate load conifer litter and light load of coarse woody debris. This fire behavior fuel model includes mostly dry Douglas-fir types but can include lodgepole pine. An understory of litter is the main component that carries fire. This fire behavior fuel model mostly includes closed canopy Douglas-fir stands with sparse understory vegetation. Historically, fire effects within Douglas-fir stands were variable due to differences in fuel loadings and stand structure combined with changes in weather and topography (Arno 1980). This gradient of fire effects created a diverse mosaic on the landscape (Arno 1980). Ground and surface fuels, in the form of duff, litter, and fine woody debris were historically consumed by fires (Arno 2000). Lodgepole pine that has suffered low mortality is included in this fire behavior fuel model in stands that have sparse understory vegetation. Flame lengths of 1 to 2 feet characterize this fire behavior fuel model.

Fire Behavior Fuel Model 184, Small Downed Logs – FBFM 184 has a moderate load of fine litter and coarse woody debris in the form of small diameter logs. This fire behavior fuel model includes lodgepole pine, Douglas-fir/lodgepole pine, and lodgepole pine/subalpine fir stands that have some degree of mortality in the form of small-diameter logs on the ground such as occur through self-thinning or previous endemic mountain pine beetle activity. Flame lengths of 2 to 3 feet characterize this fire behavior fuel model, not quite reaching the critical surface flame length of 4 feet needed for a surface fire to transition to a crown fire. Scorch height is 4 to 5 feet.

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Fire Behavior Fuel Model 185, Conifer Litter (Beetle Mortality) – This fire behavior fuel model has a high load of conifer litter and light slash commonly caused by mortality. This fire behavior fuel model best represents lodgepole pine stands that have suffered bark beetle mortality with red needles mostly on the ground and lacking ladder fuels. Lodgepole pine mortality from the mountain pine beetle may affect fire behavior in these stands (refer to the Forested Vegetation report for insect information). Fire intensity is expected to increase due to higher midflame windspeed, increase in 1-hr fuel size class of small branchwood and increase in litter loading within post-epidemic stands as compared to endemic stands (Page and Jenkins 2007). Flame lengths of 3 to 5 feet. Fires burn as surface fires, although a conditional crown fire is possible in mature stands if a crown fire entered from an adjacent stand. This fire behavior fuel model has varying proportions of dead lodgepole pine so in some stands a crown fire is not expected due to low canopy bulk density.

Fire and Fuels, Environmental Consequences

Effects Common to All Alternatives

Wildland fire behavior in treated as well as untreated areas depends on the fuels in addition to topography and weather. Given the current condition the dynamics associated with lodgepole pine mortality, untreated areas can be expected to realize higher intensity fires that consume a considerable portion of duff and litter due to current density, stand structure, red needled litter, and stand composition (Agee and Skinner 2005, Graham et al. 2004). At this time there will certainly be the potential for a surface fire of adequate intensity to kill any residual live Douglas-fir, lodgepole pine, or ponderosa pine due to fireline intensity and the resultant heat pulse to the cambium (Kauffman et al. 2008).

Within the project area, but outside the treatment units, fuel will continue to accumulate as discussed in the no-action alternative. Standing dead is beginning to fall and will continue to add to the current fuel loading.

Recent observations during wildfires in "gray stage" lodgepole pine in Canada indicate that previous assumptions regarding potential fire behavior in lodgepole pine may have underestimated fire behavior. Gray stage lodgepole pine indicates that time frame when the red needles have dropped from the trees. During the G4-0151 Fire in British Columbia during June of 2010, gray stage lodgepole produced many firebrands that started spot fires if they landed in a receptive fuelbed (Canada Fires 2010). The receptive fuelbed in this case were adjacent salvage harvests; the more residual slash and fine woody debris that remained on-site, apparently the more receptive the fuelbed to ignition (Canada Fires 2010). Spotting was observed over ½ mile in front of the main fire and rates of spread of 30 chains/hr (0.4 miles/hr) to 70 chains/hr (about 0.9 miles/hr) were observed (Canada Fires 2010).

For stands that have succumbed to bark beetles, the dead trees which will have mostly fallen within fifteen years (Mitchell and Preisler 1998) will greatly heighten 1000-hr fuel loading. Heavy loadings of 1000-hr fuels allow for long residence time should a fire occur. Residence time refers to the total length of time that the flaming front of the fire occupies one point. Long residence time promotes smoldering of duff and litter which creates high smoke emissions and exposes mineral soil. Exposed mineral soil creates a suitable site for noxious weed establishment and potential for erosion. Fire suppression costs can be very high during this extended mop-up phase to extinguish large dead logs.

There are important implications of MPB-induced tree mortality on firefighter safety and suppression tactics, including, safety zone size, escape route designation and escape time, and overall suppression strategy that have significant consequences for wildland fire personnel (Page et al., 2013a). This increase in large fallen dead wood (often called "jackstraw") hampers fire suppression as these areas are difficult to walk through and chainsaws are needed to remove layers of logs in order to dig fireline (figure 49). In the event of a wildfire fire management staff would limit and/or restrict ground crews due to safety concerns related to snags and inadequate escape routes to safety zones as a result of the continuous surface fuel buildup (USDA – Helena National Forest, 2012). Fireline construction can be very slow which may limit the success of initial attack. Ignition potential is low; however, if a fire becomes established the flame lengths and fireline intensity are such that resistance to control is very high, preventing hand crews and in many cases dozers from suppressing wildfires directly. Resiliency in this case is hampered as multiple large scale disturbances can remove future seed sources.

Figure 49. Example of downed wood (surface fuel) in Lodgepole Stand killed by mountain pine beetle (left) and overhead snag hazard to public and forest workers (right)

Effects Common to All Action Alternatives

Proposed Treatments

The desired strategy for initial attack on these forest types is “direct attack.” In most cases, this suppression strategy is the safest and most effective tactic, resulting in the least area burned. Weather, topography, and fuel conditions influence fire behavior and may enable fires to escape initial attack, possibly requiring the use of indirect suppression tactics. Implementing such indirect strategies typically requires more time and resources. In addition, these indirect strategies generally result in a larger fire size. While the location of the next wildland fire cannot be predicted and weather and topography cannot be altered, land managers can strategically place fuel treatments to influence and affect wildfires (USDA Forest Service 2010b).

Fuel treatments have been designed to alter fire behavior in treated areas, thereby reducing the future effects of a potential wildfire (Omi and Martinson 2004; Reinhardt et al. 2008; Stratton 2004). Changes in suppression strategy resulting from fuel treatments, including: safer areas for firefighters, anchors for fireline construction, areas from which to initiate burnout operations; or, fuel treatments which modified fire behavior to the extent that the need for suppression action was minimal (USDA Forest Service 2010b).

Reducing fire growth in the heading direction (fire moving with wind and/or slope) offers the most substantial reductions to fire severity and fire size (Finney 2001).

In the past years, research has been conducted in the western US on how fuels treatments affect wildfires that subsequently move through treated areas. The probability that a given acre is burned by a wildfire is low, and even lower when looking at the probability that a given treated acre be burned by a wildfire (Rhodes and Baker 2008). However, when looking at how wildfires burn through treated areas, treatments should be judged successful if desirable changes are made to fire behavior. Instead of focusing on the probability of a treated area experiencing a fire, the probability that a wildland fire is positively affected by a treated area should be judged more important (Finney 2008, personal communication). The benefits of prescribed fire versus wildfires are that the burning environment and conditions can be better managed with prescribed fire in order to achieve stated objectives as well as having adequate resources available.

BehavePlus results are presented for existing condition in table 74. Based on table 75, 99 percent of the project area would burn with flame lengths less than 4 feet, within the capabilities of ground firefighter personnel. This model does not account for on-the-ground fire-fighter safety concerns related to snags and inadequate escape routes to safety zones as a result of the continuous surface fuel buildup (figure 49). Approximately 75 percent of the vegetation conditions (table 75, FBFM 184 and 185) within the Telegraph project are similar to those encountered during the Black Mountain Fire and would warrant the same response, that is to minimize firefighter exposure to the inherent hazards of the area on-the-ground fire-fighting would be generally limited to roadways, open forest canopies, and snag free zones (See USDA – Helena National Forest, 2012). This would mean that extensive aerial support would be needed to aggressively suppress any wildfire. Reducing current and expected fuel loadings within treatment units will result in modifying the existing fuel profile enhancing fire suppression capabilities as well as firefighter and public safety in the area.

Table 75. Associated Fire Behavior (Flame lengths - FL) with existing conditions in the Telegraph project area

Current Fire Behavior Fuel Model Classification	Descriptions	Approx. Proportions within Project Area (acres / %)	Associated Fire Behavior (Flame Lengths)
101	Short, sparse dry climate grass	1,151 / 5%	0-4 ft
102	Low load, dry climate grass	388 / 2%	0-4 ft
122	Moderate load, dry climate grass-shrub	131 / <1%	0-4 ft
161	Low load, dry climate timber-grass-shrub	2,674 / 11%	0-4 ft
165	Very high load, dry climate timber-shrub	240 / <1%	8-11 ft
182	Low load broadleaf litter	2 / <1%	0-4 ft
183	Moderate load conifer litter	1,413 / 6%	0-4 ft
184	Small downed logs	10,308 / 44%	0-4 ft
185	High Load Conifer Litter	7,329 / 31%	0-4 ft
188	Long needle litter	33 / <1%	4-8 ft
Total		23,669 / 100%	

The proposed treatments will break-up contiguous natural fuel meeting the objectives as stated in the Forest Plan as a forestwide standard. In the event of a wildfire, these treatment areas are areas where firefighters can more safely and effectively perform suppression actions and where aerial fire retardant will reach the burning surface fuels without interception from overstory vegetation (USDA Forest Service 2010b). For units that will only have prescribed fire as a treatment, it is assumed that primary mortality as a result of burning in addition to secondary mortality caused by drought, insects, disease, or other causes will add woody debris over time as these snags fall in addition to the current coarse woody debris accumulations.

Vegetation growth and succession are dynamic processes as can be reflected by changes in fire behavior fuel models over time. Fire behavior fuel models can represent different successional stages as a forest regenerates, matures, and then dies over time. Fire behavior fuel models simply provide the inputs necessary to represent these different successional stages for input to the fire spread model. In addition to the fire behavior fuel models in the project area, FBFM 201 and 202 may be created in some units after slashing prior to burning. These fire behavior fuel models only last a few years while the needles are red and still attached to the limbs. Once the needles drop to the ground, FBFM 201 and 202 are no longer applicable as they would overpredict fire behavior. It is generally the goal to burn while the needles are still attached as fire carries more easily than when the needles have dropped but if the objective is to burn with low fire intensity it may be necessary to wait until the red needles have fallen off the slash.

All treatments utilizing management-ignited fire require the development of a prescribed fire plan that must follow all Federal, State, and local laws and regulations.

Alternative 1 (No Action)

Under alternative 1, no fuel treatment would occur. In the absence of disturbance, fuel conditions would generally persist or fuel loadings would increase throughout the project area. The overall result would be increased fire hazard.

Ecosystems are dynamic and tend to change slowly over time without the influence of activities or disturbances. Succession in forested areas promotes changes in species composition, stand structure, and/or vertical and horizontal continuity over time. Stands dominated by Douglas-fir with a lodgepole pine component killed by beetles would continue to be dominated by Douglas-fir; canopy cover would be lower which in turn decreases canopy bulk density and possibly the ability for these stands to sustain a crown fire. Areas of current pine mortality would change in the years to come as snags fall over, thus changing the vertical and horizontal fuel continuity and how a wildfire potentially burns through these areas. Within Douglas-fir stands, the potential for large-scale disturbance would remain high due to homogeneous forested vegetation with contiguous crowns.

Direct Effects

Fire behavior within the project area would be expected to remain similar to the existing condition assuming no further disturbances occur. Lodgepole pine stands that have experienced high mortality have progressed into the “gray stage” and are beginning to transition into the initial stages of deterioration. These stands are mostly classified as FBFM 183 (moderate load conifer litter) and FBFM 184 (small downed logs). These FBFM would transition in the coming years as the snags fall and fuel loadings increase, FBFM 185 (high load conifer litter) and FDFM 187 (large downed logs) best represent this change in fuel loading.

This increase in large dead wood (jackstraw) hampers fire suppression as these areas are difficult to walk through and chainsaws are needed to remove layers of logs in order to dig fireline. Fireline production can be very slow which may limit the success of initial attack. In addition, heavy loadings of 1000-hr fuels allows for long residence time should a fire occur. Residence time refers to the total length of time that the flaming front of the fire occupies one point. Long residence time promotes smoldering of duff and litter which creates high smoke emissions and exposes mineral soil. Exposed mineral soil creates a suitable site for noxious weed establishment and potential for erosion. Fire suppression costs can be very high during this extended mop-up phase to extinguish large dead logs.

The no-action alternative would not alter the fuel profile to reduce fire behavior and would not meet the purpose and need of this project which is to be responsive to the mountain pine beetle outbreak in the area, recover economic value of the dead and dying trees, promote desirable regeneration, improve conditions for fire suppression effectiveness as well as firefighter and public safety in the area in the event of a wildfire, and maintain diverse wildlife habitats.

In the absence of human-caused or natural disturbance such as vegetation treatment activities and wildfire, there would be an increased accumulation of surface and ladder fuels due to the significant insect and disease activity, blow down of dead trees and the progression of forest succession. In the event of a wildfire, this accumulation of fuels would lead to an increase in fire behavior, increasing the risk to public and firefighter safety. Under these conditions, fire suppression capabilities would be limited due to safety concerns related to snags and inadequate escape routes to safety zones as a result of the continuous surface fuel buildup. In order to minimize firefighter exposure to the inherent hazards, on-the-ground firefighting would be generally limited to roadways, open live forest canopies, and snag free zones. This reduced suppression capabilities could lead to more acres burned and increased risk to other resources and the communities in the surrounding area.

Indirect Effects

Management of unplanned ignitions (wildfires) cannot be predicted; unplanned ignitions within the project area would be managed according to direction in the Forest Plan, Helena Fire Management Plan, and applicable laws and policies. Vegetation resiliency, or the ability of the vegetation to readily recover following disturbance, is not high with existing conditions. Agee and Skinner (2005) define resiliency as a forest that is capable of retaining considerable basal area following a wildfire. Potential for overstory mortality is high in areas with a high proportion of ladder fuels and fine woody debris. High fire intensity may add to overstory mortality due to the increased transfer of heat and scorch. Over time, the no-action alternative would indirectly lead to increased surface, ladder and crown fuels that affect flame length, contribute to the torching of trees, and make crown fire more likely (Peterson et al. 2005, Graham 2004).

Increases in fuel loading may make overstory live trees more susceptible to damage from wildfire. It is probable the fire-tolerant trees may continue to be replaced by trees that are less fire tolerant and therefore less resistant to fires. Wildfires that escape initial attack may impact adjacent private lands and other resource values including the Tenmile watershed to the east of the project area. Direct suppression tactics by firefighting forces would not be as effective in the project area under the no-action alternative as compared with the results of the treatments proposed for the action alternatives. The no action alternative would restrict local fire managers from utilizing fire for meeting various land management objectives. Fire suppression activities would continue in the project area. Case studies of watersheds in two national parks in California found the impacts of suppression on fire return interval departure (FRID) were substantial. The results showed if all ignitions were allowed to burn, the fire return interval would have improved from a high departure rating to a low departure rating in one of the study areas. The author noted the consequences of suppressing fires included substantial impacts to the fire return interval which may have a substantial impact on an entire ecosystem (Miller 2012).

Tree mortality, as a result of insect and disease activity and natural forest succession, would continue into the future and would exacerbate the amount of standing and downed fuels in the project area. These fuel levels have the potential to significantly affect fire behavior and firefighter safety should another wildland fire occur within or adjacent to the project area.

Irreversible and Irretrievable Commitments

Changes in vegetation structure, composition, and horizontal continuity may result in undesirable consequences should a fire occur. The abundance and extent of downed fuels may result in high severity surface fire effects in the event of a wildfire. These fire effects could slow vegetation recovery following fire, result in erosion or sediment delivery to streams if duff and litter layers are consumed, or result in loss of certain vegetation types due to lack of a seed source (example – following the North Hills Fire in 2000 in the northern Big Belts ponderosa pine was eliminated in many areas due to lack of an adjacent seed source in areas that burned as a stand-replacing fire). If such a fire occurs between the time seed from serotinous cones germinations and the trees again produce cones, there could be an irreversible loss of seed source and thereby long term loss of conifer cover in some areas Telegraph Forested Vegetation Report).

Cumulative Effects

The Cumulative Effects Worksheet (appendix C) considers and addresses proposed activities in addition to the past, current, and reasonably foreseeable activities.

Fire suppression has generally been effective in these areas. It is reasonable to assume that fire suppression would continue, however it is likely that costs would continue to increase and

suppression would increasingly difficult as fuels continue to build up and ladder fuels develop in the absence of frequent, low intensity fires.

Conclusions

The No Action alternative would not satisfy the project vegetation and safety objectives as presented in chapter 1. First, this alternative would not increase resiliency within the project area nor would it reintroduce fire in the form of prescribed fire nor create places where firefighters can more safely and effectively perform suppression actions. Second, this alternative would not be consistent with Land and Resource Management Plan direction and would be unresponsive to the Powell County Wildfire Protection Plan. This alternative would not respond to the National Fire Plan goals of reducing fuels and ensuring public and firefighter safety. Although treating roadsides under the hazard tree decision has improved road travel along those selected segments, this action alone does little to increase safety within the project area as a whole.

Alternative 2 (Proposed Action)

This alternative proposes vegetation activities on 6,754 acres, about 28 percent of the project area. The proposed treatments include using a combination of commercial harvesting, pre-commercial thinning and prescribed fire. Site preparation burning is also proposed and would take place after harvesting is complete to prepare areas for tree planting (table 76).

Table 76. Proposed Treatments and approximate acres for Alternative 2 (Proposed Action)

Treatment Type	Prescription	Acres
Intermediate Harvest 434 Acres Total	Improvement Cut, Slashing, Jackpot Burn	434
Pre-commercial thinning 1,786 Acres Total	Pre-commercial Thin	1,758
	Pre-commercial Thin, Under burn	28
Prescribed Fire 1,050 Acres Total	Slashing, Broadcast Burn	1,039
	Slashing, Hand piling, Burning Piles	11
Regeneration Harvest 3,484 Acres Total	2-Aged Seedtree with Reserves	16
	2-Aged Seedtree with Reserves, Site Prep Burn	166
	2-Aged Shelterwood with Reserves, Site Prep Burn	155
	Clearcut with Leave Trees	651
	Clearcut with Leave Trees, Jackpot Burn	1,046
	Clearcut with Leave Trees, Site Prep Burn	1,355
	Clearcut with Reserves, Site Prep Burn	95
Grand Total		6,754

Direct Effects – Unit Fire Behavior

Post-treatment fire behavior fuel models were predicted based on the dominant understory or fuel stratum that would carry fire. With implementation of the proposed action, fire behavior fuel models (FBFM) 121, 181 and 202 would compose the bulk of post-treatment acres although FBFM 161, 184 and 185 make up the majority of acres currently (table 77). This transition would be due to the removal of ladder fuels, decreased canopy cover, and reduction of fuel loadings from prescribed fire.

Units that are proposed to have a silvicultural treatment prior to prescribed fire would generally be burned one to three years following harvest or slashing depending on meeting prescription criteria as stated in the burn plan.

Table 77. Fire behavior fuel model composition in the Telegraph project area for alternative 2 (proposed treatment units)

Fire Behavior Fuel Model	Pre-treat Acres	Pre-treat Proportion	Post-treat Acres	Post-treat Proportion
99 Bare ground (no fire spread)	3	<1%	3	<1%
101 Short, sparse dry climate grass	493	7%	-	-
102 Low load, dry climate grass	55	<1%	-	-
121 Low load, dry climate grass-shrub	-	-	2,816	42%
122 Moderate load, dry climate grass-shrub	13	<1%	667	9%
161 Low load, dry climate timber-grass-shrub	699	10%	424	6%
165 Very high load, dry climate timber-shrub	94	1%	-	-
181 Low load compact conifer litter (may be representative of recently burned forest)	-	-	1,048	16%
182 Low load broadleaf litter	-	-	-	-
183 Moderate load conifer litter	246	4%	5	<1%
184 Small downed logs	3,108	46%	-	-
185 High Load Conifer Litter	2,026	30%	5	<1%
188 Long needle litter	17	<1%	-	-
201 Low load activity fuel	-	-	28	<1%
202 Moderate load activity fuel	-	-	1,758	26%

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Fire Behavior Fuel Model 121/122, Grass-Shrub – Following proposed regeneration harvests the understory would mostly be grasses and shrubs. Post-implementation understory species would be highly dependent on the existing species composition. These two FBFM would look similar following regeneration harvests, except FBFM 122 will be expected to have higher flame lengths due to residual harvest debris in addition to current fine woody debris

Fire Behavior Fuel Model 201, Activity Fuels/Slash (Low Load) – Following proposed intermediate harvest activities FBFM 201 represents a low load of activity fuels less than 1 foot in depth. Fuel load is approximately 10 to 20 tons per acre, mostly in the 100-hr size class. In prescribed fire units, slash would be created in order to create a burnable fuelbed, remove ladder fuels, and protect large trees.

Fire Behavior Fuel Model 202, Activity Fuels/Slash (Moderate Load) – Following proposed pre-commercial thinning activities FBFM 202 is characterized by a moderate load of activity fuels less than 1 foot in depth. Approximately 7 to 12 tons per acre of fine fuels would be equally distributed between the 1-hr, 10-hr, and 100-hr size classes.

Fire Behavior Fuel Model 181, Low Load Compact Conifer Litter (Recently Burned Forest) – FBFM 181 is characterized by a low compact forest litter. Light to moderate load, fuels 1 to 2 inches in depth.

Regeneration Harvest

This treatment group represents approximately 3,484 acres of the 6,754 acres under the proposed action. FBFM 121 would be expected in units (2,817 acres) proposed for regeneration harvest and prescribed fire based on observations in previously harvested/burned areas on the HNF. Prescribed fire after harvest would consume much of the fine woody debris and consequently decrease fire intensity. Also, resiliency would be improved as predicted fireline intensity would be lower.

Units proposed for regeneration harvest without prescribed fire (667 acres) would be expected to have higher loadings of fine woody debris following implementation as incidental small branchwood would be added during harvest activities in addition to the existing surface fuel loadings (Reinhardt et al. 2008).and would best be represented by FBFM 122. Within these units, the higher loading of fine woody debris would increase fireline intensity if a wildfire occurred and the residual trees within seedtree and shelterwood harvests may be killed.

Regeneration Harvest

This treatment group represents approximately 1,856 acres of the 4,185 acres under the proposed alternative. FBFM 121 would be expected in units (1,552 acres) proposed for regeneration harvest and prescribed fire based on observations in previously harvested/burned areas on the HNF. Prescribed fire after harvest would consume much of the fine woody debris and consequently decrease fire intensity. Also, resiliency would be improved as predicted fireline intensity would be lower.

Units proposed for regeneration harvest without prescribed fire (304 acres) would be expected to have higher loadings of fine woody debris following implementation as incidental small branchwood would be added during harvest activities in addition to the existing surface fuel loadings (Reinhardt et al. 2008).and would best be represented by FBFM 122. Within these units, the higher loading of fine woody debris would increase fireline intensity if a wildfire occurred and the residual trees within seedtree and shelterwood harvests may be killed.

Table 78. Alternative 3, predicted post-implementation fire behavior within proposed regeneration harvests

Fire Behavior Fuel Model	Flame Length (ft)	Surface Rate of Spread (ch/h)	Heat Per Unit Area (Btu/ft²)	Fireline Intensity (Btu/ft/s)
121 Grass-Shrub (Low Load)	0.4	0.9	58	1
122 Grass-Shrub (Moderate Load)	1.6	6.3	140	16

Following implementation, flame lengths would be well below 4 feet in FBFM 121 and 122 which could be directly attacked by ground firefighters (table 78). The potential for crown fire would be nonexistent due to the lack of overstory.

Intermediate Harvest

This treatment group represents approximately 434 acres of the 4,185 acres under the proposed action and includes all proposed intermediate harvest activities. FBFM 161 would be common following implementation with some inclusions of FBFM 183 and 185. Following treatment, these stands would have reduced canopy cover, lower canopy bulk density, and increased canopy base height. For the most part, Ladder fuels would be removed. Prescribed fire would consume much of the fine woody debris in units proposed for this activity, so flame lengths and fire intensity is expected to be lower after implementation. In intermediate harvest units that will not be burned post-harvest, flame lengths may actually increase due to higher levels of fine woody debris.

Table 79. Alternative 3, predicted post-implementation fire behavior within proposed intermediate harvests

Fire Behavior Fuel Model	Flame Length (ft)	Surface Rate of Spread (ch/h)	Heat Per Unit Area (Btu/ft²)	Fireline Intensity (Btu/ft/s)
161 Low load, dry climate timber-grass-shrub	0.7	1.0	150	3
183 Moderate load conifer litter	1.8	4.8	228	20
185 High Load Conifer Litter	4.0	15.2	411	115

Following implementation, flame lengths would be of a manageable height in FBFM 161, 183, and 185 and could be directly attacked by ground firefighters (table 79).

Pre-commercial Thinning

This treatment group represents approximately 1,289 acres of the 4,185 acres under the proposed alternative and includes all proposed pre-commercial thinning activities (slashing with lop and scatter below 18 inches). Majority of existing FBFM 101 and 102 are present in this treatment area due to small openings created by past harvest activities, these areas would convert to FBFM 201 following slashing treatment. FBFM 202 would best represent the majority of treatment area in the short-term since the majority of the units are not proposed for prescribed fire. Fire behavior fuel model 202 has a moderate load of activity fuels which also contribute to moderate flame lengths and moderate spread; for the most part, canopy bulk density would be low enough that it would not readily support a crown fire.

Table 80. Alternative 3, predicted post-implementation fire behavior within proposed pre-commercial thinning

Fire Behavior Fuel Model	Flame Length (ft)	Surface Rate of Spread (ch/h)	Heat Per Unit Area (Btu/ft²)	Fireline Intensity (Btu/ft/s)
161 Timber-grass-shrub (low load)	0.7	1.0	150	3
201 Low load activity fuel	5.7	20.8	665	254
202 Moderate load activity fuel	11.9	55.4	1,206	1,225

Following implementation, flame lengths would be of a manageable height in FBFM 201 and could be directly attacked by firefighters. In the short-term (1 to 2 years following treatment), FBFM 202 rate of spread and flame length would increase from existing condition due to the recruitment of twigs, branchwood, needles and increase in herbaceous fuels. Loss of twigs and smaller branchwood greatly reduces influence of slash on rate of spread and flame length three to five years after thinning. FBFM 161 best represents the post-deteriorated of slash and recruitment of shrub and herbaceous fuels, fires within this fuel model are low rate of spread, low flame length and low intensity which could be directly attacked by ground firefighters (table 80). This change in fuel model from 202 to 161 is not depicted in table 75.

Prescribed Fire Units

This treatment group represents approximately 606 acres of the 4,185 acres under the proposed action. Slashing would remove ladder fuels and create a burnable fuelbed. Slashing in conjunction with prescribed fire would remove ladder fuels, separate live crown spacing, and reduce surface fuel loading. FBFM 181 would be common in forested areas directly following implementation although

untreated areas and small portions of treated areas may remain the same as the existing fire behavior fuel model. Three to five years post treatment FBFM would move from 181 to a 161 with reestablishment of grass and/or shrubs.

Table 81. Alternative 3, predicted post-implementation fire behavior within proposed prescribed fire units

Fire Behavior Fuel Model	Flame Length (ft)	Surface Rate of Spread (ch/h)	Heat Per Unit Area (Btu/ft²)	Fireline Intensity (Btu/ft/s)
161 Timber-grass-shrub (low load)	0.7	1.0	150	3
181 Low load compact conifer litter (recently burned forest)	0.8	1.4	123	3

Fire behavior fuel model 181 has a light to moderate load of compact forest litter which results in very low spread rate and flame lengths. Fire behavior fuel model 161 has a low load of grass and/or shrub with litter resulting in low spread rate and flame lengths. Following implementation, flame lengths would be well below 4 feet in FBFM 161 and 181 which could be directly attacked by ground firefighters (table 81).

Indirect Effects

For units that will only have prescribed fire as a treatment, it is assumed that primary mortality as a result of burning in addition to secondary mortality caused by drought, insects, disease, or other causes will add woody debris over time as these snags fall in addition to the current coarse woody debris accumulations.

Irreversible and Irretrievable Commitments

No fire/fuels irreversible or irretrievable commitment within treatment units.

Cumulative Effects

The cumulative effects analysis includes past, current, and reasonably foreseeable future activities as these activities influence the fire/fuels resource. Most activities have little influence on fire/fuels, with the exception of harvest, thinning, prescribed fire, wildfire, and livestock and wildlife grazing that change the vegetation. Management of wildfires cannot be predicted; wildfires within the project area would be managed according to direction in the Forest Plan, Helena Fire Management Plan, and applicable laws and policies. See Appendix C for detailed cumulative effects analysis.

Conclusions

The proposed mechanical and prescribed burn treatments in both action alternatives would reduce existing surface fuel loading levels, remove standing dead and break up contiguous vegetation to create landscape patterns that alter fire spread and provide for firefighter and public safety. Treated areas, in general, would provide places where firefighters can more safely and effectively perform suppression actions thereby limiting the potential for high-intensity fire to spread within and towards the WUI or the Tenmile watershed. Removal of the dead overstory would alleviate the risk of increased future fuel loadings and risk to firefighters/forest workers from falling dead trees. Specifically, intermediate harvest, regeneration harvest, pre-commercial thinning followed by under burning and prescribed fire treatments would contribute to the need for firefighter and public safety as stated above. The level of treatment differs between action alternatives. Alterative 2 proposes

approximately 4,996 of treatment acres that would lead to safer condition as alternative 3 proposes approximately 2,924 acres.

Fire management has evolved over time and fire managers look for opportunities to manage fire for restoration objectives. Reintroducing fire within this landscape is desired in order to move it toward the desired condition as outlined in the LRMP. Strategic placement of treatments (SPOTS) techniques, maximize the effectiveness of fuel treatments in reducing problem fire behavior, adverse fire effects, and suppression costs (Gercke and Stewart 2005). Mechanical and prescribed burn treatments have been strategically located along ridgelines (Continental Divide), along valley bottoms (Sally Ann Cr), conjunction with natural openings/barriers (Bullion Parks/Jericho Mountain), and along roads/trails (Rd 1863/Continental Divide Trail) to allow for safer, more efficient and direct initial attack of unwanted fires by fire suppression forces.

Post treatment fire effects within treatment units with FBFM 121, 122, 161, 181, 183 and 185 show fire behavior conditions of flame lengths to less than 4 feet and surface rate to spread less than 15.2 chains per hour, well within capabilities ground personnel (crews with hand tools) to safely engage in suppression actions under very high fire weather conditions. Post treatment fire effects within treatment units with pre-commercial thinning (FBFM 201 and 202) would increase fire behavior in the short-term (one to two years after thinning). However, once needles, twigs and smaller branchwood begin to deteriorate (three to five years) fire behavior greatly reduces and are well within capabilities ground personnel to safely engage in suppression actions under very high fire weather conditions. Within this time period, fire suppression response would rely on aviation resources or indirect attack to suppress a fire in the pre-commercial thinning units. This suppression strategy would likely be highly successful due to pre-commercial thinning units being well dispersed across the project area and of a relatively small unit size, average of 18 acres. Long-term, pre-commercial thinning greatly reduces the vulnerability of stands to fire, trees are spread widely and crown fires therefore are unlikely to occur (Fahnestock 1968).

Forest Plan Consistency

Forest Plan standards and guidelines would be met with both action Alternatives. The results of this project to fire/fuels meet Forest Plan standards as prescribed fire utilized for resource maintenance and enhancement is an accepted vegetation treatment in all indicated management areas (USDA HNF 1986). Treatment units would break-up contiguous natural fuel as stated in the Forest Plan as a forestwide standard.

Air Quality

Introduction

This analysis describes the existing condition of air quality resource within the project area and evaluates the potential effects of the proposed action and the no-action alternatives.

Information Used

Current Air Quality Emissions in Project Area

The Telegraph Project is located in Powell County, Montana; however, the nearest air quality monitoring site is the Rossiter Pump House site, located at 1497 Sierra Road East, in Helena in Lewis and Clark County. According to Brandon McGuire of the MTDEQ Air Quality Program, the $PM_{2.5}$ concentration varies throughout the year, with the highest numbers in the winter months. Mr.

McGuire advised using data from the Rossiter site. He recommended breaking the data into three groups to show the seasonal variations in $PM_{2.5}$ concentrations site.

Table 82 shows the averaged $PM_{2.5}$ concentrations from the Rossiter Pump House monitoring site.

Table 82. Averaged Daily $PM_{2.5}$ Emissions from Rossiter Pump House Monitoring Site

	November, December, January, February (2010-2012)	March, April, May, June (2010-2012)	July, August, September, October (2010-2012)
Average $PM_{2.5}$ Concentration (µg/m^3)	13.0	5.2	8.6

Powell County is identified as an attainment area for state and federal standards regarding CO, Pb, NO_2, SO_2, PM_{10}, and $PM_{2.5}$. Therefore, this project is exempt from conformity determination (the requirement that federal activities be shown to help communities attain federal air quality standards). The nearest nonattainment areas are Butte, which is located 45 miles to the south-southwest (nonattainment for PM_{10}) and East Helena, which is located 31 miles to the northeast (nonattainment for SO_2 and Pb).

Class I Wilderness Areas

The nearest mandatory Class I Wilderness Areas are the Gates of the Mountain Wilderness, located approximately 28 air miles northeast, the Anaconda-Pintlar Wilderness, located approximately 45 air miles southwest, and the Bob Marshall Wilderness Complex, located approximately 45 air miles northwest of the Telegraph Project.

An IMPROVE (Interagency Monitoring of Protected Visual Environment) site managed by the Forest Service is located in the Gates of the Mountain Wilderness. The collected samples from the IMPROVE site are analyzed for PM_{10}, $PM_{2.5}$, SO_4, NO_3, organic carbon, elemental carbon, dust, and soot. This data helps identify sources that generate pollutants for visibility degradation

According to The Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States: Report V (IMPROVE 2011), the Gates of the Mountain IMPROVE Site showed positive trends in summer concentrations from 2000 to 2008 (Hand 2011). The Gates of the Mountains Wilderness site $PM_{2.5}$ data (2010 to 2011) was obtained from Brandon McGuire of MTDEQ. That data was averaged for the same months as for the MTDEQ data, for comparison purposes and is included in table 83.

Table 83. Daily $PM_{2.5}$ Emissions Gates of the Mountains IMPROVE Monitoring Site

	November, December, January, February (2010-2011)	March, April, May, June (2010-2011)	July, August, September, October (2010-2011)
Average $PM_{2.5}$ Concentration (µg/m^3)	0.8	1.8	2.9

The data from the Gates of the Mountains Wilderness area shows the $PM_{2.5}$ emissions are highest in the summer months, when smoke inducing activities, such as wildfires, are occurring and lowest in the winter months when smoke inducing activities would be the lowest.

Methodology and Scientific Accuracy

Analysis of smoke production was conducted using current versions of FOFEM 5.9.2 (First Order Fire Effects Model), CONSUME 2.1, and SIS (Smoke Impact Spreadsheet Version V V11-30-2004) smoke production models. The use of each model is recommended through guidance specific to Region 1 Forests (Story, 2005) and encouraged by state open burning regulations defining Best Available Control Techniques for prescribed wildland open burning in *ARM* 17.8.601(1)(a)(iii).

Air Quality Affected Environment

Introduction

This section describes the Telegraph Project affected environment in terms of air quality using data from the Rossiter Pump House Monitoring site and the IMPROVE Monitoring site in the Gates of the Wilderness.

Analysis Area

The analysis area for the Telegraph Project includes Airshed 5 (project area) and Airshed 6 which is directly adjacent to the eastern boundary of the project area. (Refer to Telegraph Airsheds Map in project record.) Downwind airsheds within 100 kilometers (62 miles) that could be impacted, including any sensitive areas and mandatory Class I Airshed areas are also included in the analysis. The sensitive areas are defined as population centers, non-attainment areas, schools, hospitals, highways and airports. The nearest downwind sensitive areas adjacent to the project area are Highway 12 East, located approximately 2 miles north, the community of Rimini, located approximately 2.7 miles east, and the community of Elliston, located approximately 4 miles north of the project area. The nearest mandatory Class I Wilderness Area is the Gates of the Mountain Wilderness, located approximately 28 air miles northeast of the Telegraph Project.

Current Air Quality Estimates

The HNF is currently in compliance with all national ambient air quality standards. The air quality in the project area is good to moderate (98 percent of the days in 2012), according to the EPA's Air Quality Index (AQI) Report (EPA 2013a). There are no major heavy industrial areas in the HNF. Existing sources of emissions in the Telegraph Project area include vehicles, road dust, residential wood burning, wood fires, burning of logging slash, and burning for fuel reduction.

There are no Major sources within 25k of the project area that produce more than 100 tons per year of emissions (25k and 100 tons per year are guidance from R1 Smoke Guidance Document for stationary sources that should be disclosed). Other sources (less than 100 tons per year or greater than 25k distance from project area) of emissions within 100 air kilometers of the project area are the cities of Helena and East Helena, Continental Lime Plant in Townsend, Montana Tunnel Mines in Jefferson City, Ash Grove Cement in Montana City, Holcim US Inc. Cement Plant in Trident, Sun Mountain Lumber in Deer Lodge, and the Golden Sunlight Mine in Whitehall, (list is not all inclusive), with vehicle exhaust, residential wood burning smoke, road and agriculture dust, and construction equipment as the primary emitters (Grenon and Story 2009). These emissions from these sources visibly do not impact the project area due to dispersal by predominant winds from the west with very strong wind gradients. Regional wildfire smoke has accumulated within the area during periods of extensive wildfire activity in 1988, 1994, 2000, 2003, 2007, and 2012. The prime source of wildfire emissions is from central and southern Idaho, southwest Montana, and the Bob Marshall Wilderness. Other than wildfire smoke, no additional sources of air quality degradation are expected.

No specific monitoring information is available concerning existing air quality within the Telegraph Project area. The nearest particulate data is from the Rossiter Pump House air quality station, which is located approximately 18 miles northeast of the project area, in Helena, Montana.

Air Quality Environmental Consequences

Effects Common to All Alternatives

There are potential impacts to air quality from prescribed fire occurrences under all alternatives.

Effects Common to All Action Alternatives

The air quality impacts for alternatives 2 and 3 can be divided into two phases. The first phase is the timber harvesting that will take 3 to 5 years for completion and will involve the use of mechanized equipment and hauling. The second phase includes prescribed fires (broadcast, underburn, jackpot, and pile burns) that will also be spread over 5 to 8 years following harvest activities and fuels treatments.

Alternative 1 – No Action

Direct and Indirect Effects

Under this alternative, no treatments would occur, and there would be no anthropogenic emission contribution to degrade air quality. This alternative could, however, increase accumulation of ground fuel causing an increased possibility of high intensity wildfires in the future. This could result in a higher potential for air quality degradation. Wildfires are known to result in high levels of emissions, including greenhouse gases and associated NAAQS violations.

Air quality can be degraded by smoke from wildfires to the point of human illness in some instances. Smoke from wildfire could also cause visual impacts to the surrounding areas and create hazardous driving conditions on adjacent state, county, and Forest Service roads for extended periods of time. Should a stand-replacing wildfire occur, dust emissions, resulting from fire suppression equipment (both on and off roads) could show a marked increase until seasonal rains soak the surface of the burned area.

Air emissions from wildfires burning under the no action alternative (alternative 1) were modeled and table 84 and table 85 show the $PM_{2.5}$ emissions in pounds per acre (lbs/acre) and concentrations in µg/m³ for an estimated 170 acres burned per day wildfire. (MacDonald Pass Fire 2009)

Table 84. Emissions from Wildfire Burning under alternative 1 – No Action (lbs/acre)

PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	CO_2	CH_4
982	833	39	47	10,755	65,140	497

Table 85. $PM_{2.5}$ Concentrations from Wildfire Burning under alternative 1 – No Action (µg/m³)

Downwind Distance from Wildland Fire Scenario (miles)	24-Hour Average $PM_{2.5}$ concentrations (µg/m³)
0.1 (Fireline)	185.26
0.5	93.17
1.0	36.826

Downwind Distance from Wildland Fire Scenario (miles)	24-Hour Average $PM_{2.5}$ concentrations (µg/m³)
2.0 (Highway 12)	24.161
3.0	20.889
4.0 (Community of Elliston)	18.969
5.0	17.359

The modeling results show the $PM_{2.5}$ projected concentrations are 185.26µg/m³ on the fireline and 36.826µg/m³ 1 mile downwind of the fire.

Irreversible and Irretrievable Commitments

There are no irreversible or irretrievable commitments of air quality resources for this alternative.

Cumulative Effects

In an environment such as the Telegraph Project where air mixing and dispersal is robust, past impacts to air quality are not usually evident or cumulative. The HNF is currently in compliance with all national ambient air quality standards. The only effect of alternative 1 on air quality would be the increased likelihood of a high severity wildfire, which could have a short-term effect on air quality, such as localized visibility impacts. If such an event were to take place, the addition of these emissions to existing anthropogenic emissions could break the 35µg/m³ threshold for $PM_{2.5}$ 24-hour concentrations.

Alternatives 2 and 3

Direct and Indirect Effects

Alternatives 2 and 3 have the same type of modeled fuel treatments; jackpot, underburn, broadcast, site prep, and pile burn. Site Prep burning, burning following harvest where the bulk of the canopy was removed. The goal is to reduce logging slash and prepare the site for regeneration. Underburn, or the use of fire to only burn the understory layer beneath the canopy layer, will be used in the precommercial thinning areas. Broadcast burning, a controlled burn where the fire is intentionally ignited and allowed to burn over a designated area will be used in portions of the regeneration harvest and slashing areas of the project. Jackpot burning, which involves igniting the fuels collected from the silvicultural treatments, will be used in the intermediate harvest and some of the regeneration harvest areas. Pile burn, hand or mechanical piling of fuels, generally follows slashing or harvest where slash disposal is needed but broadcast burning is not feasible or desirable.

Smoke impact modeling was conducted for alternatives 2 and 3 using slash fuel loading conditions for the prescription burns and pile burns. Using an average 2.0 mile distance to the nearest receptor (Highway 12 East) acreage was modeled at 200 acres for spring and fall burns (broadcast, jackpot, underburn). For Pile Burning it was estimated there would be 40 pile burns per day, assuming thirty minute ignition-intervals. The piles were modeled as semi-spheres, 40 feet wide by 20 feet high by 80 feet in length and a 20 percent packing ratio. An average 1.0 mile distance to receptors was used for all analyses (table 86).

Table 86. Alternatives 2 and 3 Prescribed Burning Concentrations of Activity Fuels*: Spring and Fall (µg/m³)

Spring Months (March to June) Downwind Distance from Burn Unit (miles)	Spring Months (March to June) 24-hour Average $PM_{2.5}$ Concentrations (µg/m³)	Fall Months (July to October) Downwind Distance from Burn Unit (miles)	Fall Months (July to October) 24-hour Average $PM_{2.5}$ Concentrations (µg/m³)
0.1	39.573	0.1	40.593
0.2	35.512	0.2	35.313
0.3	32.467	0.3	31.965
0.4	29.071	0.4	28.857
0.5	25.315	0.5	25.226
0.6	21.726	0.6	21.472
1.0	15.03	1.0	14.277
2.0 (Highway 12)	10.119	2.0 (Highway 12)	9.516
3.0	8.404	3.0	7.86

*Telegraph Project Smoke Model Results Broadcast, Underburn, and Jackpot Prescribed Burning

For spring burning, projected 24-hour $PM_{2.5}$ emissions are below 15.03 µg/m^3 (24-hour average $PM_{2.5}$ 35 µg/m^3 standard) at all distances greater than 1.0 mile from the burn. For fall conditions, projected 24-hour $PM_{2.5}$ emissions are below 14.277 µg/m^3 (24-hour average $PM_{2.5}$ 35 µg/m^3 standard) at all distances greater than 1.0 mile from the burn. Within those minimum ambient distances the public would be restricted from the area and/or warned about elevated smoke concentrations through multiple avenues such as news releases, signs, and personal contacts and/or area access closures would be implemented (table 87).

Table 87. Telegraph Project Model Results, Pile Burning – Alternatives 2 and 3 Pile Burning Concentrations (µg/m³)

Downwind Distance from Burn Unit (miles)	24-hour Average $PM_{2.5}$ Concentrations (µg/m³)
0.1	71.937
0.5	24.407
1.0	14.148

For the pile burns, projected 24-hour $PM_{2.5}$ emissions are below 14.148 µg/m^3 (24-hour average $PM_{2.5}$ 35 µg/m^3 standard) at all distances greater than 1.0 miles from the burn for the pile burns. Within those minimum ambient distances the public would be warned about elevated smoke concentrations through multiple avenues such as news releases, signs, and personal contacts and/or area access closures would be implemented. The burning would be completed over a 3–8 year period in the spring or fall for prescribed burns and winter for pile burns. Spring burns would likely occur during a period of more wind dispersion than fall due to longer spring daytime length and higher mixing heights. The smoke plumes would likely disperse in a generally easterly direction. $PM_{2.5}$ from burns would not be likely to impact surrounding communities; the community of Rimini is 2.7 miles east of the project area, projected emissions at that distance are 9.48 µg/m^3 or less. Some concentrations of smoke might occur near residences in the project area. This would most likely occur during the burn smoldering phase where smoke could be trapped by nighttime inversions.

Beyond the minimum ambient distances, the smoke concentrations are expected to be within NAAQS and state of Montana air quality standards. The Telegraph Project burns would be coordinated with the Montana/Idaho State Airshed Group. The operations of the Montana/Idaho State Airshed Group are critical to minimize cumulative smoke/$PM_{2.5}$ air quality impacts. The State Airshed Group Monitoring Unit in Missoula evaluates forecast meteorology and existing air quality statewide by individual airshed and specifies restrictions when smoke accumulation is probable due to inadequate dispersion.

During the burn implementation periods, the prescribed burn boss is responsible for conducting a site specific smoke analysis with current weather and air quality conditions prior to ignition. Using that information, the burn boss would determine how many acres can be burned and identify any effects on residents located downwind of the project burn area.

Irreversible and Irretrievable Commitments

There are no irreversible or irretrievable commitments of air quality resources for these alternatives.

Cumulative Effects

In areas with good air mixing and dispersal, air resources are somewhat unique in that the past impacts to air quality are not usually evident or cumulative. The Telegraph Project emissions would be cumulative only with other concurrent local emission sources such as adjacent Forest Service Ranger Districts and/or other Forests prescribed burning on the same day, as well as burning for both agricultural and private forestation needs. There are very few sources of emissions within the immediate area, less than 2 air miles. However, when expanded to the maximum scope of the air quality analysis (up to a 100 air kilometer radius), there exists a possibility that emissions from the cities of Helena, East Helena, Butte, Deerlodge, Anaconda, and Townsend, and Continental Lime Plant in Townsend, Montana Tunnel Mines in Jefferson City, and Ash Grove Cement in Clancy,(list is not all inclusive) vehicle exhaust, residential wood burning smoke, road and agriculture dust, and construction equipment may influence the overall air quality, thus limiting the ability to burn on a given day. Detailed cumulative effects are discussed in appendix C of this report.

Conclusions

The air quality standards are currently showing attainment for $PM_{2.5}$ 24-hour standard in the HNF, according to the EPA's *Air Quality Index Report* (EPA 2013a). The HNF is in compliance with all national ambient air quality standards.

The effect of no action on air quality would be the increased risk of a high severity wildfire, which could have a significant effect on air quality, such as localized visibility impacts and extended duration health hazards. When coupled with existing anthropogenic emissions, the possibility for above standard $PM_{2.5}$ is probable. Implementation of alternatives, as demonstrated in the smoke modeling with incorporated design features, would be in compliance with the Forest Plan by complying with air quality standards by not causing or contributing to any exceedences or violations of Federal or state standards and by cooperating with the Montana Air Quality Bureau in the Prevention of Significant Deterioration (PSD) program and State Implementation Plan (SIP). Smoke concentrations are expected to be within NAAQS and state of Montana air quality standards. The Telegraph Project burns would be coordinated with the Montana/Idaho State Airshed Group, and specific restrictions would be implemented when smoke accumulation is probable due to inadequate dispersion. By incorporating all previously described design features, the Forest Plan direction would be met under all action alternatives, both for forestwide Airshed overall and for the use of prescribed fire in all affected management areas.

Climate Change

Introduction

The primary relationship between forests, forest management, and climate change is the role forests play globally in removing atmospheric carbon that is contributing to global warming. Forests cycle carbon. They are in a continual flux, both emitting carbon into the atmosphere and removing it (sequestration) through photosynthesis. The proposed actions being considered here may alter the rates and timing of that flux within the individually affected forest stands. These changes, however, would be localized and infinitesimal in relation to the role the world's forests play in ameliorating climate change and indistinguishable from the effects of not taking the action. A meaningful and relevant conclusion on the effects of a relatively minor forest management action such as this on global greenhouse gas pools or global climate change is not possible. However, as this is a relatively new public issue and currently of broad interest, the local effects on carbon stores and flux are discussed. Regional, continental, and global factors related to forest's influence on global climate change are also briefly discussed to provide context for understanding the nature of these local effects.

Forest Carbon Cycling and Storage Affected Environment

Analysis Area

The scale of analysis is the project area because this allows for a general discussion of carbon cycles in the area. This scale is far too small to be meaningful to global climate.

Affected Environment

Forests cycle carbon. They are in continual flux, emitting carbon into the atmosphere, removing carbon from the atmosphere, and storing carbon as biomass (sequestration). Over the long-term, through one or more cycles of disturbance and re-growth (assuming the forest regenerates after the disturbance), net carbon storage is often zero because re-growth of trees recovers the carbon lost in the disturbance and decomposition of vegetation killed by the disturbance (Ryan et al, 2010; Kashian et al. 2006).

The majority of the project area can be characterized as dominated by lodgepole pine forests which have been recently killed by the mountain pine beetle (please refer to the Forested Vegetation report). In these areas, forest stands have shifted from a carbon sink to a source. Over time these areas may shift back into a sink stage in their carbon cycle assuming natural reforestation occurs. Other forested stands in the area are dominated by Douglas-fir, with increasing amounts of ladder fuel development in the understory. Generally competition for water and nutrients is high and the trees are susceptible to drought, insects, disease, and fire. At this stage of their development, these stands are estimated to be net carbon sinks. That is, they are likely sequestering carbon faster than they are releasing it to the atmosphere. The strength of that sink has likely been weakened in some stands due to recent scattered tree mortality from the mountain pine beetle infestation in minor components of ponderosa or lodgepole pine. Finally, the third type of stand condition common in the project area is young forests regenerated from past harvest. These stands are also in competition for light and nutrients due to their density, but overall are still growing and are estimated to be net carbon sinks.

Forest Carbon Cycling and Storage Environmental Consequences

Effects Common to All Alternatives

None of the alternatives would have a measurable impact on regional or global climate change trends.

Effects Common to All Action Alternatives

To varying degrees, the action alternatives would alter the rates and timing of the carbon flux cycle within treated stands. The difference between the alternatives in terms of acres treated is minor and in terms of carbon cycles these alternatives are analyzed together.

In the short term, the Proposed Action would remove and release some carbon currently stored in treatment area biomass through harvest of dead trees, thinning of green trees, and other fuel reduction activities, including prescribed burning. A portion of the carbon removed would remain stored for a period of time in wood products (USEPA 2010, Depro et al. 2008). Additionally, motorized equipment used during any of the proposed activities would emit greenhouse gasses. For at least the short term, on site carbon stocks may be lower under the action alternatives than under No Action. Actions such as the proposed intermediate harvest may increase long term carbon storage (Finkral and Evans 2008, North, Hurteau, and Innes 2009, Mitchell et al. 2009) but current research in this field shows highly variable and situational results (Mitchell et al. 2009; Reinhardt and Holsinger, 2010; Ryan et al. 2010).

The pine-dominated forests recently killed by MPB are estimated to be functioning as a net carbon source to the atmosphere. Removal of dead wood would reduce onsite carbon stores. The portion removed as wood products may partially delay carbon release relative to on-site decay rates. The portion burned would hasten release of that carbon to the atmosphere compared to on-site decay rates. These stands would continue to emit more carbon than they absorb and would remain net carbon sources until trees that sequester additional carbon are well established. The proposed reforestation would help ensure these forest stands return to a carbon sink function as quickly as possible. As the stands continue to develop, the strength of the carbon sink would increase until peaking at an intermediate age and then gradually decline but remain positive (Pregitzer and Euskirchen 2004). Carbon stocks would continue to accumulate as the stands mature, although at a declining rate, until impacted by future disturbances.

In Douglas-fir dominated forests, and the young stands regenerated from past harvest, proposed vegetation treatments are intermediate in nature (thinning and/or prescribed burning) which would reduce existing carbon stocks and temporarily reduce net carbon sequestration rates in treated stands. While some stands may continue to function as a sink, in others the reduction may be enough that for the short term stands would emit more carbon than they are sequestering. These stands would remain a source of carbon to the atmosphere (or weakened sink) until carbon uptake by new and remaining trees again exceeds the emissions from decomposing dead organic material. As stands continue to develop the strength of the carbon sink would increase then gradually decline, but remain positive (Pregitzer and Euskirchen 2004).

To the extent proposed actions reduce the risk or delay the event of future stand replacing disturbance events, potential emissions from those events are equally reduced or forestalled. Generally treatments are designed to enhance forest resiliency to disturbances such as wildfire and insect outbreaks; refer to the Forested Vegetation report for more information.

Sustaining forest productivity and other multiple-use goods and services requires that land managers balance multiple objectives. The long-term ability of forests to sequester carbon depends in part on

their resilience to multiple stresses, including increasing probability of drought stress, high severity fires and large scale insect outbreaks associated with projected climate change. Management actions, such as those proposed with this project that maintains the vigor and long-term productivity of forests and reduce the likelihood of high severity fires and insect outbreaks can maintain the capacity of the forest to sequester carbon in the long-term. Thus, even though some management actions may in the near-term reduce total carbon stored below current levels, in the long-term they maintain the overall capacity of these stands to sequester carbon, while also contributing other multiple-use goods and services (Reinhardt and Holsinger 2010).

Alternative 1, No Action

Direct and Indirect Effects

There would be no direct human-induced emissions of carbon into the atmosphere under the No Action alternative. In mature pine dominated forests, a stand-replacing event has just occurred with the mountain pine beetle outbreak. Affected stands are and would continue to function as carbon sources in the short term, with dead trees releasing carbon into the atmosphere as they decompose. This state would continue for up to a decade or more until the rate of forest re-growth, assuming trees regenerate, meets and exceeds the rate of decomposition of the killed trees. As stands continue to develop, the strength of the carbon sink would increase (typically peaking at an intermediate age and then gradually decline, but remain positive) (Pregitzer and Euskirchen 2004). Carbon stocks would continue to accumulate as the stands mature, although at a declining rate, until again impacted by subsequent disturbance. In Douglas-fir dominated forests, stands would likely continue as carbon sinks until the next disturbance event (fire, wind, insect infestation, etc.). When this next stand replacing event (high tree mortality) occurs, the affected areas would convert to a carbon source (emitting more carbon than is being sequestered). Assuming reforestation occurs, these forests would again function as sinks once the rate of re-growth exceeds the rate of decomposition.

For the short term, onsite carbon stocks may remain higher under the No Action alternative than under the Proposed Action. Nevertheless, caution is advised against interpreting carbon inventory maintenance or gains from deferred or foregone timber harvest in any specific forest or stand as affecting atmospheric concentrations of greenhouse gases. This only holds true if harvest does not occur elsewhere in the world to supply the same world demand for timber (Gan and McCarl 2007, Murray 2008, Wear and Murray 2004). The result can be a net carbon impact if the timber is replaced in the marketplace with higher carbon source products such as steel or concrete or is harvested in a manner that does not result in prompt reforestation (Ryan et al. 2010, Harmon, 2009).

The risk of some high mortality disturbance events is greater under the no-action alternative. The long-term ability of forests to persist as net carbon sinks is uncertain (Galik and Jackson 2009). Drought stress, forest fires, insect outbreaks and other disturbances may substantially reduce existing carbon stock (Galik and Jackson 2009). Climate change threatens to amplify risks to forest carbon stocks by increasing the frequency, size, and severity of these disturbances (Dale et al. 2001, Barton 2002, Breashears and Allen 2002, Westerling and Bryant 2008, Running 2006, Littell et al. 2009, Boisvenue and Running 2010). Recent research indicates that these risks may be particularly acute for forests of the Northern Rockies (Boisvenue and Running 2010). Increases in the severity of disturbances, combined with projected climatic changes, may limit post-disturbance forest regeneration, shift forests to non-forested vegetation, and possibly convert large areas from an existing carbon sink to a carbon source (Barton 2002, Savage and Mast 2005, Allen 2007, Strom and Fule 2007, Kurz et al. 2008a, Kurz et al. 2008b, Galik and Jackson 2009). Leaving areas of forest densely stocked, as in the no-action alternative, maintains an elevated risk of carbon loss due to disturbance. Thinning, prescribed fire, and other management actions are often suggested as climate change “adaptation actions” because they may increase forest resilience to these multiple stresses,

and thus increase the likelihood of sustaining forest carbon benefits in the long-term (Millar et al. 2007; Joyce et al, 2008; Ryan et al, 2008). Similarly, providing for prompt reforestation after disturbance ensures that forests become sinks again in the future and can speed carbon recovery. The no action alternative foregoes such climate change adaptation actions.

Irreversible and Irretrievable Commitments

There is increased potential for future stand replacing events such as wildfire or insect outbreaks in the project area as compared to the action alternatives. Such an event could lead to atmospheric release of carbon stored, with potential long-term impacts to carbon storage in the event that natural regeneration of forests does not occur or is delayed.

Cumulative Effects

Neither the No Action alternative nor the action alternatives would have a discernable impact on atmospheric concentrations of greenhouse gases or global warming, considering the limited changes in both rate and timing of carbon flux predicted in the affected acres and the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities contributing to that pool.

Alternative 2

Direct and Indirect Effects

Please refer to Effects Common to All Action Alternatives. The trends described would occur on 6,754 acres, primarily regeneration harvests in dead lodgepole pine forests (3,484 acres), with some intermediate harvest (434 acres), pre-commercial treatments in young regenerated stands (1,786 acres), and prescribed fire treatments or fuel hand treatments (1,050 acres). Prescribed fire would also be used following harvest on some of the regeneration and intermediate harvest areas.

Irreversible and Irretrievable Commitments

No irreversible commitments have been identified. Irretrievable commitments would be a change, or rate of change, to carbon stored and released in the project area.

Cumulative Effects

Neither the no-action alternative nor the action alternatives would have a discernible impact on atmospheric concentrations of greenhouse gases or global warming, considering the limited changes in both rate and timing of carbon flux predicted in the affected acres and the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities contributing to that pool.

Alternative 3

Direct and Indirect Effects

Please refer to Effects Common to All Action Alternatives. The trends described would occur on fewer acres than with alternative 2 (4,185 acres), including regeneration harvests in dead lodgepole pine forests (1,856 acres), with some intermediate harvest (434 acres), pre-commercial treatments in young regenerated stands (1,289 acres), and prescribed fire treatments or fuel hand treatments (606 acres). Prescribed fire would also be used following harvest on some of the regeneration and intermediate harvest areas.

Irreversible and Irretrievable Commitments

No irreversible commitments have been identified. Irretrievable commitments would be a change, or rate of change, to carbon stored and released in the project area.

Cumulative Effects

Neither the no-action alternative nor the action alternatives would have a discernible impact on atmospheric concentrations of greenhouse gases or global warming, considering the limited changes in both rate and timing of carbon flux predicted in the affected acres and the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities contributing to that pool.

Conclusions

Although not a statutorily defined purpose of National Forest System management, forests do provide a valuable ecosystem service by removing carbon from the atmosphere and storing it in biomass (Galik and Jackson, 2009). U.S. forests are a strong net carbon sink, absorbing more carbon than they emit (Houghton 2003; US EPA 2010, pg. 7-14, Heath et al. 2011). For the period 2000 to 2008, U.S. forests sequestered (removed from the atmosphere, net) approximately 481.1 teragrams (Tg) of carbon dioxide per year, with harvested wood products sequestering an additional 101 Tg per year (Heath et al. 2011). Our National Forests accounted for approximately 30 percent of that net annual sequestration. National Forests contribute approximately 3 Tg carbon dioxide to the total stored in harvested wood products compared to about 92 Tg from harvest on private lands. Carbon flux rates have not yet been calculated for the HNF, but the extensive recent disturbances from bark beetles and forest fires would have sharply weakened the pre-disturbance sequestration rates.

The entire HNF represents about fourteen one hundredths of one percent (0.0014) of approximately 44,931 Tg of carbon stored in forests of the coterminous United States (Heath et al. 2011). The proposed project would affect only a tiny percentage of the forest carbon stocks of the HNF, and an infinitesimal amount of the total forest carbon stocks of the United States.

Within the United States, land use conversions from forest to other uses (primarily for 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 (Ryan et al. 2010, Conant et al. 2007). The affected forest lands in this proposal would remain forests, not converted to other land uses, and long-term forest services and benefits would be maintained.

Forested Habitats of Special Concern

Introduction

This report discusses the ecology of special vegetation habitats. The complexity of ecosystems is not fully understood by the best available science. While research and experience provides managers ever-increasing knowledge, there is unavailable and incomplete information. This analysis is based upon best available science and professional judgment. Habitats of special concern are unique habitats or species that are rare, in decline, and/or ecosystem indicators. These habitats have been identified by specialists, the Forest Plan, and previous analyses in conjunction with public comments:

- Old Growth
- Snags
- Whitebark pine

- Aspen

Ponderosa pine is typically addressed as a species of concern. However, ponderosa dominance types (PIPO and PIPO-IMix) are present on less than 1 percent of the Project Area and Combination Boundary. Similarly, the dry biophysical setting (PPDF1) where ponderosa pine has the potential to be a component is only present on 1 percent of the project area and 2 percent of the combination boundary. Ponderosa was not noted in any treatment unit diagnoses. A review of the R1 Summary Database shows only an estimated 24 trees per acre of ponderosa pine at both the Combination Boundary and Project Area scales. Because there are so few areas in the analysis boundaries where ponderosa pine can be expected to be a substantial component, this species is not addressed in detail in this report. Design criteria for the action alternatives are included to retain ponderosa pine if it is encountered. Therefore there is no measurable impact to ponderosa pine with any alternative. Similarly, juniper is also commonly a forested species of special concern. However little to no juniper is present in any of the analysis areas and it is not analyzed in detail. This report focuses on existing condition and effects to structure, composition, sustainability, and disturbance regimes of special habitats.

Assumptions

Assumptions reviewed in other Vegetation reports apply. Especially pertinent is the assumption that tree species evolved with different fire frequencies; ponderosa pine, aspen, and whitebark pine are seral species that rely on fire to maintain viability. In Telegraph these species occur in habitat types where without disturbance more shade tolerant species become dominant as succession progresses. Fire suppression has disrupted natural fire frequencies leading to undesirable conditions for these species.

- The assumptions used for the old growth analysis also include:
- Green et al. (1992) minimum tree characteristics are appropriate to define old growth.
- Managed old growth does not have to meet minimum tree characteristics per Green et al. (1992) to be managed as old growth to meet the Forest Plan standard.
- Complete stand examinations represent the best data available for stands. These data are appropriate to determine individual stand characteristics.
- The algorithm (R1 Old Growth Utility, FSVeg) is the best tool available to identify stands that have old growth characteristics.
- Old growth characteristics that occur in stands less than 10 contiguous acres are not identified as old growth. 10 acres is the minimum size per the Forest Plan.

The snag analysis assumes that Aerial Detection Surveys (ADS) provide a reasonable estimate of trees killed by bark beetles. To provide a conservative and simple analysis, it was assumed that no snags would be left by harvest even though design criteria specify snag retention goals. In addition, some snags would be created by prescribed burning; however, these levels are not estimated quantitatively.

Information Used

Please refer to the Vegetation Introduction for more detailed information concerning information sources.

- The FSVeg database houses statistical vegetation data, including:

- *Landscape-level FIA (Forest Inventory Analysis*). This data, along with intensification plots, was used to statistically estimate old growth at various scales.
- *FIA grid intensification plots*. The HNF intensified the base FIA grid 4x using the same protocols to provide data at the mid-scale.
- *Stand examination data*. These statistical stand-level examinations were run through the R1 Old Growth report utility. Based on walk-throughs, informal plots, and review of data, several units were identified where new exams were needed to determine whether they are old growth. These exams were conducted in 2010 according to R1 CSE protocols.
- *R1 Old Growth Report Utility*: This utility in FSVeg produces the Region 1 FSVeg Old Growth Report based on the Region's old growth definition and minimum criteria (Green et al. 1992). Associated characteristics such as vertical structure, snags, live trees with broken tops, downed logs, and live trees with decay are also considered. The utility includes a future condition determination in which 10-year increments are added to the age of the trees to predict when the stand might become old growth. No mortality is modeled.

- *Summary Database*: The HNF developed a forestwide summary database which includes the data from all available base FIA and intensification plots, including recent re-measurements.
- *FACTS* (Forest Activity Tracking System) is the current activity database. Spatial Data Engine (SDE) is the spatial component of FACTS to facilitate GIS analyses.
- *Silvicultural diagnoses* were done in 2008 for every proposed treatment unit. Site-visit notes from other specialists were also used where available and applicable.
- *GIS covers* and associated tabular data housed in the HNF GIS library were used, such as management areas, drainage boundaries, and photographic imagery (NAIP).
- *Region 1 Aerial Detection Survey (ADS) data* provided by the Forest Health and Protection Group in Missoula, Montana was used to document pest trends. At the third-order drainage scale, ADS information was combined with proposed treatment areas to analyze effects to snags.
- *References and literature sources* were reviewed. Concerned members of the public submitted additional literature citations; these were reviewed and, where applicable, included in analysis.

Methodology and Scientific Accuracy

This analysis is based on the best available science and acknowledges that there is incomplete and unavailable information. "*Scientific uncertainty, incomplete information, and controversy among experts are inescapable facets of the scientific process*" (Clarke 2006). Uncertainty arises from factors such as complexity, natural variability, random variation, measurement error, and lack of knowledge (Clarke 2006). Elements of uncertainty are considered qualitatively. Policy measures designed to deal with uncertainty include public participation, interdisciplinary processes, and monitoring.

There are a series of tables that display numbers of acres and percentages. All raw numbers and calculations can be found in the Project file. The values shown are rounded; as a result sometimes the total is slightly less or more than the actual total; in these cases, an acre or percentage was added to or subtracted from the largest value. GIS analyses are done at various scales, which involves joining various data layers. The data outputs are exported as spreadsheet files and summaries done using pivot tables. The raw data often contains multiple "acre" columns. The acre column the farthest right in each data set is the column that is updated after unions are performed in GIS and used for all summaries.

The presence and condition of whitebark pine and aspen is derived from multiple data sources including the HNF summary database, VMap, site visits, and stand examinations. The ecology of these species and habitats is well-researched and documented; available science was used to assess the sustainability of the current condition and the effects of proposed treatments. *Methodologies for snags and old growth are more complex and are addressed in detail under the Affected Environment sections of this document*.

Please refer to the Vegetation Introduction for more detailed information concerning scientific accuracy. The data sources used are summarized as follows for scientific accuracy:

- *FIA and FIA Intensification Plots*: FIA plots are used at broad scales. The data is not represented spatially but provides statistically reliable estimates. FIA plots are maintained at the National level on a periodic re-measurement schedule (USDA 2004b).
- The latest *R1 Summary Database Estimator* tool was used, selecting the most recent 4x intensification dataset for the HNF (USDA 2008).
- *Stand Examinations*: Stand exams are used at the stand-level. They are taken according to R1 CSE protocols and quality checks are performed. The data is statistically reliable within a stand. Stand exam data does not exist for every stand. Several new exams were conducted in 2009.
- *R1 Old Growth Report Utility*: The R1 Inventory & Analysis team uses a program to eliminate potentially non-viable exams. The report provides a summary of critical statistics for the stand. The algorithm behind this report was prepared by Renate Bush, Northern Region Timber and Range Management Inventory and Analysis expert. Only full field stand exams were used. Stands that had been harvested or burned were not included. The same algorithm is used with FIA data. The accuracy of this process is further documented in the project file (USDA 2004b).
- *FACTS/SDE*: FACTS is frequently updated and represents the best data available concerning activities. FACTS does not contain information prior to the 1950's generally because accurate records prior to that time were not kept. Site visits are used to verify past activity.
- *Silvicultural diagnoses*: Diagnoses were done in 2008. Documentation for each proposed unit includes a summary of vegetation structure and condition, insect activity, habitat type, evidence of past harvest, snag conditions; informal plots; old growth assessment; and photographs.
- *ADS*: Aerial Detection Survey methods and accuracy are well-documented and accepted as a viable way to map and monitor insect and disease activity.
- *Literature/References*: The best available science was reviewed, including citations provided via public input. Peer reviewed documents were selected when possible.

Cumulative Effects Methodology

The geographical analysis area for cumulative effects is the Project Area because that is where the effects to special habitats can be examined at the fine scale (stand or treatment units) and because the analysis would yield immeasurable trends at larger scales. The temporal bound of past activities is limited to the 1950s due to lack of earlier records in FACTS. The future extent of foreseeable activities is limited to projects that are listed in the SOPA. For all activities, effects are described qualitatively in the short term and long term. Where data exists, the indicators and measures presented in the Introduction to this report are assessed quantitatively. For past activities, "Harvest" includes regeneration and intermediate harvest. "Fuels activities" include activities such as prescribed fire, hand slashing, and pile burning. Activity acres often overlap; the acres reported reflect multiple entries additively. For example, a 30-acre stand may have a harvest, followed by an underburn; this sequence would be reported as 60 acres. The actual "footprint" of activity is 30 acres.

The existing condition incorporates the results of past activities as measured using remote sensing, ADS, FIA and grid intensification plots, stand examinations, and field diagnoses. Out of the comprehensive cumulative effects table, only the activities with potential effects to special habitats are included in this report for detailed analysis. See the project file for a full listing of all activities considered, and the rationale for their inclusion or exclusion from this report. Cumulative effects are addressed in a single section at the end of the document for all of the habitats of special concern.

Old Growth Affected Environment

Introduction

Old growth is a late-stage state of mature forest important for habitat and diversity; this state is not static and as old growth dies it is replaced by younger forests growing older. Old growth management includes protecting existing old growth and promoting sustainability of younger forests as potential future old growth. Old growth habitat involves not only the age of a forest but also structural and functional 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 et al. 1995). At the landscape scale forests exist in a mosaic of patches of different ages since the last disturbance. For high elevation forests, the majority of the landscape would historically not have been very old at a given time due to fire cycles (Johnson et al. 1995). The landscape level processes that create this mosaic may often be beyond the manipulation or control of managers (Johnson et al. 1995).

Green et al. (1992) definitions of old growth are utilized consistently in Region 1 and the HNF. Old growth criteria were developed based on a National definition that old growth forests are ecosystems distinguished by old trees and related structural attributes; they encompass the later stages of stand development that typically differ from earlier stages in characteristics such as tree age, tree size, and number of large trees per acre and basal area (Green et al. 1992). Old growth is stratified based on habitat type groups.

The old growth resource in the Telegraph has been impacted by the mountain pine beetle (MPB). Prior to the outbreak, the bulk of old growth stands identified by the R1 Old Growth utility were dominated by lodgepole pine. Based upon the extensive MPB-caused mortality, these stands no longer provide old growth habitat. The project is designed to ensure that no treatment occurs in old growth; therefore there is no direct effect to old growth with any alternative. However, indirect effects could occur by changing vegetation characteristics in stands that could grow into old growth someday, and by treating adjacent to old growth stands. The following measure will be used to evaluate indirect impacts to old growth for each alternative: *Acres of Old Growth Adjacent to Treatment Units.*

Analysis Area

The analysis areas for old growth are the third order drainages associated with the project (**1106B, 1107,** and **1108-1**) because that is the scale that applies to the Forest Plan standard. These drainages are encompassed by the Combination Boundary but extend beyond the Project Area. Also, old growth is estimated for the Forest, Divide Landscape, Project Area and Combination Boundary to provide additional habitat context. Please refer to the Vegetation Introduction for a summary of these scales. Potential old growth at the fine scale, within treatment units, was also addressed for the effects analysis.

Old Growth Methodology

Old growth is designated primarily where there is available data. Per the Forest Plan, old growth is assessed at the third order drainage scale. The stand exam inventory is used to identify old growth stands; this sample is biased because it targeted productive stands with a high probability of containing commercial timber. The inventories therefore reflect a minimum amount of potential old growth. Old growth is not a static condition; however, frequent re-measurement or expansion of the inventory is prohibitive. Designations are re-examined at the project scale when treatments are proposed. When stand characteristics change substantially due to factors such as insects, disease, or wildfire, the stand is no longer considered old growth. Please refer to the project file for more detailed information (USDA 2012c).

The first step taken is modeling to identify old growth. The R1 Inventory Analysis Team ran the FSVeg utility that compared exam data with FACTS to determine if exams were still representative. “Clean” stands were run through the R1 Old Growth Utility in FSVeg to identify old growth (USDA 2010b). This report identifies stands that meet minimum criteria. The results of the algorithm were combined with GIS layers including third order drainage boundaries, past activities, and insect aerial detection surveys (ADS). Stands identified as old growth are checked to determine if changes have occurred since the exam. Non-adjacent stands smaller than 10 acres are eliminated; however, these small areas are checked against proposed treatments to determine if a proposal may affect old growth.

Each third order drainage affected by the proposal is then assessed. Old growth is identified to represent 5 percent of the drainage. Stands known to be old growth based on the algorithm at least 10 acres in size (or smaller in adjacent groups) are designated first. Old growth in excess of 5 percent is not designated to manage as old growth per the Forest Plan, but remains identified as old growth for purposes of habitat analyses. The criteria used for selection includes age (oldest); size (largest stands or contiguous areas); elevation (below 6,000 feet); riparian areas; and management area (not T-1 through T-5); and non-pine forest types in areas heavily infested with MPB. The other Forest Plan prioritization criteria are used when possible but often the limited amount of old growth and/or data available does not offer abundant choices. Also, the topography of a given watershed does not always provide abundant riparian or areas below 6,000 feet. These criteria are meant to provide a prioritization guide when possible, and are used as such. If old growth identified by the algorithm do not constitute 5 percent, additional areas are designated which may not meet old growth definitions yet, but are the “next best thing.” The Forest Plan criteria (oldest, largest, riparian, non-timber emphasis) are applied to determine the “next best thing.” The inventoried stands that best meet the most considerations are selected to designate for old growth management. Remote imagery, photo interpretation, and strata/habitat type information may also be used to designate old growth.

Designation in the Telegraph area was challenging due to high landscape homogeneity, dominated by dead and dying lodgepole pine affected by the MPB. Stands with exams were selected where available, with the exception of mature lodgepole pine impacted by the MPB. In some cases, young lodgepole pine stands, and stands without exams, were selected where no better options were available. All stands were reviewed with aerial photography and past activity layers. Additionally, in 2010, a sample of designated old growth stands had walk-through surveys done to assess whether conditions had changed since designation. These stands were relatively unchanged, or still the most viable next-best-thing option for designation.

Next, proposed treatment units were evaluated to assess whether they could be old growth, particularly where there is no stand exam available. Diagnoses were done in 2008 which identified areas where exams were needed to determine if the site was old growth. In 2010, stand exams were conducted where the potential for old growth was identified. Some of these are located within third

order drainage boundaries, and some are not. The determination of old growth is important for not only for Forest Plan Consistency, but also for wildlife habitat, and other project objectives and design. None of these areas were old growth based on the results of the R1 Old Growth Utility run against the new data.

Old growth is identified and mapped at the stand level; however, it is also useful to estimate amounts at broad scales. The Summary Database can be used to make statistically viable estimates.

Old Growth Estimates at Broad Scales

Polygons of old growth are identified at the stand level to meet Forest Plan standards and spatially depict habitat, and will be addressed in subsequent sections. However, it is also useful to estimate the broad scale amount of old growth with statistically viable FIA grid intensification plots. Because this data is on a grid basis, polygons of old growth cannot be delineated from the data alone; in other words, a plot of old growth does not necessarily map into a stand of old growth. The data does provide a good estimate of the abundance of old growth at various scales of interest. All estimates are at 90 percent confidence and plots that have been burned or harvested since inventory are excluded. The bounds around the Project Area estimate are very wide due to fewer 4x plots being available at that scale. The amount of old growth has dropped in the last few years due to MPB. The R1 Summary Database has captured much of this change due to live/dead re-measurements that have occurred.

Table 88. Summary Database Old Growth at Multiple Scales

Analysis Scale	Old Growth Estimate	Lower Bound	Upper Bound
HNF – Forest Wide	8.4%	6.7%	10.1%
Divide Landscape	9.8%	6.2%	13.6%
Telegraph Combo Area	11.1%	5.6%	18.1%
Telegraph Project Area	12.5%	0.00%	25%

Because there is more old growth estimated by broad grid plots than in polygon identification, we can conclude that there is additional old growth on the landscape than we have located through purposive stand level examinations. It is for this reason that additional data is collected within proposed treatment areas to assess whether previously “unknown” old growth would be impacted by management.

Old Growth Polygons in Third Order Drainages and the Project Area

There are (3) third order drainages associated with the project: 1106B, 1107, and1108-1. Five percent of each has been designated to be managed as old growth, selecting known old growth or the “next-best thing.” The acres used only include Forest Service ownership. The availability of data, topography, and existing conditions required some stands to be selected that do not meet all the prioritization criteria in the Forest Plan. These criteria are meant to aid in selection when choices are available; they were used as such but choices were limited. Please refer to appendix E of the Forested Habitats of Special Concern report for a map of old growth.

Table 89. Designated Old Growth Stands in Third Order Drainages

3rd Order Drainage	Type	Stand I.D.	Elevation (feet)	Habitat Type Group	Is OG today?	Acres
1106B	PSME	33701013	6,462	D	Yes	19
2,792 acres	PIEN-ABLA	33701020	6,740	D	No	27
	PIEN-ABLA	33701025	6,133	G	Yes	7
	PIEN-ABLA	33701028	6,217	D	No	7
	PIEN-ABLA	33701038	6,362	G	Yes	22
	PIEN-ABLA	33701257	6,629	F	No	12
	PSME	33702027	5,972	B	No	16
	PIEN-ABLA	33702071	6,522	F	No	9
	PIEN-ABLA	33702091	6,100	G	No	24
	PIEN-ABLA	33702102	6,497	D	No	16
159 Acres						
1107	PICO	33801005	6,388	H	No	91
7,302 acres	PIEN-ABLA	33801024	6,246	H	No	26
	PIEN-ABLA	33801028	6,251	H	No	9
	PIEN-ABLA	33801042	5,928	F	Yes	33
	PICO	33801050	6,383	H	No	13
	PICO	33801078	6,579	G	No	9
	PICO	33802029	6,056	A	No	16
	PICO	33802030	6,462	A	No	15
	PSME	33802180	6,085	D	No	7
	PIEN-ABLA	33802191	6,727	D	No	12
	PSME	33802218	5,750	D	No	17
	PSME	33802219	5,981	B	Yes	10
	PSME	33802220	6,073	D	No	10
	PIEN-ABLA	33803047	5,909	E	No	24
	PSME	33803052	6,308	B	No	8
	PIEN-ABLA	33803061	6,206	D	No	36
	PICO	33804010	6,887	H	No	30
365 Acres						

3rd Order Drainage	Type	Stand I.D.	Elevation (feet)	Habitat Type Group	Is OG today?	Acres
1108-1	PICO	34601009	6,707	H	No	34
12,557 acres	PSME	34602028	6,176	F	No	16
	PIEN-ABLA	34601072	6,711	F	No	14
	PSME	34601073	7,007	F	No	89
	PIEN-ABLA	34601078	6,746	G	Yes	20
	PIEN-ABLA	34601079	6,504	G	Yes	14
	PIEN-ABLA	34601080	6,603	F	No	38
	PIEN-ABLA	34601081	6,795	E	Yes	22
	PSME	34601084	6,425	F	Yes	16
	PIEN-ABLA	34601087	6,145	F	Yes	11
	PSME	34601089	6,386	F	No	23
	PIEN-ABLA	34602018	6,407	H	No	22
	PIEN-ABLA	34602020	6,237	H	No	7
	PIEN-ABLA	34602021	6,423	H	No	8
	PIEN-ABLA	34602027	6,304	G	Yes	7
	PIEN-ABLA	34602068	6,463	H	No	8
	PIEN-ABLA	34602072	6,255	H	No	7
	PIEN-ABLA	34602100	6,565	F	Yes	14
	PIEN-ABLA	34701053	6,369	F	Yes	13
	PSME	34701137	5,886	E	No	10
	PIEN-ABLA	34701140	5,869	E	Yes	14
	PSME	34701145	6,174	B	No	38
	NONE	34702003	6,977	G	No	48
	PICO	34702098	7,095	F	No	37
	PICO	34702100	6,746	E	No	43
	PICO	34702104	6,595	F	No	44
	PIEN-ABLA	34702113	6,500	D	No	15
						635 Acres

Most of the old growth is at over 6,000 feet because there are few areas below 6,000 feet in these drainages. Most is dominated by spruce/fir, with several Douglas-fir stands designated as well. Some

younger surviving lodgepole pine stands are designated because there were no other options. Only 222 acres of the designated old growth across these drainages currently meet Green et al. (1992) characteristics today; the rest are “next-best-thing” because there were no other known old growth stands to select. As previously stated, old growth designation in these watersheds was challenging due to the preponderance of lodgepole pine forests recently killed by MPB.

Most of the old growth identified within the project area through stand examinations also lie in third order drainages. However, several stands are identified as old growth per stand exam data near the north edge of the project boundary. These stands are not designated for Forest Plan purposes because they are not in a third order drainage. However the stands provide additional old growth habitat.

Table 90. Non-Designated Old growth within Project Area, but Outside Third Order Drainages

Type	Stand ID	Habitat Type Group	Acres
PSME	33802072	E	18
PSME	33802275	D	7
PSME	33802092	A	8
PSME	33802077	B	3
PSME	33802062	D	3
PSME	33802076	B	7
PSME	33802073	B	4

Many lodgepole pine old growth stands were identified from earlier stand exams; however these have been killed by MPB and are no longer considered old growth. The old growth that remains identified is dominated primarily by Douglas-fir, Engelmann spruce, and/or subalpine fir. Please refer to Appendix 1 of the Forested Habitats of Special Concern report. The old growth outside of the third order drainages is labeled as “non-Forest Plan old growth.”

Old growth by virtue of its characteristics is vulnerable to a variety of mortality agents; see the Forested Vegetation report for more information. Pine-dominated old growth is (or was) at high risk to MPB because it has high density and is dominated by pines greater than 10 inches diameter. Similarly, most old growth with Douglas-fir is at high hazard to the Douglas-fir beetle (DFB) due to the presence of large, old, dense trees and high density. Western spruce budworm (WSB) is actively defoliating Douglas-fir, spruce, and subalpine fir, contributing to stress which can predispose stands to beetles. Dwarf mistletoe (DMT) is a parasitic plant that interacts with other stressors to contribute to mortality in lodgepole pine. Root diseases may also be present in old growth because Douglas-fir in particular is a susceptible species, and older trees and high density stands are at higher risk than younger, more open stands (USDA 2002b). Also, old growth is susceptible to fire due to a multi-layered condition; dense, connected crowns; and high amounts of downed debris. Finally, old trees may simply die from competition. Old growth is not a static phenomenon; it dies and is replaced as younger stands age. The processes that create old growth vary with site, disturbance regime, and ecology of tree species; drier ponderosa pine and Douglas-fir types developed under a more frequent disturbance regime (Arno et al. 1995, Tesch 1980) while higher elevation lodgepole types were largely established from stand-replacement events (Arno et al. 1993). Habeck (1988) emphasizes the importance of conserving old growth to represent the range of ecosystems on a landscape.

Old Growth Environmental Consequences

Effects Common to All Alternatives

There is no treatment proposed in old growth with any alternative. 5 percent of each third order watershed has been designated to manage as old growth. While it is not known site specifically where all statistically estimated old growth polygons may be, diagnoses and stand exams show that it does not occur in any proposed treatment unit. All old growth would continue to develop successionally under all alternatives.

Under all alternatives, succession would continue. In Douglas-fir old growth, more small trees would develop in the understory as fuels accumulate from trees that die (Fischer and Clayton 1983, Morgan et al. 1994, Brown et al. 2004). Closed canopies would remain closed, and open stands would become closed over time. These stands are susceptible to DFB, WSB, and root disease. Spruce/fir old growth would be similarly susceptible to WSB and root disease. Diseases would continue to operate at current levels. In lodgepole pine succession without frequent fire can be a natural progression (Lotan and Perry 1983); stands may have rare, large fires that kill the overstory. Stand-replacement fire is not uncommon in these forests, but the effect of having a large amount of forest with closed canopies would likely be that large, continuous areas would be converted to early seral forests (Keane 2002 et al., Brown et al. 2004).

The effects of a wildfire on old growth not adjacent to proposed treatment units would not be substantially altered by any alternative. Should a wildfire would move through untreated portions of the project area, stand replacing events could occur in old growth. When wildfires occur, stands with a substantial dead and down component, multi layers in the canopy and large areas of closed canopy would likely be substantially consumed (Brown 2000, Keane et al. 2002, Brown et al. 2004). Tree losses could also occur because of hazardous insect/disease conditions, and old growth would be replaced by younger stands over time.

Effects Common to All Action Alternatives

There is no treatment proposed in old growth with any Action Alternative. However, all action alternatives include treatment units adjacent to old growth. The effects of a wildfire may be less severe in treated stands. Studies have shown that similar treatments produce characteristics that limit fire intensity and increase the resistance to mortality (Brown et al. 2004; Scott and Reinhardt, 2001; Perry et al. 2004; Hummel and Agee 2003). Those characteristics include reducing surface fuels to limit flame length, increasing the height to flammable crown fuels, decreasing crown density by thinning overstory trees, keeping large trees of fire-resistant species (Hummel and Agee, 2003). Fire moving through treated areas would more likely be a surface fire upon entering old growth. The fire may travel back into the crowns in old growth depending on structure and burning conditions. Specific effects would vary widely depending; however, it is reasonable to conclude that a fire entering as a surface fire may have less severe impacts on old growth than one entering as a crown fire. Treatments would also create a mosaic of stands on the landscape with lower hazard to insects, helping to lessen insect populations in localized areas. Strategic placement of treatments may help to preserve old growth where it exists.

Additionally, the action alternatives have implications for the processes that form old growth, including succession, fire, insects, disease, and windthrow. These processes would continue and give rise to future old growth in untreated areas. Management of old-growth must be based on the acceptance and anticipation of change; managers should consider old growth management at the broad scale, designing landscapes containing a mixture of communities, processes and structures characteristic of natural conditions (Foster et al. 1996) . Telegraph contains a preponderance of

homogeneous structures; treatments would promote a mosaic which can support a mixture of processes and structures.

At the stand level, management of younger forests can help them become old growth in the future. Cochran and others (1994) found that thinning may be used to accelerate development of stands to have old growth characteristics. Treatment would enhance the resiliency of forests to insects, disease, and fire. Lindh and Muir (2004) found that pre-commercial thinning can encourage old growth characteristics; quantitative differences between young and old stands suggest that old-growth composition may be achieved and hastened by manipulation of stand density. Another study in the Pacific Northwest found that active management (repeated thinning) can speed the development of attributes associated with old-growth (Latta and Montgomery 2004), although the full complexity and attributes of old growth are not entirely understood or replicable (Montgomery et al. 2006). Because old growth can also develop from un-thinned forests (Lindh and Muir 2004), it is appropriate to include both treated and untreated areas when considering long-term objectives of old growth.

Alternative 1, No Action

Direct and Indirect Effects

Old growth, and younger stands that may become old growth, maintain existing condition and hazard to insect, disease, and wildfire. Insects would continue to spread according to susceptibility and current trends. The current distribution of age classes, species mixes, and within-stand and across-landscape structural homogeneity would be maintained. Potential future old growth is maintained in a fairly dense condition subject to stress and mortality. No treatments would occur adjacent to existing old growth.

Irreversible and Irretrievable Commitments

Forests typically regenerate following disturbance, so irretrievable conditions would not likely result from wildfire, insects, or diseases. The irreversible, short term effect to these agents could be a loss of the existing old growth. In the event of stand replacement from a disturbance, it would take over 150 years for stand structures to develop that are similar to those that exist today. The loss is not irretrievable because eventually younger stands would grow to become old growth, although not necessarily in the same abundance, forest type, or landscape pattern currently in place. The available mosaic of structures on the landscape to allow for a variety of old growth formation processes is fairly limited because of the recent widespread mortality caused by MPB.

Alternative 2

Direct and Indirect Effects

Approximately 6,754 acres would be treated. **669** acres of old growth are at least partially adjacent to these proposed treatments. Fire entering old growth from treated areas is more likely to be a surface fire. Additionally, all treated acres would be more resilient to disturbance and represent potential future old growth. The fire behavior on the project area as a whole is lessened, resulting in a lower chance of younger stands that may become old growth being lost. Landscape heterogeneity in age class and structure is enhanced, providing for a mix of old growth creation opportunities over time via natural processes. Intermediate harvests and pre-commercial thinning would create resilient conditions conducive to the more rapid development of old growth conditions (Lindh and Muir 2004; Latta and Montgomery 2004; Cochran et al. 1994).

Irreversible and Irretrievable Commitments

There would be no irreversible or irretrievable commitments. No treatment would occur in old growth. None of the processes that form old growth would be eliminated from the landscape. Forests would be regenerated following regeneration harvest and may develop into old growth someday; these stands have been killed by MPB so the potential to achieve old growth is not materially different between alternatives. Similarly, intermediate harvests and prescribed fire would alter stand conditions but not preclude treated stands from developing old growth characteristics in the future. Proposed treatments would modify wildfire behavior adjacent to old growth to lessen the probability that it could be lost in the event of a wildfire.

Alternative 3

Direct and Indirect Effects

Treatment would occur on 4,185 acres with **456** acres of old growth at least partially adjacent to proposed treatments. The discussion for alternative 2 applies, with the effects occurring to a lesser extent.

Irreversible and Irretrievable Commitments

Please refer to the discussion for alternative 2; the principles are the same with effects occurring to a smaller extent because fewer acres would be treated with alternative 3.

Old Growth Direct and Indirect Effect Conclusions

All alternatives are consistent with the old growth standard in the Forest Plan because 5 percent of each third order drainage affected by the project has been designated to manage as old growth.

Snags Affected Environment

Introduction

Snags are abundant across all scales of interest due to MPB. Estimates of Snag Densities for Eastside Forests in the Northern Region (Bollenbacher et al. 2008) utilizing Eastern Montana snag data provides a replacement for the Northern Region Snag Protocol for eastside Montana forests in Region 1. The information provided does not set forth required direction but rather provides current snag data and analysis for consideration by Forests (Bollenbacher et al. 2008). The information presented was used to describe snags at the Forest scale. This publication is the best available science to help guide snag management, and aids Forests in determining realistic snag management targets within the Forest Plan framework.

At the Forest, landscape, and third order drainage scales, the HNF summary database was used to derive estimates of snags per acre by size classes consistent with the Forest Plan.

Forest Plan consistency is assessed at the third order watershed scale. ADS bark beetle infestation data was combined with drainage boundaries and proposed treatment areas to describe snag conditions pre-and post-treatment. The ADS layer includes an estimate of the number of trees killed on polygons where bark beetle activity was seen. This data was averaged for the scale of interest to generate an estimate of average TPA of snags. For simplicity and to provide a conservative analysis, post-treatment estimates were made assuming all the snags are cut from all harvest units. Using ADS, the analysis subtracted beetle-killed snags within units from the total, and the remaining dead trees averaged for the watershed. The result was an average snags per acre estimate reflecting trees recently killed by bark beetles.

The indicator for effects to snags correlates to the Forest Plan standard of providing for a minimum of two snags per acre at the third order drainage scale. The measure to compare alternatives is an *estimate of snags per acre for each third order drainage utilizing ADS*.

Analysis Area

The primary analysis areas used for snags are the third order drainages associated with the Telegraph Project: 1106B, 1107, and 1108-1. These drainages are encompassed by the Telegraph Combination Boundary and extend beyond the Project Area. This analysis scale allows for a direct evaluation of Forest Plan Consistency. Additionally, snags are described for the Forest, Divide Landscape, Project Area and Combination Boundary scales to provide additional habitat information. Please refer to the Vegetation Introduction for a summary of these scales. Snags at the fine scale, within treatment units, are also addressed for the purposes of the effects analysis.

Snags: forestwide and Divide Landscape

Snags have been created at broad scales from a variety of disturbances, ranging from individual tree competition-based mortality to high severity fires or insect infestations. The most notable recent disturbance is the MPB outbreak, which affected pine types across the HNF. Additionally, large wildfires have created snags; over 200,000 acres have burned on the HNF since 1970.

The Summary Database is used to summarize snags at broad scales utilizing FIA grid intensification plots. The size classes are consistent with the Forest Plan and estimates have 90 percent confidence intervals. Snags in smaller size classes have nearly doubled since estimates made prior to the MPB. The estimate for snags greater than 20 inches dbh has remained fairly similar; this is because most of the trees killed by MPB at both scales were lodgepole pine which do not typically grow greater than 20 inches dbh. Large snags are not abundant because large live trees are also limited due to growing conditions. The large live trees greater than 20 inches that remain available for snag recruitment are likely Douglas-fir or Engelmann spruce.

Table 91. Snags/Acre at Broad Scales, Forest Plan Size Classes, Summary Database

Forest Plan Size Classes	Snags/Acre HNF	Snags/Acre Divide Landscape
7–11.9” dbh	49.64	63.66
12–19.9” dbh	12.10	9.93
>20” dbh	1.15	0.41
Live Trees/Acre >20” dbh	2.04	2.18

Estimates of Snag Densities for Eastside Forests in the Northern Region (Bollenbacher et al. 2008) describes the density and distribution of snags within and outside wilderness/roadless areas, by habitat type groups, dominance groups, and seral stages. The authors utilized FIA data, but the dataset did not include all the plots currently available. The analysis was displayed by four groups:

- *Group 1*: Warm habitat types with mixed conifer dominance groups other than lodgepole pine. These forests are dominated by Douglas-fir, ponderosa pine, limber pine, with some lodgepole pine and spruce. Due to a high frequency historical fire regime, the creation of snags was generally at low numbers, and low in frequency, but fairly constant over time.
- *Group 2*: Cool habitat types with mixed conifer dominance groups other than lodgepole pine. These forests are dominated by subalpine fir and spruce with some Douglas-fir. Due to a low

frequency, stand replacing historic fire regime, creation of snags was generally a pulse event, creating many snags in early-seral conditions, fewer in mid-seral, and more in late-seral.

- *Group 3*: Cold habitat types with mixed conifer dominance groups other than lodgepole pine. These forests are dominated by whitebark pine, with some lodgepole, spruce, and/or subalpine fir. Fire frequency and intensity was highly variable.
- *Group 4*: Lodgepole pine dominance in all habitat types. Lodgepole was broken out because the fire regime is dominated by stand replacement, with some mixed severity which had a thinning effect in some habitat types. Stand-replacing fire was common and severity was affected by periodic outbreaks of MPB that led to large fuel loads and pulse events for snags. Additionally, due to tight stocking, average diameters are generally smaller than mixed conifer stands. *This is the group predominantly present in the Telegraph area*.

Seral stage and spatial distribution are important snag characteristics. Cool and lodgepole groups have more snags in the early-seral stage due to a greater proportion of stand-replacing fires and species intolerance to fire. All groups show fewer mid-seral stage snags as snags transition to downed wood. There is generally an increase in live large trees and snags as forests mature. Snags occur in a clumpy manner (Bollenbacher et al. 2008).

Table 92. Range of Snags/Acre on HNF (Bollenbacher et al. 2008)

Analysis Group	> or = 10” dbh	> or = 15” dbh	> or = 20” dbh
Warm habitat type group	1.1–4.8	0.1–1.4	--
Cool habitat type group	7.8–21.7	1.0–5.5	0.3–2.2
Cold habitat type group	--	--	--
Lodgepole pine dominance group	3.9–12.7	--	--

The snags in each class are not mutually exclusive. Large snags on the HNF are mostly found in the cool habitat type group. The larger the snag, the less common it is. This is due to: (1) fewer trees living to an old age; (2) as trees age, they grow slower, never reaching large diameters; and (3) the inability of systems to contain large old trees and snags due to various types of disturbances (Bollenbacher et al. 2008).

Bollenbacher and others (2008) summarize snags in wilderness and roadless areas separately to make a distinction between areas that have been influenced by management and those that have not. The authors recognize uncertainty associated with climate and fire suppression; however, the work suggests that the snags in roadless/wilderness areas represent a natural snag condition. HNF Forest Plan snag targets (2/acre by third order drainage, 0.2 to 1.3/acre at the treatment unit scale depending on diameter class) are relatively consistent with the snag distribution found in wilderness/roadless areas, although a bit high for large diameters and a bit low for small diameters. The information suggests that large snags (greater than 20 inches dbh) are naturally rare.

Table 93. Snags/Acre Inside and Outside Wilderness/Roadless (Bollenbacher et al. 2008)

Area of Analysis	> or = 10” dbh	> or = 15” dbh	> or = 20” dbh
In Wilderness/Roadless	5.9	1.6	0.0
Outside Wilderness/ Roadless	2.7	0.4	0.1

Snags: Project Area and Combination Boundary

The estimated quantity and distribution of snags across the larger scales is not applicable to Forest Plan consistency but is useful for discussions of habitat. The MPB has had extensive impacts, with the extent of infestation peaking in 2009 covering 94 percent of the Project Area and 77 percent of the Combination Boundary. Therefore snags are both extensive and well-connected across these areas.

Table 94. Beetle-Created Snags in Project Area and Combo Boundary, ADS 2006-2012

	Project Area	Combo Bdry
# Trees Killed; ADS 2006-2012	791,296	2,410,920
Average Snags/Acre	33	20

In addition, FIA grid intensification plots are available to summarize snags by Forest Plan size classes in these boundaries. These plots were re-measured for live/dead trees in the last several years. Due to the landscape predominance of lodgepole pine, there are no estimated snags greater than 20 inches dbh, although some live trees in this class are present for future recruitment.

Table 95. Snags/Acre by Forest Plan Size Classes, Project Area and Combo Boundary, Summary Database

Forest Plan Snag Size Classes	Project Area	Combo Bdry
7–11.9”	49.64	69.42
12–19.9”	9.03	10.03
20”+	0.00	0.00
Live TPA 20”+	3.01	1.67

Snags: Third Order Drainages (Forest Plan)

Forest Plan consistency is assessed at the third order drainage scale by summarizing the estimated quantity of beetle-killed trees. These snags are primarily medium to large sized dead lodgepole pine. This snag pulse is transitory, and after these trees fall snags could become rare. Large diameter (greater than 20 inches dbh) and snags of species other than lodgepole are relatively rare. The snag estimates from ADS represent a minimum estimate because ADS does not reflect older dead trees or those killed by other causes such as fire. Diameters cannot be derived from ADS; however, since large trees are preferred by bark beetles, snags likely belong to the largest sizes available. Acres infested are not cumulative because spatial overlaps occur yearly. Estimates of trees per acre infested, however, are cumulative because ADS records only currently infested trees each year. This analysis shows that the average snags per acre across the third order drainages exceeds the Forest Plan minimum of 2 per acre. The distribution of snags in third order drainages is fairly contiguous and intensive. At the peak of the acreage extent of the outbreak, in 2009, 89 percent, 88 percent, and 99 percent of drainages 1106B, 1107, and 1108-1 were infested by MPB respectively.

Table 96. Snags Created by Bark Beetles in Third Order Drainages, 2006-2012 (ADS)

Detection Year ADS	Trees Killed in 1106B	Trees Killed in 1107	Trees Killed in 1108-1
2006	48	145	278
2007	645	3,535	4,591
2008	57,257	120,654	232,738
2009	28,602	84,620	66,804
2010	8,482	37,412	41,241
2011	7,757	48,693	61,324
2012	60	70	641
Total	102,851	295,130	407,616
Average Snags/acre	33	37	32

The Summary database was also used to summarize snags at the third-order drainage scale. Relatively few plots are available in these analysis areas, resulting in lower confidence. The confidence intervals for these estimates result in a lower bound of 0.00 for the estimate, and an upper bound of roughly double the estimate value. However the information is provided to show a correlation with Forest Plan size classes because size class is not available in ADS.

Table 97. Snags per Acre by Forest Plan Size Class, Third Order Drainages, Summary Database

Forest Plan Snag Size Classes	Snags per acre 1106B	Snags per acre 1107	Snags/Acre 1108-1
7-11.9”	160.47	44.13	43.76
12-19.9”	24.07	4.01	8.75
20”+	0.00	0.00	0.00

Snags Environmental Consequences

Effects Common to All Alternatives

Under all alternatives, natural processes and disturbances at all scales will continue to create snags. Public firewood cutting is permitted and could reduce the snag resource adjacent to roads. Large untreated areas would remain on the landscape where snag creation and attrition processes would be undisturbed. In the long term, snags are likely to become rare as the current “snag pulse” is lost to natural attrition. Additionally, while lodgepole pine snags are abundant, snags of other species and of large size are limited.

Snag Attrition

The timing of when dead trees shift from a vertical to horizontal position varies, and the rate that trees fall in different environments may be related to the speed of bole decay at the ground level (Mitchell and Preisler 1998). Attrition may also vary by species. According to Smith (2000), ponderosa pine snags that result from MPB infestation may fall within the decade where there is a lack of factors that make these snags durable. Another study found that beetle-killed ponderosa pine begin falling at a rapid rate after year 5, and most of the fall occurs between years 5 and 12 (USDA

2000a). However, in the Telegraph area, most of the newly created snags are lodgepole pine. In a study done on MPB-killed lodgepole pine, dead trees began falling 3 years after death in thinned (more open) stands and 5 years after death in un-thinned stands; 90 percent had fallen by year 12 and 14 respectively; and no particular year had a higher rate of fall than average once trees had begun to fall (Mitchell and Preisler 1998). Trees may fall sooner in more open stands because more wind can penetrate, and/or because more sunlight speeds up bole decay (Mitchell and Preisler 1998). Similar results were found in fire-killed lodgepole following the Sleeping Child burn, where an average of 13.4 percent of the snags studied fell yearly (Lyon 1977). Due to the current limited age class diversity, after the snags created by this MPB outbreak fall there will be few lodgepole snags until the forests regenerate, mature, and begin to die again. This "pulse" cycle is consistent with stand-replacing disturbance regimes. However because there is also living Douglas-fir, spruce, and subalpine fir, some snag creation should occur through time to partially ameliorate this loss.

Effects Common to All Action Alternatives

Snags would be reduced in proposed harvest units and maintained or increased in burning units. Snags outside of treatment units would be unaffected in the short term aside from ongoing public firewood gathering and natural creation/attrition. Creation of snags in some untreated areas may be lessened to some degree due to the alteration of fire behavior across the project area. Enhancing vigor and resilience of treated areas may provide for snag recruitment into the future after the current pulse of snags from fires and insects have been lost through natural attrition.

Under action alternatives, snags would be managed through the design of un-treated areas, retention of live trees for recruitment in treated areas, and setting snag retention goals in treated areas. In harvest units, contractors are required to fall any tree they identify as a safety hazard (OSHA Instruction CPL 2-1.19). However, retention goals would be included in prescriptions; if a snag designated for retention must be removed for safety, it would remain onsite as coarse woody debris and a substitute snag selected for retention. No retention of individual dead lodgepole pine is desired; these trees are generally small diameter and not windfirm. Some groups or clumps of lodgepole snags may be left in inoperable areas or when mixed with other retention trees. All whitebark pine snags would be retained unless the pose a specific safety or operability concern. In regeneration harvest units, roughly 20 snags per 10 acres from a mixture of diameter classes available, with seral species preferred; and all snags greater than 20 inches dbh would be retained. In intermediate harvest units, the goal would be to retain all snags greater than 20 inches dbh; and additional snags to average at least two per acre of the largest and most windfirm snags available, or as many are available less than that. There would also be abundant live trees in various size classes retained for snag replacement as well as inoperable areas and buffers in units where snags would be retained.

Snag recruitment is anticipated from proposed prescribed fire, based on prescribed mortality goals. The target overstory mortality in burn units varies (*Forested Vegetation Specialist report*). For example, mortality goals are generally low in regeneration harvest units because the remaining trees are desirable for seed, shelter, and/or structural diversity. Mortality goals are higher in broadcast burns in areas not harvested. In prescribed burn prescriptions, specifications would generally include limiting cutting of snags greater than 12 inches diameter during pre-fire preparation unless they are a specific safety or line containment hazard.

Alternative 1, No Action

Direct and Indirect Effects

No snags would be cut. Snags would continue to be recruited via natural disturbances. Public firewood cutting is permitted and could reduce the snag resource adjacent to roads; however, in

general the current abundance of snags would be maintained in the short term until they are lost over time from natural attrition. As that occurs, snags may become limited. Please refer to Effects Common to All Alternatives.

Irreversible and Irretrievable Commitments

The snag processes expected to occur with alternative 1 are not irretrievable; forests typically regenerate and snags would be created through time according to disturbances. However, the homogenous landscape may yield high snag pulses followed by periods with few snags. This condition may result in irreversible snag losses at some temporal or spatial scales. The future snag resource may not always be well-distributed spatially, temporally, and across size classes.

Alternative 2

Direct and Indirect Effects

Alternative 2 proposes treatment on 29 percent of the project area; the untreated 71 percent would have no snags removed and live trees retained for recruitment. Untreated areas are well-distributed and connected. Many snags (primarily lodgepole pine) in proposed treatment areas would be felled. Refer to Design Criteria and Effects Common to All Action Alternatives for the specific snag retention guidelines to be applied to proposed treatments. The treatment types are assessed for general effects to snags as follows:

- *Intermediate Harvest* (434 acres proposed). A stand of live residual trees is retained which provides for snag recruitment. Snag recruitment would occur to a lesser amount and/or at a slower pace after treatment because treatments are designed to increase tree vigor and lower susceptibility to mortality.
- *Regeneration Harvest* (3,484 acres proposed). This treatment results in removal of most of the existing overstory. Scattered individual or patches of live tree reserves would be identified to provide seed, structure, snag recruitment, and/or species diversity. Some existing snags would be retained within reserve patches, or as scattered individuals.
- *Prescribed Fire*: Prescribed fire alone is proposed on 1,050 acres in alternative 2. Few snags would be felled in these areas, limited to those necessary for safety and fire containment purposes. Prescribed fire follows harvest (intermediate or regeneration) on an additional 3,279 acres. Target overstory mortality in burning areas would vary depending on objectives, ranging from fuel reduction to site preparation for regeneration. In all cases, some snag creation is expected.
- *Pre-commercial thinning* (1,786 acres proposed): These areas were previously harvested and generally contain few to no snags. The treatment is focused on thinning young trees. There would be little to no impact on snags; if they occur, they would be retained.

Third order drainage snags are assessed for Forest Plan consistency using ADS. While snag retention and creation would occur as described in the Design Criteria, to make a simplified and conservative estimate it was assumed that no snags would be retained in treatment units. The number of beetle-killed snags that could be lost was calculated by taking the total TPA killed in the watershed and subtracting the quantity of snags in treatment units. The potential for additional snags created with prescribed fire are not estimated. Some treatment units are not in a third order drainage, so the acreage does not match total treatment acres. Due to the extensive number of snags, and relatively small area proposed for treatment, the snags remaining after treatment are still in excess of the Forest Plan minimum standard of 2 per acre. Additional snags from older mortality not recorded by ADS may also be present, and more would be created by prescribed burning. Diameter distribution is not

available in ADS, but in general snags would be the largest diameter available due to MPB feeding preferences. Snags greater than 20 inches dbh would be rare because trees in that size class are rare. Adequate snags and linkages would be provided. This assessment of bark beetle snags provides a minimum estimate that assures that Forest Plan standards are met.

Table 98. Beetle-killed Snags/Acre in Third Order Drainages Post-Treatment, Alternative 2

	ADS # trees killed by bark beetles 2006-2012	Average Snags/acre	# Snags in Treatment Units, Potential to be Cut	Number of Beetle-created Snags Remaining Post-Treatment	Post-Treatment Alt 2 Average Snags/acre
1106B	102,851	33	38,890	63,961	20
1107	295,130	37	85,925	209,205	26
1108-1	407,616	32	75,556	332,061	26

Irreversible and Irretrievable Commitments

The removal of snags in units would represent a short term irreversible loss but the loss is not irretrievable because new snags would eventually be recruited by future mortality agents. Snag retention goals, snag creation through fire, and the abundance of snags in untreated areas would ensure that adequate snag habitat is provided through time. Effects to snags outside treatment units would generally be the same as Effects Common to All, except that treatment may lower snag recruitment in some areas by changing potential fire behavior across the landscape.

Alternative 3

Direct and Indirect Effects

Alternative 3 proposes treatment on 18 percent of the project area; the untreated 82 percent would have no snags removed and all live trees retained for recruitment. Untreated areas are well-distributed and connected. Many snags (primarily lodgepole pine) in proposed treatment areas would be felled. Refer to the discussion for alternative 2. The treatment types are assessed for general effects to snags as follows:

- Intermediate Harvest (434 acres proposed). See effects described for alternative 2.
- Regeneration Harvest (1,856 acres proposed). See effects described for alternative 2.
- Prescribed Fire: Prescribed fire alone is proposed on 606 acres in alternative 2. Prescribed fire follows harvest on an additional 2,014 acres. See effects described for alternative 2.
- Pre-commercial thinning (1,786 acres proposed). See effects described for alternative 2.

Third order drainage snags are assessed for Forest Plan consistency using ADS data as described for alternative 2. Alternative 3 reduces beetle-killed snag numbers to a lesser extent than alternative 2.

Table 99. Average Beetle-killed Snags in Third Order Drainages Post-Treatment, Alternative 3

	ADS # trees killed by bark beetles 2006-2012	Average Snags/acre	# Snags in Treatment Units, Potential to be Cut	Number of Beetle-created Snags Remaining Post-Treatment	Post-Treatment Alt 3 Average Snags/acre
1106B	102,851	33	18,267	84,584	27
1107	295,130	37	53,198	241,931	30
1108-1	407,616	32	43,719	363,897	28

Irreversible and Irretrievable Commitments

Please refer to the discussion for alternative 2. The commitments for alternative 3 would be similar, except that treatment would occur on fewer acres than with alternative 2.

Conclusions for Direct and Indirect Effects to Snags

All alternatives are consistent with the Forest Plan because the average snags per acre in each third-order drainage would exceeds the minimum 2 per acre after treatments based on a spatial analysis of ADS. The potential for firewood cutting is unlikely to substantially impact the snag average numbers given the high abundance of lodgepole pine snags currently present. SMZs and BMPs are utilized in project design; therefore, as the Plan predicts, the snag resource would not be materially affected in riparian areas. Snag retention guidelines are not required for Forest Plan consistency in harvest units because adequate snags are found in untreated areas. However, project design acknowledges the importance particularly of large, rare snags and includes snag retention criteria.

Whitebark pine Affected Environment

Introduction

Whitebark pine is considered a species of special concern for the HNF because it is a rare and important habitat component, and is in decline due to several factors. Whitebark pine was recently analyzed by the U.S. Fish and Wildlife Service (USFWS) in 2010 as a candidate for listing under the Endangered Species Act. Their 12-month finding states that whitebark pine as a species is declining based on synergistic threats from habitat loss (USDI 2011). However, USFWS also states that the entire range of whitebark pine is not threatened by extinction. USFWS determined that whitebark pine federal listing is warranted but precluded, which currently makes the species a candidate for federal listing. As a result of this finding, the Region 1 Regional Forester added whitebark pine to the Regional Forester's Sensitive Species list on December 24, 2011 (USDA 2011b). Several threats to whitebark, as follows, were identified by the USFWS (USDI 2011), the combination of which has raised concerns about the long-term viability of whitebark ecosystems.

- *Fire Suppression*: After a century of fire suppression, many whitebark stands are experiencing a species conversion to more shade-tolerant trees, and a lack of suitable seedbeds for regeneration.
- *Climate Change*: In a warmer climate, the species' fundamental habitat would shift to cooler sites at higher elevations and higher latitudes. Additionally, drought and climate change can enhance the success of MPB and white pine blister rust.
- *White Pine Blister Rust (WPBR)*: White pine blister rust (*Cronartium ribicola*) is an exotic fungal disease against which whitebark has limited resistance. As this disease has moved into fragile, high-elevation ecosystems, normal successional pathways have been altered. Because

WPBR is exotic, these trees have limited defenses. WPBR typically infects nearly all individuals of the host species, causing branch and stem cankers in trees that eventually kill most trees.

- *Mountain Pine Beetle (MPB)*: 5-needled pines are susceptible to MPB. In densely stocked stands, whitebark is likely to be attacked by because of stress from competition (Sturdevant and Kegley 2006).

"*Whitebark pine will have a very bleak future without management intervention*" (Keane and Arno 1993). The restoration of whitebark fits in the purpose and need in that it is a focus species for the maintenance of diverse wildlife habitats. To compare alternatives, the following indicators and measures are used:

- Indicator 1: Amount of whitebark pine habitat impacted by restoration treatments.
  - Measure 1: Acres Containing Whitebark Pine Treated by Prescription Type
- Indicator 2: Expected whitebark pine metrics over time (5 years and 50 years).
  - Measure 2: Whitebark pine metrics in example stands (trees per acre, TPA; ft2 basal area per acre, BA/ac; diameter; and height as modeled by FVS.

Analysis Area

To set the context, the forestwide and combination boundary scales are analyzed. The existing condition is also described for the Project Area and for proposed treatment units. The effects analysis focuses on the Project Area and treatment units because this is where the impacts of alternatives can be clearly compared. Effects become diluted at larger scales. Temporally, the existing condition reflects a snapshot of the most recent information available. The effects analysis considers short term impacts (within 5 years) and long-term implications (50 years in the future).

Whitebark Pine Ecology

Whitebark pine grows at the highest forested elevations and at timberline, in cold, windy, snowy, and generally moist climatic zones (Arno and Hoff 1989). Its tolerance to cold, superior hardiness on harsh microsites that exist after a fire, 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 the major seral species that is eventually replaced by more shade tolerant species, while on harsh upper subalpine forests and at treeline it can successfully dominate as climax vegetation (Keane et al. 2012). This tree is an important ecological component of high elevation communities, providing a food source and shelter to squirrels, bears and other animals, aiding in the protection of soil and water quality in the sensitive high basins, acting as a "nurse tree" for other conifers, and filling a host of other roles in harsh, cold environments (Tomback et al. 2001).

Whitebark pine ecosystems were maintained through fire and insect regimes, and regenerate best in open, sunny conditions (Tomback et al. 2001). Whitebark pine has large seeds and regenerates by means of seed caching by Clark's nutcrackers, with squirrels and other animals playing a minor role. Though high severity fires will kill whitebark, mature trees are somewhat resistant to low intensity ground fires compared to associates (spruce and subalpine fir). Whitebark pine fire regimes are complex and variable in space and time, but in general all three types of fire severities describe whitebark pine fire dynamics: non-lethal, stand replacing, and mixed-severity (Keane et al. 2012). Historically, whitebark experienced endemic levels of mortality from fire and MPB which rejuvenated new generations and maintained lodgepole pine and subalpine fir as components but not dominants (Arno and Hoff 1989). The balance of a natural fire regime with related vegetative successive processes has been disrupted, and as a result whitebark pine has lost its competitive advantage (USDA 2011b). The lack of fire has reduced the availability of suitable open sites where

whitebark can establish and maintain sufficient growth rate to compete. As blister-rust damage increases, the likelihood of nutcracker seed dispersal decreases (McKinney and Tomback 2007) because the ability of whitebark pine to reproduce naturally is strongly affected by blister rust because it kills branches in the upper cone bearing crown. MPB accelerates the loss of key mature cone-bearing trees.

Since WPBR was introduced to North America in 1910, it has spread through the range of 5-needled pines. It has a complicated life cycle composed of five types of spores on two hosts; it requires an alternate host such as *Ribes* to complete its lifecycle (Tomback et al. 2001). The disease creates cankers on branches and the bole of the tree, usually eventually girdling and killing it. Some trees are resistant and can survive indefinitely. However, most whitebark are susceptible because they do not have natural defenses to this exotic disease. The percentage of whitebark that are genetically resistant may increase slowly through the process of natural selection. Forces of natural selection could be harnessed if 5-needled pines are given a chance to regenerate (Tomback et al. 2001). Mortality is heightened by the interaction between WPBR, MPB, and climatic stressors that reduce vigor. The combination of MPB, fire suppression and WPBR are raising concerns about the long-term viability of whitebark ecosystems.

The trend of whitebark pine decline is documented at many scales and by many sources. Broad-scale studies have found downward trends in whitebark health and abundance across its range; most specific to western Montana, Keane and Arno (1993) found a 30-90 percent decline. Analysis at the Regional scale indicates that the abundance of live whitebark pine is decreasing from 18.3 percent of periodic FIA plots containing at least one live whitebark pine tree, to 15.8 percent in the annualized inventory (USDA 2010c). More locally, a study done the HNF found that mortality of whitebark pine up to 95 percent (Sturdevant and Kegley 2006). Surveys conducted in 2005 on four whitebark areas across the Forest found that percent mortality from blister rust ranged from 0 to 95 percent, and that rust was present in 29-100 percent of the stands in the survey areas (USDA 2012e). There is a preponderance of data that provides evidence of a substantial and pervasive decline throughout almost the entire range of whitebark pine (USDI 2011).

Recent science provides guidance regarding restoration of whitebark pine. Keane and Parsons (2010) recommend 1) emulating historical fire regimes; 2) use prescribed burning; 3) use wildland fires; 4) plant, plant, plant; and 5) monitor results. This study evaluates various methods including silvicultural cuttings and prescribed fire to emulate historical fire regimes, with the primary goal being the removal of competing species and creating openings suitable for regeneration (Keane and Parsons 2010). More recently, Keane and others (2012) published A Range-Wide Restoration Strategy for Whitebark Pine (*Pinus albicaulis*), providing a comprehensive strategy for whitebark restoration. The four principles of this strategy are summarized as follows (Keane et al. 2012):

1. *Promoting rust resistance*, by a) supporting selective breeding programs to develop and deploy blister-rust resistant whitebark; b) facilitating and accelerating natural selection for rust resistant trees by reducing competition, providing openings for natural seed dispersal and seedling survival; and c) planting seedlings from trees known to have some level of resistance.
2. *Conserving genetic diversity*, by collecting and archiving seeds and growing and planting genetically diverse seedlings.
3. *Saving seed sources*, by protecting mature seed-producing resistant whitebark pine trees so that apparent rust-resistant seeds can be harvested in the future; and
4. *Employing restoration treatments*, by considering whitebark pine areas that are in decline for restoration treatments, including limiting the spread of blister rust, using fire to encourage regeneration, implementing silvicultural cuttings to reduce competition and increase vigor and

reduce likelihood of MPB attacks, planting rust-resistant seedlings to accelerate the effects of selection, and promoting natural regeneration and diverse age class structures to maintain ecosystem function and reduce landscape level beetle hazard, and to provide large populations for selection for rust resistance.

Recommended actions relative to these principles include assessments, planning, reducing disturbance impacts, gathering seeds, growing seedlings, protecting seed sources, implementing treatments, planting seedlings, monitoring activities, and conducting research (Keane et al. 2012).

Whitebark Pine at Broad Scales

At the broad scale, whitebark presence has been assessed using periodic FIA plots (USDA 2010c). The table below indicates the percentage of the total periodic FIA plots, for the HNF, which contain at least one whitebark pine tree. This data does not include the 4x intensification plots utilized in the HNF Summary.

Table 100. Whitebark pine, FIA plots, HNF (does not include 4x plots)

Live PIAL (% Plots)	Dead PIAL (% Plots)	Live And/or Dead PIAL (% Plots)
20.8%	8.7%	20.8%

The R1 Summary Database was queried to summarize the abundance of whitebark pine on the Divide Landscape area. This showed an average of 1,420 whitebark trees per acre in this landscape. Most of these are small trees and do not dominate most of the stands in which they occur.

On the HNF, whitebark is found most commonly on the SPFI5 or SPFI1 biophysical settings, at elevations greater than 6,000 feet (USDA 2012e). Most areas dominated by whitebark have a canopy cover class of 41 to 60 percent and the 5- to 14.9-inch size classes are the most common (USDA 2012e). Although sites where whitebark dominates in the combination and project area are extremely rare (as indicated by VMap and FIA intensification plots), it is present as a minor or understory component in additional areas, as noted by other data sources which primarily consist of diagnosis walk-throughs. In the Telegraph area, whitebark is present on subalpine fir climax habitat types. This landscape does not contain the elevations and sites where whitebark would be dominant. Rather, it is a minor component in sites dominated by lodgepole pine, subalpine fir and/or Engelmann spruce. The 4x grid intensification plots in the Summary Database indicate whitebark pine presence within the combination boundary (10 percent) but not the project area. These plots are broad scale and did not occur in the limited areas containing whitebark pine in the project area. Additional whitebark pine may be present in the understory in other areas, undetected by FIA grid plots, VMap, stand exams, or walk-through surveys.

Table 101. Whitebark pine at Finer Scales, Multiple Data Sources

Analysis Scale	PIAL, 4x Plots, R1 Summary Database	VMap Post MPB	Other Data Sources*
Combo Boundary	Present 10% plots; avg 1,863 TPA, 20 BA/ac	5 acres (0.4%)	2,659 acres (2%)
Project Area	0 TPA, 0 BA/ac	0 (0%)	1,102 (5%)

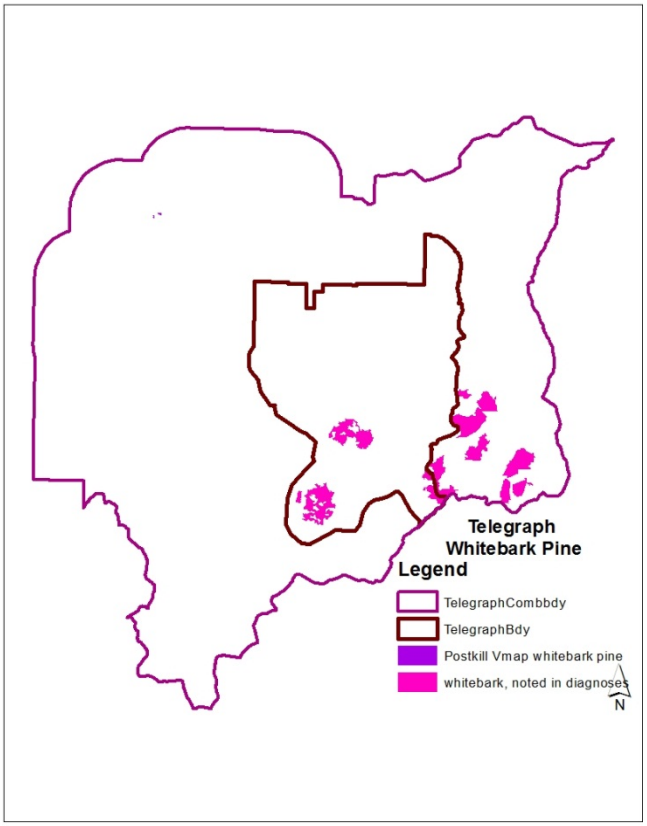


Figure 50. Whitebark Pine, Combination and Project Area

The trend that whitebark pine ecosystems are in peril on the HNF is supported by ADS. A significant increase in MPB-caused mortality has been noted as shown in the table below. The estimated numbers of trees killed by MPB are cumulatively because only recently killed trees are recorded each year.

Table 102. MPB Impacts to Whitebark Pine, ADS, HNF

Year	Acres WBP with MPB	# WBP Trees Killed by MPB	Notes
2005	2,114	5,244	Wilderness areas not flown.
2006	1,043	2,793	Wilderness areas not flown.
2007	424	930	Big Belts and wilderness areas not flown.
2008	3,189	38,429	Most of Big Belts and wilderness not flown.
2009	17,059	125,062	Wilderness areas not flown.
2010	12,203	21,268	Wilderness areas not flown.
2011	66	154	Big Belts and wilderness areas not flown.
Total	N/A	193,880	

Further whitebark monitoring has been conducted on the HNF relative to mortality trends. In 2006, plots were installed to map mountain pine beetle and blister in WBP on the HNF (Sturdevant and Kegley 2006). The areas measured included Edith Peak and Baldy Mountain in the Big Belt Mountains, and Occidental Mountain/Bluebird Meadow on the Divide landscape which is not far from the Telegraph area. The study found the following mortality trends. Most stands had MPB, WPBR, or both.

Table 103. Whitebark pine mortality trends in selected areas (Sturdevant and Kegley 2006)

Study Area	Range of % WBP mortality	% stands w/ WPBR	% stands w/ MPB
Edith Peak	0-95%	88%	69%
Baldy Mtn	1-50%	100%	100%
Occidental Mtn	5-50%	100%	42%

FINDIT plots were installed in several other stands as part of this study, which found WBP mortality rates due to MPB of 44 percent and 72 percent. This study noted whitebark regeneration in most stands, but competing conifers may compromise the survival of this regeneration.

There have been older causes of mortality in WBP on the HNF, although they are not quantified. For example, a MPB outbreak in the 1930s affected some areas, as evidenced by anecdotal accounts of old WBP snags with evidence of infestation. WBP has also been experiencing blister rust related mortality for some time, but at variable rates depending on location. WBP surveys conducted prior to the MPB outbreak in 2005 on the Townsend and Helena Districts provide additional information. While rust was present nearly everywhere, it was less severe in more isolated locations such as Occidental Mountain. WBP regeneration was generally extensive, further substantiating the promise for future WBP generations.

Table 104. 2005 Whitebark Pine Survey Summaries, HNF

Area	# Stands Surveyed	Range % Mortality from Rust	% Stands with MPB	WBP Regeneration Summary
Holloway	7	10–60%	29%	300–1,000 TPA seedlings.
Edith Peak	6	15–95%	100%	400–2,000 TPA seedlings.
Baldy Mtn	5	0–60%	80%	50–2,000 TPA seedlings.
Occidental Mtn	12	5–25%	33%	Trace–1,200 TPA seedlings.

Whitebark Pine within Proposed Treatment Areas

Several proposed treatment areas contain whitebark pine, mostly seedlings or saplings. The whitebark pine is a relatively minor component, with some mature dead and dying trees present near openings. These areas will be assessed for all alternatives because they provide a fine scale comparison of the potential impacts. The treatment units that contain whitebark pine are clustered around Bison Mountain and Mary Ann Creek, below Treasure Mountain.

Table 105. Whitebark pine presence noted in Proposed Treatment Units (diagnoses)

Proposed Action Unit IDs	Acres of Proposed Action Units where WBP is present
35, 56, 57, 59, 60, 61, 62, 63, 74, 75, 76, 77, 80, 81, 84, 85, 88, 89, 106, 109, 110, 111, 112, 117	781

In proposed treatment areas, diagnoses documented existing condition. These units are located at elevations from 6,200 to 7,400 feet. The dominant component is dead and dying lodgepole pine (on 90 percent of the area, lodgepole pine is greater than 70 percent of composition), with some subalpine-fir and Douglas-fir. With the exception of Unit 59, where it makes up roughly 30 percent, whitebark pine is estimated to be less than 10 percent of the species composition. The existing trees per acre and basal area per acre (prior to the MPB outbreak) ranged from 250 to 1,200 and 60 to 200 square feet per acre, respectively. With the exception of two young stands about 20 years old and 2 inches average dbh (47 acres), the remainder of these areas averaged 60 to 200 years old and 6 to 13 inches average dbh prior to the mountain pine beetle outbreak. The vertical structure class was primarily even aged with a few areas in a 2-aged condition (subalpine fir understory beneath lodgepole).

The units containing whitebark pine grow on lower subalpine-fir climax habitat types, primarily ABLA/XETE (subalpine fir – beargrass) and ABLA/VACA (subalpine fir – dwarf huckleberry). Lodgepole pine is a common dominant conifer, with subalpine fir and/or Engelmann spruce as minor components particularly in the understory. Whitebark pine is particularly viable in ABLA/XETE when disturbance regimes favor it over its competitors as it is noted as a minor component in many stands on these types (Pfister et al. 1977). Whitebark restoration may be less appropriate on ABLA/VACA as it is not generally found on those sites. The gradation between these types occurs on a relatively fine scale in the proposed treatment areas.

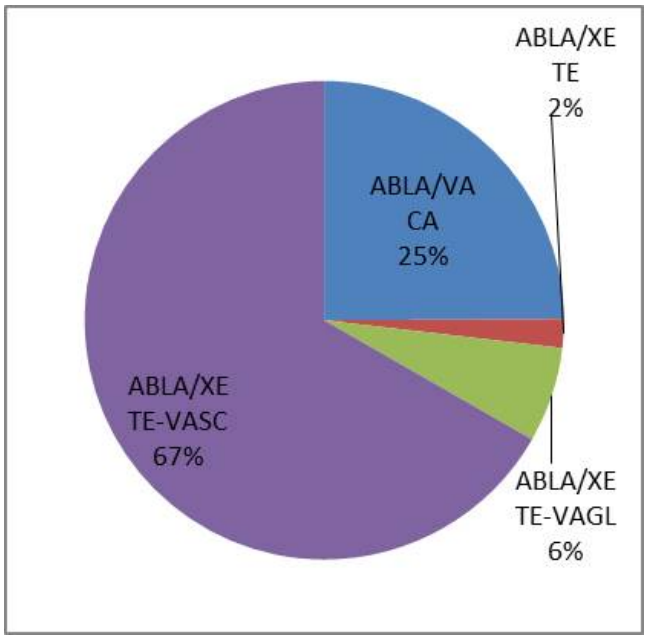
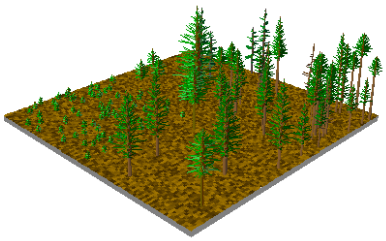
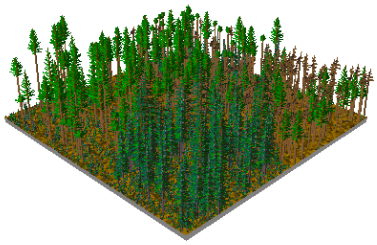


Figure 51. Habitat Types in Proposed Action Units containing Whitebark pine

Table 106. Whitebark pine conditions in Example Stands (FVS)

Stand ID	Representative Photo (2008 Diagnoses)	SVS Image (1995 Inventory)	Summary of Exam Data (1995)
34602287			137 TPA 46 ft^2 BA/ac QMD 7.8” Avg. Ht 25 Avg. Age 61 Whitebark Metrics: 5 TPA (4%) 5 ft^2 BA/ac (11%) 13.6” QMD Avg. Height 2’ Avg. Age 125
34602038			6666 TPA 124 ft^2 BA/ac QMD 1.8” Avg. Ht 4’ Avg. Age 31 Whitebark Metrics: 60 TPA (1%) 0 ft^2 BA/ac (0%) 0” QMD Avg. Height 3’ Avg. Age 23

Whitebark pine Environmental Consequences

Effects Common to All Alternatives

Due to the relatively minor abundance of whitebark pine, and lack of the habitat types and topography where it could be expected to dominate, none of the alternatives would materially alter the abundance or health of whitebark pine at the landscape or Forest scales, or measurably impact the viability of whitebark pine across its range. At these broad scales, the overall decline of whitebark pine due to the factors identified by the USFWS (2011) would generally continue. Within untreated areas in the project area under any alternative, over time whitebark pine may cease to be a stand component in the absence of natural disturbance or management intervention due primarily to competition from other tree species and the limited availability of seed trees and suitable regeneration sites.

Effects Common to All Action Alternatives

The proposed treatments are the same for both action alternatives, although they occur on different numbers of acres. Within treated areas on the appropriate habitat types, whitebark pine is more likely to be retained and increased as a stand component. While the scale of this effect is relatively minor, the action alternatives would help to conserve whitebark genetics to the extent possible and ensure individuals are available for continued regeneration and natural selection processes into the future.

At a landscape scale, proposed treatments follow variable retention concepts for moist forests. This involves the retention of structures, organisms, and conditions from a pre-harvest forest stand for incorporation into the post-harvest ecosystem and, ultimately, forest stand (Franklin and Johnson 2011). This allows for retention of windfirm individuals and clumps from the previous stand, while creating open conditions desirable for the establishment of early successional forest. Natural regeneration through the creation of openings for nutcracker caching is an objective, while retaining the existing whitebark seedling and saplings. Given widescale mortality of the dominating lodgepole pine, mature tree reserves would be relatively sparse and consist of individual or clumps of Engelmann spruce, subalpine fir, or Douglas-fir. Forest aggregates including dead lodgepole pine would be retained in riparian areas, inoperable areas such as seeps and rock outcrops, and the mosaic of untreated areas across the landscape. Other biological legacies such as windfirm snags and downed wood would be retained as well. These treatments effectively retain and "daylight" the existing whitebark pine, while creating larger openings to promote the establishment of new whitebark regeneration. The utilization of harvest and prescribed fire as tools accomplishes these objectives to the greatest extent possible across the landscape.

At the fine scale, the proposed treatments within a unit are defined utilizing standard silviculture terminology as listed in the alternative tables. These systems incorporate variable retention concepts and contribute to an overall design of structures that gradate across the project. Due to the gradation of habitat types, a mixed composition of regeneration species is desired in addition to whitebark pine. Please refer to the Forested Vegetation specialist report for a description of fine-scale prescriptions; and refer to the Design Criteria in this report. The effects to whitebark pine from the prescriptions are briefly described below.

- ***Regeneration Harvests*** (2-aged Seedtree with Reserves; 2-aged Shelterwood with Reserves; Clearcut with Leave Trees): Dead and dying lodgepole pine would be removed, creating open and sunny conditions for regeneration and reducing the potential for high severity fire after the dead trees have fallen. With the exception of large diameter individuals or retention clumps, trees of other species would be removed as shade-tolerant competitors. No whitebark pine trees would be cut. In the case of a seed tree harvest, widely scattered mature whitebark pine, spruce, and Douglas-fir would be retained to provide seed for regeneration. In the case of a shelterwood, more of these surviving mature trees would be retained to provide seed, create a partially shaded for regeneration as well as contribute to structural diversity. In seedtree and shelterwood cuts, overstory remnants would create a 2-aged condition. This condition balances the creation of openings for whitebark while encouraging natural regeneration of other species as well because the sites are not likely to support a dominant component of whitebark pine. In the case of clearcuts with leave trees, scattered individuals and clumps of leave trees would also be retained to provide for structure, future snags, and biological legacies; however these would be a minor component and not materially contribute seed or shelter for regeneration, and would result in even-aged stands. Clearcut treatments seek to maximize regeneration opportunities for shade intolerant whitebark pine with some lodgepole pine. In all regeneration harvests, the resulting stands would be open and suitable for nutcracker caching sites and/or whitebark pine planting.
- ***Pre-commercial Thin***: This treatment would occur in young stands where regeneration occurred after previous harvest. The stand would be thinned to favor whitebark pine by removing all other conifers within 20 feet of whitebark pine. No whitebark pine trees would be cut, even where growing in clumps. Where no whitebark pine are present, the stand would be thinned according to site specific prescriptions, generally 12- to 20-foot spacing.
- ***Jackpot Burn***: This mosaic burning treatment is proposed after harvest in several units to reduce concentrations of heavy fuels and create patches of mineral soil particularly suited to nutcracker

caching and whitebark germination. This burn is applied where existing whitebark seedlings and saplings are somewhat abundant, and these would be avoided with fire.

- ***Site Preparation Burn***: A more broadcast nature burn is proposed after harvest in units with little existing whitebark regeneration to maximize natural regeneration opportunities by removing shade tolerant regeneration and exposing some mineral soil.
- ***Broadcast Burn***: A small area noted with whitebark pine lies in this burn-only treatment. A wide variety of conditions are desired across the large treatment area. Where whitebark occurs, prior to burning slashing would be done to daylight around whitebark pine. The burn would focus on removal of fuel concentrations and shade tolerant competition, while minimizing potential losses of whitebark through lighting techniques and pulling slash away. This treatment may impact some individuals, but would reduce competition for surviving trees and create openings for regeneration.
- ***Tree Planting***: To the extent that rust-resistant seedlings are available, units would be planted with whitebark after harvesting and/or burning. Planting would occur in a clumpy manner to emulate natural regeneration patterns. Planting would augment the expected natural regeneration of multiple species.

These treatments incorporate several elements of restoration recommended by Keane et al. (2012), including: (1) Promote rust resistance by accelerating natural selection by reducing competition and providing openings for natural seed dispersal and seedling survival; (2) planting seedlings known to have some level of resistance to the extent they are available; (3) using fire to encourage regeneration; and (4) implementing silvicultural cuttings to reduce competition and increase vigor, and promoting natural regeneration and diverse age class structures. By utilizing these treatments on some proportion of the landscape, all action alternatives take steps to restore whitebark pine by emulating natural disturbance regimes.

Alternative 1, No Action

Direct and Indirect Effects

No whitebark pine would be impacted by management. There would be no chance for individuals to be damaged inadvertently by implementation. Conversely, no recommended elements of whitebark pine restoration would be employed. Restoration activities are needed to address the threats to whitebark pine (USDI 2011); no action would perpetuate the current downward trend of the local population. The small seedlings and saplings found in proposed treatment areas would be expected to persist in the understory in the short term, although in the long term are likely to be out-competed by other conifers. The decline of whitebark pine in the analysis areas of interest would continue according to current trends. New whitebark regeneration would not likely occur given competition and shady conditions perpetuated in these stands.

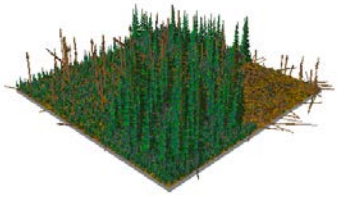
- Indicator 3a: Amount of whitebark pine habitat impacted by restoration treatments.
  - Measure 3a: Acres Containing Whitebark Pine Treated. No treatments would occur, and no proportion of the project area would be affected by whitebark restoration prescriptions.

Table 107. Whitebark pine Indicator 3a, Acres and Proportion Treated with a Whitebark component

Acres Treated	% Project Area
0	0%

- Indicator 3b: Expected whitebark pine composition over time in an example stands.
  - Measure 3b: Whitebark pine composition in the short term and long term in example stands, as modeled by FVS. In addition to growing the stands from inventory conditions in 1995, the MPB outbreak was modeled. In addition to lodgepole pine mortality, 70 percent of whitebark pine greater than 8 inches dbh was estimated to have been killed by MPB, based on diagnosis observations. In Stand 287, the minor whitebark component (scattered older trees) present in 1995 have died and no regeneration occurs over the 50-year timeframe. In Stand 038 the whitebark present in 1995 (23-year old saplings) decrease slightly and persist at levels below 1 percent of the composition, growing from about 3 feet tall in 1995 to 14 feet tall in 2063.

Table 108. Whitebark pine indicator 3b, Metrics in Example Stands modeled by FVS

Stand ID	Whitebark Metrics	5 years (2018)	SVS Image 2018	50 Years (2063)	SVS Image 2063
287	TPA / % Total TPA BA/ac / % Total BA/ac Average Height	0 / 0% 0 / 0% N/A		0 / 0% 0 / 0% N/A	
038	TPA / % Total TPA BA/ac / % Total BA/ac Height	56 / <1% 0.2 / <1% 7’		38 / <1% 0.8 / <1% 14’	

Irreversible and Irretrievable Commitments

Over time whitebark pine may cease to be a stand component in the absence of natural disturbance or management intervention due primarily to competition from other tree species and the limited availability of seed trees and suitable regeneration sites. This effect may be both irreversible and irretrievable.

Alternative 2

Direct and Indirect Effects

The effects to whitebark pine would be limited to the treatment units. Landscape conditions and trends would be the same as Common to All Alternatives.

Within treatment units, no whitebark would be cut and to the extent possible individuals of all size classes would be protected from logging equipment as well as fire through ignition and slash distribution techniques. Even so, some incidental individuals could be killed or damaged.

Conversely, tree cutting and prescribed fire would remove competing species and create desirable openings for whitebark regeneration. Whitebark would be a desired advance regeneration component and potential natural regeneration component. To the extent that funding and rust-resistant stock is available, whitebark would be planted.

The HNF has several examples where informal monitoring has shown whitebark advanced and natural regeneration has been successful following regeneration harvests. These include the Granite Whitebark and Duck Creek Pass timber sales. These areas contain substantial components of whitebark seedlings and saplings today. Approximately 300 whitebark saplings per acre are now free to grow in the Granite Whitebark harvest area, and additional regeneration is probable (USDA 2012e). Additionally, the Duck Creek Pass timber sale (mid 1980s) also has whitebark pine natural regeneration (USDA 2012e). There are also anecdotal accounts of abundant WBP regeneration in old clearcuts in the Treasure Mountain area.

Figure 52. Granite Butte Whitebark pine timber sale

Proposed treatments parallel recommended whitebark restoration treatments discussed in the latest science. The project fits two of the recommendations found in Keane and Parsons (2010): emulating historical fire regimes and using prescribed burning. Harvested openings reduce the density of competing species and create areas for nutcracker seed caches (McKinney and Tomback 2007). The treatments incorporate elements of restoration treatments described by Keane and others (2012), including using fire to encourage regeneration, implementing silvicultural cuttings to reduce competition and increase vigor, and promoting natural regeneration. To a small extent, alternative 2 would address some of the threats to whitebark pine (USDI 2011).

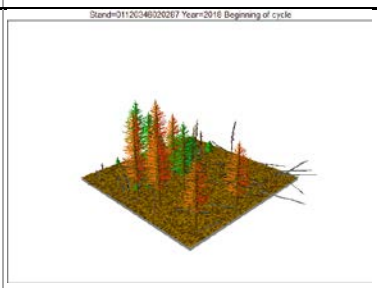
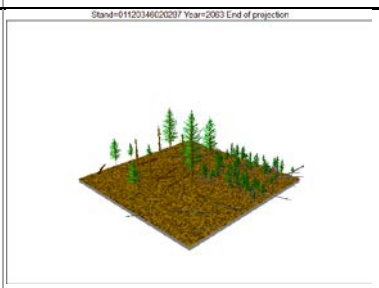
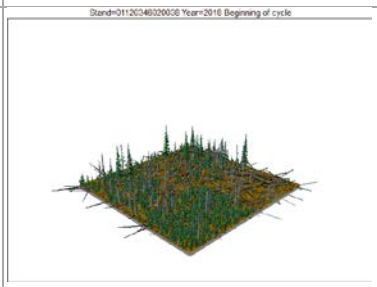
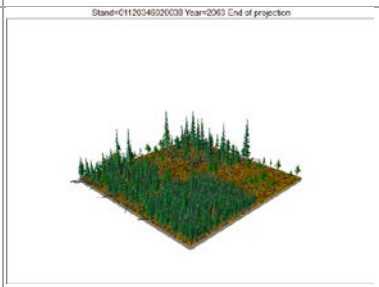
- Indicator 3a: Amount of whitebark pine habitat impacted by restoration treatments.
    - Measure 3a: Acres Containing Whitebark Pine Treated

Table 109. Whitebark pine indicator 3a: Acres and Proportion Treated with Whitebark component, Alternative 2

Prescription	Acres Treated
2-Aged Seedtree with Reserves, Site Preparation Burn	88
2-Aged Shelterwood with Reserves, Site Preparation Burn	5
Clearcut with Leave Trees	6
Clearcut with Leave Trees, Jackpot Burn	84
Clearcut with Leave Trees, Site Preparation Burn	547
Precommercial Thin	47
Broadcast Burn (with slashing)	3
Total:	781 acres
% Project Area	3%

- Indicator 3b: Expected whitebark pine composition over time in an example stands.
  - Measure 3b: Whitebark pine metrics in the short term and long term in example stands, as modeled by FVS. The most common prescription – Clearcut with Leave Trees followed by Site Prep burn – was modeled because it would apply to over 70 percent of the proposed treatment areas. To model this prescription, dead and dying lodgepole pine between 6 and 20 inches dbhwere removed, followed by a site preparation burn and planting of approximately 80 TPA whitebark pine with 70 percent expected survival. Natural regeneration was also modeled. In stand 287, whitebark pine established at greater than 40 percent of the composition and is maintained into the pole stage by 2063, growing to nearly 30’ tall. In stand 038, whitebark is maintained at 5 percent species composition. Due to shade tolerant remnants and expected lodgepole pine regeneration whitebark would not likely become dominant, but treatments help ensure that seed producers are available in the future.

Table 110. Whitebark pine Indicator 3b, Metrics in Example Stands modeled by FVS

Stand ID	Whitebark Metrics	5 years (2018)	SVS Image 2018	50 Years (2063)	SVS Image 2063
287	TPA / % Total TPA BA/ac / % Total BA/ac Average Height	70 / 44% 0 / 0% 2’		64 / 49% 3 10% 8-28’	
038	TPA / % Total TPA BA/ac / % Total BA/ac Height	80 / 5% 0 / 0% 2’		73 / 5% 3 / 3% 11-20’	

Irreversible and Irretrievable Commitments

There is potential for some incidental whitebark pine individuals to be killed or damaged during treatment from equipment and/or prescribed fire. However this would be minimized to the extent feasible through the design criteria. The individual trees impacted would be lost, and constitute an irreversible commitment. However, the magnitude of this loss is expected to be minor. Because treatments create conditions suitable for natural regeneration, overall whitebark would be promoted and the new seedlings established outweigh those potentially lost. Therefore there are no irretrievable commitments.

Alternative 3

Direct and Indirect Effects

The direct and indirect effects to whitebark pine for alternative 3 are the same as described for Effects Common to All Alternatives and alternative 2, except that fewer acres would be treated. Therefore, the effects to whitebark pine would occur on a smaller proportion of the landscape.

- Indicator 3a: Amount of whitebark pine habitat impacted by restoration treatments.
    - Measure 3a: Acres Containing Whitebark Pine Treated

Table 111. Whitebark pine indicator 3a, Acres and Proportion Treated with whitebark component, Alternative 3

Prescription	Acres Treated
2-Aged Seedtree with Reserves, Site Preparation Burn	12
2-Aged Shelterwood with Reserves, Site Preparation Burn	5
Clearcut with Leave Trees, Jackpot Burn	3
Clearcut with Leave Trees, Site Preparation Burn	313
Precommercial Thin	29
Broadcast Burn (with slashing)	3
Total:	366
% Project Area	2%

- Indicator 3b: Expected whitebark pine composition over time in an example stands.
  - Measure 3b: This fine-scale example measure is the same as displayed for alternative 2, as the same example stands are utilized. The effects described would represent fewer acres in alternative 3.

Irreversible and Irretrievable Commitments

The irreversible and irretrievable commitments are the same as described for alternative 2, with the potential magnitude occurring on fewer acres proportionate to the treatments occurring in whitebark pine with alternative 3 as shown in the table above.

Aspen Affected Environment

Introduction

Aspen is a short-lived species, falling prey to a variety of diseases (Shepperd 1986) and animal impacts from grazing, browsing, barking, trampling, and digging. It historically has relied on fire or disease to remove the diseased overstory, kill encroaching conifers, and stimulate a new generation of suckers from the existing clone root system (Shepperd 1990). Mature aspen trees inhibit the growth and success of new suckers via auxins in their common root system. Aspen is a seral species which requires full sunlight to regenerate (Shepperd 1996). Without regeneration, stands of this short-lived tree are expected to become decadent and deteriorate because root systems decline when clones do not periodically self-regenerate (Shepperd et al. 2001). Mature aspen clones can decline due to repeated animal herbivory or competition from invading conifers (Shepperd et al. 2001). Without periodic disturbance to kill old stems and trigger regeneration, seral aspen will eventually disappear from the landscape and generally be replaced by shade tolerant conifers that establish under the aspen and eventually crowd it out (Shepperd 1996). A successfully regenerated aspen stand should have several thousand stems per hectare (Shepperd 1996).

Analysis Area

The analysis areas for aspen are the project area and proposed treatment units. Due to its rarity effects at larger scales do not provide a meaningful comparison of alternatives.

Aspen Condition

Because aspen occurs in isolated patches, it is not well represented by landscape data. Its presence was noted during diagnoses in several proposed treatment units. It is likely less common in the project area than it was historically because of encroachment and overtopping by conifers, overgrazing by cattle and large native herbivores, and the absence of fire (Brown et al. 1987, Shepperd et al. 2001). Aspen is a species of concern because the lack of disturbance has resulted in a failure of clones to survive and rejuvenate. Aspen clones that do sprout are impacted by big game because the suckers are a desirable food source. It is desirable to maintain this species on the landscape to provide diversity, structure, and riparian habitat. ADS reports provide information about aspen at the Regional level. Current aspen numbers in Montana are estimated at 1/3 of historical numbers (USDA 2006d). Aspen mortality is probably underestimated in ADS due the lack of visible signatures associated with mortality in trees that die after an extended period of decline. Reductions of Montana aspen forests are believed to be largely due to fire suppression activities over the past 100 years (USDA 2006d).

VMap notes very few areas dominated by aspen, limited to **0.01 percent of the Project Area**. Based on its presence found during site visits, aspen is likely present in other areas as a minor suppressed component. The 4x FIA intensification plots note aspen presence across the scales of interest. Grid plots detect aspen at the Divide Landscape scale, averaging 1,270 trees per acre. However, while aspen was found in limited areas during diagnoses, none occurred on 4x grid plots at either the combination or project area scales.

Table 112. Aspen Presence, Summary Database (4x FIA Intensification Data)

Analysis Scale	Trees per Acre
Divide Landscape	Present on 5% of plots; avg 1,270 TPA
Combination Boundary	Present on 0% of plots
Project Area	Present on 0% of plots

Diagnoses noted the condition of aspen within proposed treatment areas. Diagnoses can be found in the Project File. Generally, aspen is present as small clones in decline, with encroachment of conifers and decadence of the aspen overstory, little active suckering, and browsing impacts from elk and/or cattle. However some large and vigorous clones (60’ tall) are also present where maintenance of the existing condition would be desirable.

Aspen Environmental Consequences

Effects Common to All Alternatives

The MPB outbreak across the landscape has likely reduced conifer encroachment to aspen clones that occur within lodgepole pine stands, and could potentially allow them to increase in extent and vigor. Succession and natural disturbance processes would continue through time. Potential wildfires could both kill existing aspen stems and also stimulate new suckering post-fire that could increase the vigor and extent of aspen; however given continued fire suppression policies the potential for this may be limited.

Effects Common to All Action Alternatives

Alternatives 2 and 3 are identical in terms of the number of acres treated containing aspen, and the design criteria that would be applied. Therefore most effects are common to All Action Alternatives.

Aspen promotion would be the goal of several units through burning and/or removal of competing conifers so that the aspen can become more vigorous. Aspen stands that are dominated by conifers, or those breaking up and not naturally reproducing, need treatment to rejuvenate (Shepperd 2001). Successful prescribed fires kill most aspen stems, stimulating suckering from the roots (Brown et al. 1987). Clearcutting best meets aspen regeneration needs, although partial cutting may stimulate suckering in some clones by removing competing conifers; group selection techniques may also be beneficial if groups are large enough to allow full sunlight (Shepperd 2001). Fire is a very viable method to treat aspen because it kills overstory stems, kills some root segments interrupting auxin flow, and removes competing vegetation; fire can be combined with other manipulation treatments to closely mimic natural fire disturbance cycles (Shepperd 2001).

All treatments would be designed to protect and enhance aspen where it occurs. Aspen treatments would consist of removing competing conifers and burning in some areas to allow aspen to dominate and sucker. Aspen would be in a more open condition where fire can be reintroduced periodically to maintain its vigor. Removal of conifers in and near aspen along with some prescribed fire could provide for greater improvements in suckering, vigor, and clone extent than the impacts of MPB alone.

Aspen was noted in diagnoses in the following areas, which are identical for both alternatives 2 and 3. These areas provide the measure for the aspen analysis. Aspen may also seed in or begin suckering in units where its presence is currently so minor that it was not found during diagnoses. Alternative 2 would have the greatest potential for this unknown impact because more areas are treated than alternative 3.

Table 113. Acres of Proposed Treatment containing an Aspen Component

Alternative	Acres Treated	% Project Area
1 (No Action)	0	0%
2 and 3	705	3%

Alternative 1, No Action

Direct and Indirect Effects

In the short term, aspen would appear unchanged; however, natural processes would. Most of the aspen is not in a desirable condition and this state would be perpetuated and potentially worsen over time; however as noted in Effects Common to All, the MPB outbreak may also serve to release aspen in some areas. Aspen is not likely present in its historic abundance, due mostly to fire suppression. Aspen areas would likely be converted to coniferous sites. The current distribution of age classes, species mixes, and within-stand and across-landscape structural homogeneity would be maintained in the short term.

Irreversible and Irretrievable Commitments

Over time some aspen communities may be lost as unique habitat features. This may or may not be irretrievable depending on future conditions and disturbance. This species may rebound if a future disturbance occurs to create conditions suitable for it, as viable clones can persist under the soil.

Alternatives 2 and 3

Direct and Indirect Effects

Please refer to Effects Common to All.

Irreversible and Irretrievable Commitments

There are no irretrievable commitments associated with alternative 2 or 3 because aspen can be expected to re-sprout where it is damaged by management activities. This disruption would be beneficial to the health of the clone as described under Effects Common to All Action Alternatives. The loss of individual aspen stems would be irreversible.

Cumulative Effects – All Special Habitats

The following tables address in detail the activities pertinent to the cumulative effects analysis for habitats of special concern. Indicators and measures are also addressed. Refer to the Project File for the full cumulative effects list, and rationale for the selection of activities included here for detailed analysis.

Activity/Name	Decade/ Year	Scope of Activity (Project Area)	Cumulative Effect – Habitats of special concern
Past Activities			
Forest Service Timber Harvest	Pre 1960 1960–1969 1970–1979 1980–1989 1999–1999 2000–2009 2010–2011	Regeneration: 25 acres Regeneration: 880 acres Intermediate:180 acres Regeneration: 1,019 acres Intermediate: 50 acres Regeneration: 1,007 acres Intermediate: 65 acres Regeneration: 825 acres Intermediate: 87 acres Regeneration: 0 acres Intermediate: 0 acres Regeneration: 48 acres Intermediate 188 acres	Generally, intermediate harvest retained forest canopies and regeneration harvest replaced stands. Although no pre-harvest data exist, it is probable that and old growth and snags, if present, would have been removed or substantially altered. Harvest did not generally occur in whitebark areas as it is not a merchantable tree species. Where whitebark or aspen occurred, generally they would have been promoted by creating more open condition. While it is unknown whether design criteria would have specifically enhanced these species, it is unlikely that they would have been cut as they do not have commercial value. The results of these treatments are part of the existing condition. *Alternative 1* would not alter further old growth or remove snags. Potential future old growth would develop along existing trends, including susceptibility to natural mortality agents. Fire would move through the project area and old growth according to existing vegetation conditions. It would not add to nor detract from any beneficial effects to whitebark and aspen. *Alternatives 2 and 3* would also not directly treat any old growth; however these alternatives may alter structures and disturbance processes in adjacent areas as well as impact young forests that may become old growth in the future. These alternatives would remove snags, additive to the amounts cut in previous treatments. The alternatives would also have an additive beneficial effect to whitebark and aspen by promoting these species where they occur.

Activity/Name	Decade/ Year	Scope of Activity (Project Area)	Cumulative Effect – Habitats of special concern
Fuels Activities	1960–1969 1970–1979 1980–1989 1990–1999 2000–2009 2010–2011	329 acres 268 acres 552 acres 1,453 acres 19 acres 236 acres	Fuel treatments generally opened the forest canopy, reduced fuels and/or reduced small trees, creating more open conditions. Some treatment areas may have "grown back" to pre-treatment condition. It is not likely treatments occurred in old growth, but if they did may have removed old growth characteristics. Snags generally would have been retained and/or created by fire. Whitebark and aspen would generally have been promoted. *Alternative 1* would not add to these effects. *Alternatives 2 and 3* would add to the acres impacted by fuel activities, including promoting aspen, whitebark, and creating snags, but would not occur in old growth.
Timber Harvest on non FS (acres approx. GIS)	2005–2011	74 acres	This harvest likely removed old growth (if present) and snags, but the FS assumes these are not provided on private land when assessing habitat and standards. Other effects would be as described for FS harvest.
Ongoing Activities			
Timber Harvest on Private or other non FS lands.	Ongoing	Timber harvest may occur on private lands on unspecified acres, primarily tractor logging within the planning area	Although known harvest has been addressed in Past Activities, there is potential for private land owners to conduct additional harvest. There is potential to add to the effects as described for past private land harvests but it is not quantifiable.
Noxious Weed Treatment on National Forest Lands	Ongoing	Herbicide treatment is primarily along roads and in patches that are accessible to mechanized equipment (spraying with ATVs) and/or by hand, biological (insects), goats/sheep, and aerial spraying.	Weed treatments have minimal to no effect on old growth or snags, as the primary effect would be to small trees in near roadways. There is also only minimal effect to tree species of interest. Damage to seedlings is likely limited to roadsides. There is no cumulative effect with Alternative 1. The Action Alternatives would further promote aspen and whitebark.
Grazing Activities on Private Lands Hat Creek C&H Grazing Allotment Slate Lake C& H Grazing Allotment Tenmile Priest Pass C&H Grazing Allotment	Ongoing Ongoing Ongoing Ongoing	Grazing of cattle, sheep and horses on private lands within the Telegraph Project boundary. 74 acres in the project area. 827 acres in the project area. 1,730 acres in project area	Grazing generally has no impact to old growth or snags. Grazing may result in miniscule impacts to whitebark pine where small trees may be trampled, but these effects are not substantial because grazing is not focused in whitebark areas. Aspen could be negatively impacted by browsing and trampling. Alternative 1 does not offset nor add to these impacts. Alternatives 2/3 would actively promote aspen and whitebark, and cumulatively offset grazing damage to a small degree.

Activity/Name	Decade/ Year	Scope of Activity (Project Area)	Cumulative Effect – Habitats of special concern
Fire Suppression	Ongoing	Fire suppression (appropriate management response) would impact potential wildfires.	Fire suppression in the past, present, and future will continue to have long lasting impacts on vegetation structure and process, including the development of old growth, snags, and aspen/whitebark habitats. Alternative 1 would neither add to nor detract from these effects. Alternatives 2 and 3 would in some measure offset the effects of fire suppression by re-introducing fire and mimicking the results of natural disturbance patterns to increase landscape resilience.
Public Firewood Gathering	Ongoing	Personal use firewood permits are issued for NFS lands, under which dead trees may be cut. This occurs adjacent to open roadways.	Firewood cutting of dead trees is allowed from open roads. This activity may reduce snags in old growth adjacent to roads. This activity reduces snags adjacent to open roads. Generally old snags are not cut because they are "punky." Similarly, while some large diameter snags may be lost, often these are avoided due to complexity of falling them. This activity would have no measurable impact to living whitebark or aspen*. Alternative 1* would not add the amount of dead trees cut in old growth areas; and would not add to or detract from the quantity of snags removed with this activity. Because firewood cutting is limited to small areas, snag loss would not materially change the effects analysis for snags with *Alternatives 2 or 3.* These alternatives may reduce the amount of firewood available in treatment units; however, much of the landscape is left untreated where firewood would be available. Where proposed treatment units occur, trees cut with the action alternatives are more or less the same as what is available to firewood cutting.

Reasonably Foreseeable: No activities identified applicable to habitats of special concern.

- *How would alternatives affect old growth cumulatively*? Old growth is adjacent to proposed treatments; fire from these areas would be more likely to enter old growth as a surface fire. To assess this cumulatively, ongoing and past treatments (there are no foreseeable) were assessed for adjacency to old growth; stands designated for old growth management per the Forest Plan as well as old growth outside of third order drainages were included. Some old growth is adjacent to both past and proposed activities; this duplication was eliminated for the total acreage. Under all alternatives, there are over 400 acres of old growth adjacent to managed areas. The action alternatives would add to the amount of managed areas adjacent to old growth, alternative 2 to the greatest extent. The changes to fire behavior are only known for the proposed project. Past treatments may provide a similar buffering effect, be neutral in terms of fire behavior, or exacerbate fire behavior depending on the type of treatment and existing condition. Altering vegetation adjacent to old growth may also have implications for habitat connectivity and use.

Table 114. Measure 1, Cumulative Acres of Old Growth Adjacent to Past, Present, and Foreseeable Treatments

Past/ Ongoing	Alt 1	Cumulative Alt 1	Alt 2	Cumulative Alt 2	Alt 3	Cumulative Alt 3
470	0	470	669	858*	456	697*

*duplication of stands eliminated; some stands are adjacent to both past and proposed activities so the cumulative effect is not a simple sum.

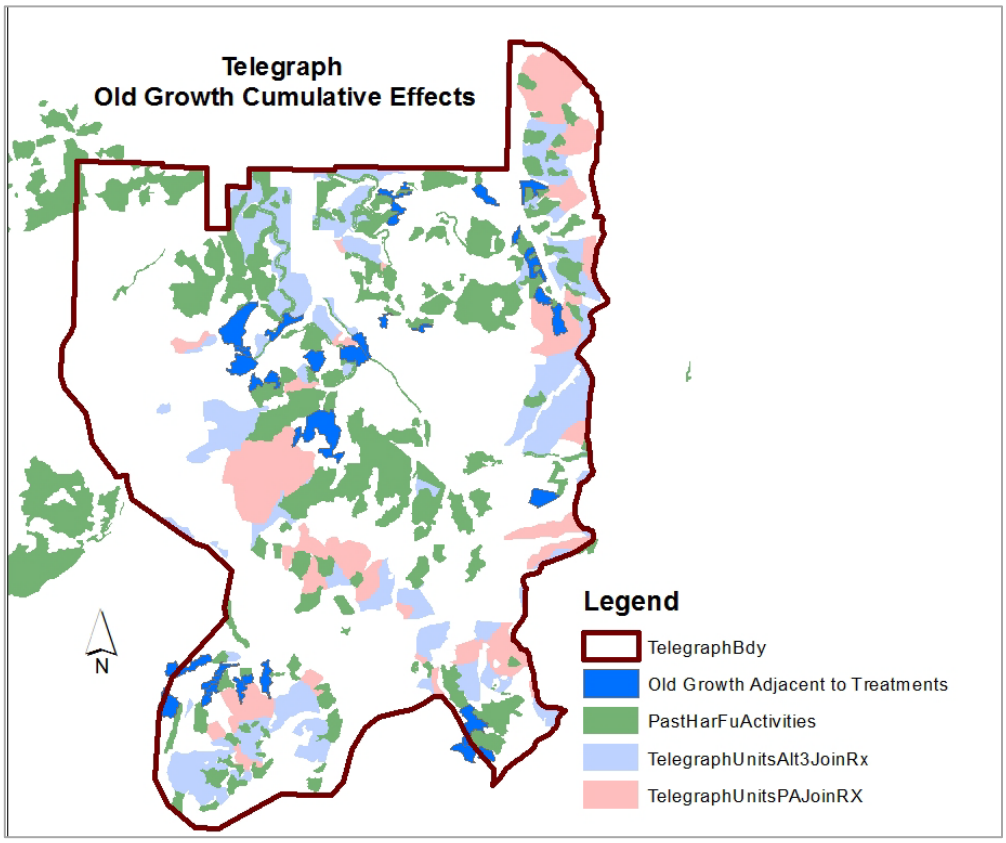


Figure 53: Cumulative Treatment Areas Adjacent to Old Growth

- *How would alternatives affect snags cumulatively?* For all alternatives, estimated post-treatment snags per acre by third-order drainage exceeds the Standard (2 per acre). The impact of past treatments is part of the existing condition measured by ADS 2006-2012. The only ongoing activities that may impact snag estimates are the *Roadside Hazard Tree Removal* (*RHR*) project and *public firewood gathering*. The RHR project has been implemented recently; therefore cutting of snags tallied by ADS may have occurred. To show a conservative analysis, all ADS beetle-killed trees were totaled in RHR units and the average number of snags per acre calculated for the drainage. This is subtracted to show the potential cumulative effect of RHR at the third order drainage scale. The only drainage impacted is 1107, in which an estimated 8,119 beetle-killed trees may have been cut. This averages only 1 snag per acre across the drainage. Cumulatively all drainages still exceed the Forest Plan minimum.

Table 115. Cumulative Snag Estimates – ADS data

Drainage	Snag Loss/Acre, Roadside Hazard Tree	Post Treatment Snags/Acre Alt 1	Cumulative Snags/Acre Alt 1	Post Treatment Snags/Acre Alt 2	Cumulative Snags/Acre Alt 2	Post Treatment Snags/Acre Alt 3	Cumulative Snags/Acre Alt 3
1106B	0	33	33	20	20	27	27
1107	1	37	37	26	25	30	29
1108-1	0	32	32	26	26	28	28

As shown for RHR, removal of snags adjacent to roads has a relatively minor impact on average snags per acre across a third-order drainage due to the abundance of snags available away from roads. This trend is true for firewood cutting. An unknown amount of additional firewood cutting may occur on other road segments. However, there are not enough snags available in these areas compared to the number of snags across the landscape to substantially alter the average snags/acre at the third order drainage scale.

- *How would alternatives affect whitebark pine cumulatively?* Within treated areas on the appropriate habitat types, with the action alternatives whitebark pine is more likely to be retained and increased as a stand component. If past treatments occurred in whitebark pine, the effect is unclear and would depend on the project design. Generally more open conditions created by past treatments would have favored whitebark, and it is unlikely whitebark were cut because they have little to no commercial value. Conversely, care to retain or avoid damaging whitebark may not have been included in past project design.
    - *Measure 3a: Acres Containing Whitebark Pine Treated*. The probability of past and ongoing treatments occurring in areas where whitebark is or may have been present is assessed by overlaying past and ongoing treatments over the whitebark pine layers, including known areas from VMap and other data sources as well as potential areas (biophysical setting SPFI2) where whitebark is a potential component. This shows a slight cumulative increase in the acres potentially affected by forest management in the project area. This increase would not materially alter effects to whitebark at the project area scale.

Table 116. Whitebark Pine Measure 3a: Cumulative Acres Treated with potential Whitebark

Past/Ongoing Activities in Potential WBP areas	Alt 1	Cumulative Acres Alt 1	Alt 2	Cumulative Acres Alt 2	Alt 3	Cumulative Acres Alt 3
138	0	138	781	919	366	504

- *How would alternatives affect aspen?* Aspen would be promoted in treated areas by reducing conifer competition and creating conditions more suitable for suckering. Potential effects to aspen are estimated by overlaying known aspen dominance groups (VMap) with past activities. Due to the limitations of aspen mapping, very little cumulative increases are measured. However, aspen was likely promoted by removing competing vegetation. Anecdotally, past harvest particularly in the Hahn Creek area contain aspen.

Table 117. Measure 4: Acres treated containing an aspen component and Proportion of Project Area

Past/Ongoing Activities in Aspen areas	Alt 1	Cumulative Acres Alt 1	Alt 2	Cumulative Acres Alt 2	Alt 3	Cumulative Acres Alt 3
1	0	1	705	706	705	706

Wildlife

Introduction

The Environmental Baseline

The *"Affected Environment"* section summarizes *baseline information* on wildlife ***habitats***[1], wildlife populations, and environmental processes characteristic of the project area and the surrounding landscape. This provides a context for gauging the effects of environmental changes that can be expected under different action alternatives (alternatives 2 and 3). The affected ***environment*** is synonymous with the conditions that would prevail under the "no action" alternative (alternative 1). The "*Environmental Consequences"* section derives from the environmental baseline in its determination of effects associated with the three alternatives.

Because of the pervasive influence of the mountain pine beetle epidemic, which has coursed through Helena National Forest (Forest) pine forests since 2006, forest conditions in the project area and throughout much of the surrounding landscape are atypical of what has been the norm over the past several decades, and they do not reflect what Forest planners envisioned when devising *Forest Plan* management goals for wildlife in the early 1980s [USDA 1986, p. II/11 – II/21]. Roughly half the forest ***stands*** in the project area are dominated by mature/pole lodgepole pine forests, the overstories of which are now mostly dead. As a consequence, ***overstory*** conditions, which have already become more open with the loss of foliage, are about to change even more dramatically over the next 5-10 years as dead trees fall.

In the following sections, the affected environment for wildlife is described primarily in terms of what is present on the ground today [which is similar to what has been present during the 3 years of wildlife fieldwork on which this report is based]. However, the implications of the evolving forest structure for local wildlife associations over the next decade are considered as well.

Hierarchy of Issues

Following direction in the National Environmental Policy Act (NEPA), those wildlife issues with potential to be "truly significant to the action in question" are emphasized and while those of "other-than-significant issues" [*40 CFR 1500, 1502*] are abbreviated in their analysis. The following aspects of the wildlife resource are emphasized in this analysis (see Appendix A of the Wildlife Specialist Report, Wildlife Analysis Approach):

- ***Species***, habitat features, and environmental processes that have some real potential to be measurably impacted by timber harvest, thinning, and prescribed fire at the scale proposed under the two action alternatives;
- Species or ***habitat components*** that might be affected to an extent that designated thresholds (***standards***, guidelines) are approached or crossed under any of the alternatives;

[1] ***Bold, italicized*** words are defined in the glossary.

- Species whose normal routines might be seriously disrupted by human activity during project implementation on a scale that could disrupt local populations;
- Focal habitat features, the functioning of which might be impaired by environmental conditions arising from any of the alternatives;
- Selected issues that, for one reason or another, have proven controversial in the public arena over the past few years.

Using these criteria, the analysis is divided into the following hierarchy:

- *Driving Issues:* These involve wildlife species or habitat features that have had a primary role in shaping project alternatives, and they are therefore discussed in detail. Driving Issues are: elk, mule deer, Canada lynx, and wetland/***riparian*** areas.
- *Other Prominent Issues:* A number of species and habitat elements, while having less influence on project design, are consequential enough to invite detailed discussion similar to that provided for "driving issues." These include the following: travel ***corridors*** and linkage zones, habitat ***fragmentation***, dead tree habitats (***snags*** and coarse woody debris), migratory landbirds and shorebirds, grizzly bear, wolverine, and 4 management indicator species (marten, goshawk, pileated woodpecker, hairy woodpecker).
- *Topics not Analyzed in Detail:* This category includes species, habitats, and management components that contribute to an understanding of the local wildlife resource but that (1) by themselves have had little effect on project design, (2) are covered by detailed analysis of other species and habitat elements, or (3) are unlikely to meaningfully affect or be affected by any of the project alternatives. They are covered more briefly than the "driving" and "prominent" issues and the rationale for doing so is provided in that section. Some of them are addressed at length in background reports for other resources (*Forest Vegetation, Range, Soils, Fire, Weeds*). Topics in this category include the following: aspen, whitebark pine, mature and early seral conifer forest, old-growth, ***edge*** and ***ecotone***, grassland-shrubland habitat, livestock grazing, noxious weeds, white-tailed deer, moose, black bear, mountain lion, and 5 ***sensitive species*** (gray wolf, boreal toad, fisher, flammulated owl, and black-backed woodpecker).
- *Non-Issues:* Analyses of some species and habitats that are sometimes analyzed in HNF NEPA documents are not included here because (1) they are not present or only fleetingly present in the project area, (2) they have been covered by previous coarse-filter analysis or analysis of management indicator species, or (3) their populations would not be meaningfully affected by the project. These include the following: mountain goats, pronghorn antelope, a number of species and habitat components that are particularly widespread and abundant (deer mice, ground squirrels, mountain chickadees, pinegrass, huckleberries, etc.) , and several sensitive species (bighorn sheep, harlequin duck, northern bog lemming, leopard frog, plains spadefoot, peregrine falcon, bald eagle). These topics are addressed only in passing.

Topic Organization

This report is organized according to the hierarchy of issues described above rather than on the more traditional organization scheme of habitat and species groups. As a result, "threatened and ***endangered species,***" "sensitive species," "***big game*** species," "management indicator species," and "wildlife habitats," which normally serve to group species and habitat components, are not all-inclusive here. Rather the species and habitats are dispersed among the issue categories— "driving issues," "prominent issues," and so on. This organization applies to both the "Affected Environment" and "Environmental Consequences" sections of this report.

Regulatory Framework

National Forest Management Act

The Forest Service is charged with maintaining the ***diversity*** of all existing native and desired non-native vertebrate species in a planning area under the National Forest Management Act of 1976 (NFMA). The regulations impose a standard by requiring habitat objectives to be established for maintaining viability of MIS throughout a planning area.

Forest Service Manual

The Forest Service Manual (FSM) provides direction for the management of terrestrial resources. FSM 2630 provides overall objectives for maintaining and improving wildlife habitat. Section 2670 establishes objectives and procedures for managing and protecting threatened, endangered, and sensitive species.

Helena National Forest Plan

The Helena National Forest Plan provides standards and guidelines that set the framework for management of wildlife species. Forestwide standards provide direction for wildlife management and are identified on pages II/17 – II/21. The standards that apply to the alternatives are analyzed for all alternatives. This plan also identifies Management Areas (MAs), and provides direction for each. MA direction relative to wildlife is summarized below:

- T-1 - Wildlife and fisheries habitat improvement projects may be implemented, provided they are compatible with the management area goals (USDA 1986, p. III/30).
- T-5 - Wildlife and fisheries habitat improvement projects may be implemented, provided they are compatible with the management area goals. Maintain adequate thermal and hiding cover adjacent to ***forage*** areas, provided timber harvest volumes are not significantly reduced over the rotation period (USDA 1986, p. III/47).
- L-1 - Specific wildlife and fisheries needs will be identified and considered when developing allotment management plans, provided the needs are compatible with area goals. Habitat improvement projects will be scheduled when they would help achieve area goals (USDA 1986, p. III/11).
- M-1 - Management practices to maintain or improve wildlife habitat will be permitted where necessary to meet the objectives of adjacent management areas (USDA 1986, p. III/5).
- W-1 - Wildlife habitat improvement practices, including road management, prescribed fire, and other techniques, will be used to maintain and/or enhance the quality of big game and nongame habitat. Maintain adequate thermal and hiding cover adjacent to forage areas. Generally this means providing at least 25 percent ***cover***, where available, on identified winter range (USDA 1986, p. III/50).
- P-3 – Wildlife habitat improvement projects will conform to Forest Service wilderness policy (USDA 1986, p. III/75).

Endangered Species Act

The Endangered Species Act of 1973 requires all Federal agencies to review any project authorized, funded, or carried out to determine that the action is not likely to jeopardize the continued existence of any proposed, threatened, or endangered species. This is accomplished via preparation of a ***biological assessment*** for those listed or proposed species present in the project area.

National Environmental Policy Act

The National Environmental Policy Act of 1969 requires that all environmental analyses consider a full range of reasonable alternatives to the proposed action that address the significant issues and meet the purpose and need for the proposed action.

Migratory Bird Memorandum of Understanding

On December 12, 2008, a memorandum of understanding was signed by the Forest Service and the USFWS to promote the conservation of migratory birds (USDA and USDI 2008). Section D (3) of the Memorandum of Understanding says, "Within the NEPA process, evaluate the effects of agency action on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors".

Assumptions, Information Used, and Methodologies/Scientific Accuracy (40 CFR 1502.15)

Much of the information presented in this analysis comes directly from field examination of the Telegraph project area (See Wildlife Field Notes in the project file). Where direct observation of local habitat components or wildlife species was not possible, inferences were made from scientific literature, data from surrounding areas, and discussions with other biologists. The basic approach has been to begin with site-specific field data and then to use information from other sources, scientific research, and ecological theory to fill in data gaps and to provide a broader context for interpreting local wildlife patterns.

Most of the habitats discussed here are described in more detail in the *Forested Vegetation Background Report*, the *Forested Habitats of Special Concern Background Report*, and the *Fire Regime Condition Class Background Report*. The analysis that follows confines itself to aspects of the environment that are of particular significance to wildlife. It by no means provides an exhaustive review of all the available habitat components. The tallies of wildlife species associated with different habitats come from personal observations in the project area (See Wildlife Field Notes in the project file), observations reported by other biologists and personnel, landbird surveys and studies summarized in the References section.

The Assumptions, Information Used, and Methodologies/Scientific Accuracy Section pertain only to those habitats and species that are analyzed in the Wildlife Specialist Report. Appendix A of the Wildlife Specialist Report summarizes those habitats and species that are carried forward in this analysis and the rationale for those for which there will be no further discussion.

Information and assumptions common to all wildlife habitats and species are:

- Information associated with wildlife in conifer forest habitats is derived from field surveys, Montana Department Fish, Wildlife, and Parks (MFWP) big game survey data, and the Montana Natural Heritage program (See project record).
- R1-VMap (VMap 14) is used to model and map wildlife habitat for selected species in the project area. R1-VMAP data are remotely sensed and represents a broad-scale, ***coarse filter*** depiction. It relies on satellite imagery and describes three main vegetation components—***canopy cover***, tree dominance type, and stand size. R1-VMAP spatially represents habitats within the project area. Intensified grid data are used to model habitat forestwide.
- The scale at which cumulative effects is measured varies among habitats and species. The respective scales are described in the Cumulative Effects section.

- The ArcMap geographic information system (GIS) is used to model, map, and quantify habitats and project impacts using accepted methodologies as described in the following sections.
- GIS data and product accuracy may vary. They may be: developed from sources of differing accuracy, accurate only at certain scales, based on modeling or interpretation, incomplete while being created or revised, etc. Further, results may vary amongst products and outputs. Therefore, calculations (acres and miles) are usually expressed as 'approximate' to account for this variation. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results.

Species Habitat Associations

Highly specialized species, like pileated woodpeckers, American martens, and northern goshawks, are strongly tied to individual vegetative types, size classes, stand structural characteristics, landscape-scale patterns or topographic features, or combinations of the above. For instance, pileated woodpeckers nest predominantly in large-diameter ponderosa pine or cottonwood snags (McClelland 1977); American martens occur within dense, mid- to late seral spruce-fir/lodgepole pine forests (Ruggiero *et al.* 1994); and goshawks nest within multi-storied, mid- to late seral forests at all but the highest elevations (Reynolds *et al.* 2006). Although these habitat associations are well-researched and accepted in the scientific community, "outliers" or rare occurrences of individuals using uncommon habitats do occur and are acknowledged in the literature. For instance, research shows that goshawks have a preference for stands no less than 30 acres in size (Reynolds *et al.* 2006), yet McGrath *et al.* (2003), sampled nest stands that were much smaller. McClelland (1977) found that pileated woodpeckers almost exclusively nest in ponderosa pine, cottonwood, and western larch (west of the Continental Divide), but reported a rare use of Douglas-fir snags. Researchers typically acknowledge but disregard outlying results when identifying habitat associations. In turn, for this analysis, we assume that species ***sustainability*** is best modeled by using what the scientific literature designates as typical habitat for a species and do not consider atypical outliers in our analysis unless data collected in the project area supports use of 'atypical' habitat relationships.

Habitat models described in Samson (2005) are based on peer-reviewed literature, non-peer reviewed publications, particularly unpublished master's theses and PhD dissertations, research reports, and data accumulated by the Forest Service. Where possible, the peer-reviewed professional society literature is emphasized in that it is the accepted standard in science.

Literature published since 2000 was emphasized in that such recent publications review the previous literature and provide the best available and most recent science. Unpublished literature with a strong focus on unpublished master's theses and PhD dissertations provided information reflected in two to three year investigations into ecology, behavior, and/or habitat requirements of the four species described in Samson (2005). Such unpublished university-based information was important to provide detailed information on species given the possible lack of studies published in the professional peer-reviewed literature. See Samson (2005) for more information on how these habitat models were derived.

Limitations of Habitat Models

Habitat models are designed to relate the occurrence and/or abundance of a species to environmental predictors which can then be used to allow these predictions to be mapped within a particular landscape or region (Barry and Elith 2006). These predictions have inherent limitations and it's important to understand these limitations to allow for transparency in decision making.

Habitat model limitations stem from two general types of errors: deficiencies in data and deficiencies in their ecological realism (Ibid). Data deficiencies arise from small sample sizes, lack of absence

data, and missing predictor variables that may be useful in explaining environmental constraints. Model deficiencies also arise from small sample sizes that are usually not randomly derived. Further, it's difficult to model species' distribution due to the variety of biotic and abiotic factors that comprise species' ecological requirements. Species' responses to environment "depend on the competitive context, and this in turn varies given the dynamic nature of species' distributions, the effects of natural and human disturbance, and the complicating effects of variation in the speed with which different species re-occupy sites from which they have been displaced" (Ibid, p.421).

Models are a simplification of complex biological systems and therefore cannot be perfectly predictive. Most habitat models are limited to vegetative structure and do not include other habitat variables (i.e., microclimate) and other life history phases (i.e., dispersal, territory establishment, etc.). General models tend to be simpler which in turn enhances the clarity of the model and increases its applicability over a broader range (Van Horne 2002 p.64).

Habitat models that rely on point of detection (POD) data have been successfully utilized to predict habitat relationships and build species' models (Peterson *et al.* 2002). Sergio and Newton (2003, p. 857) describe how (1) "occupancy (POD) may be a reliable method of (habitat) quality assessment, especially for populations in which not all territories are occupied, or for species in which checking occupancy is easier than finding nests"; (2) "successful conservation should maintain or improve high quality (occupied) sites rather than focusing on poor (unoccupied) sites" (p. 863); (3) occupancy data are often available, either by specific or amateur monitoring schemes; and (4) occupancy through space and/or time is a reliable measure of territory quality, thus can provide key information for the development of conservation strategies.

The models described in Samson (2005, 2006) and summarized in *Criteria for Wildlife Models Helena National Forest Version June 2009* (USDA 2009a) are based on research findings and POD data collected in Region One.

Probability of Severe Wildfires following MPB Mortality

Wildfires are inevitable (Arno 2000; Arno *et al.* 1997). They are essential for many wildlife species, beneficial to some, and detrimental to others, depending upon the magnitude and severity of the fires. Higher-than-normal severity wildfires that cover larger-than-normal expanses can be detrimental to wildlife (Turner *et al.* 1994), especially when they occur on landscapes that historically had low or moderate severity wildfires. Wildfire severity is typically modeled using FlamMap or other models and is usually based on such factors as stand density and structural complexity (ladder fuels) (Finney 2006). Models are commonly used to address the long-term sustainability of wildlife habitats. In most cases, changes in wildfire severity are considered an indirect effect upon wildlife. Effects are further qualified as to the degree that wildlife habitats can be sustained into the future based on the risks and severity of predicted fires.

R1-VMAP and FIA Intensified Grid Data

R1-VMAP data are remotely sensed while FIA intensified grid data (intensified grid data) are from on-the-ground plots. These two datasets are used to describe the habitats in this report. R1-VMAP [described in more detail in the Vegetation Overview] represents a broad-scale, coarse filter depiction. It relies on satellite imagery and describes three main vegetation components—canopy cover, tree dominance type, and stand size. R1-VMAP spatially represents habitats at the landscape level and within the project area. It also provides a context against which to identify treatment effects on a given habitat. The R1-VMAP version used in this analysis is derived from 2011 imagery and is the most up to date data available. The intensified grid data are point data and generally incorporate additional vegetation parameters not included in R1-VMAP. For example, snag and down wood habitat data are collected as part of intensified grid point data and cannot be derived from R1-

VMAP. Point data also provide an opportunity to refine and verify broad scale spatial data (i.e., R1-VMAP) and also provide a baseline against which future management actions may be measured. The assumptions and limitations of both of these data sets are described in the Vegetation Overview Section.

Table 118. Assumptions, information used, and methodologies used to determine effects to wildlife

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
	Driving Issues	
Elk	Data used to analyze effects to habitat are based on field observations and surveys. ***Elk herd units*** were developed in conjunction with Montana Fish, Wildlife, and Parks. ***Summer range*** is assumed to be the entire elk herd unit. ***Winter range*** is based on updated FWP range maps (2008). ***Elk security areas***, ***hiding cover*** and ***thermal cover*** are defined in the glossary. Hiding and thermal cover data are derived from R1-VMAP based in part on the following documents: *The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products (*USDA 2011*)* and *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (USDA 2009b). Hiding and thermal cover models are described in the *Criteria for Wildlife Models Helena National Forest Version June 2009 (*USDA 2009a*).* Hiding cover is based on the MFWP definition of 'a stand of coniferous trees having a crown closure of greater than 40 percent' (USDA 1986, p. II/18). The methodology for modeling hiding cover is described in USDA (2009a) and includes a consideration of stand age in areas that have experienced previous timber harvest and/or prescribed fire activity. Any stand that is less than 15 years old that has been treated with timber harvest or prescribed fire is not considered hiding cover. Conversely, stands that are greater than 15 years old and meet the requisite canopy cover of at least 40% are considered hiding cover. The trees in these stands are generally at least 5 feet tall although there is some variation. Tree height is generally 5 feet or greater in areas of mapped hiding cover; by the time canopy cover is $\geq$ 40%, trees are generally at least five feet. There will always be within stand variation, however. There is no tree height requirement for hiding cover in the Forest Plan*.* Hiding cover is based on canopy cover (see also Appendix B in the Forest Plan). In order for a polygon to be considered hiding cover, it must be at least 40 acres in size pre and post project implementation. The exception is remaining cover in security areas. The existing cover is comprised of 40 acres or more or 40%+ canopy cover while the remaining acres post implementation is not configured into 40 acre patches.	Analyses are based on site-specific information and scientific literature. Methodologies used to determine direct and indirect effects to elk include the following: ***Habitat effectiveness*** (Lyon 1983) is based on motorized route densities open to the public during the summer (May 16 and October 14) and weighted according to the discussion below. Changes in open motorized route densities by alternative are disclosed as changes in habitat effectiveness as outlined in Lyon (1979). This analysis includes habitat effectiveness during project implementation and post implementation. Hiding cover and open road densities are analyzed for the post-implementation conditions as well as during project implementation (temporary roads, use of roads closed to the public) relative to Forest Plan Standards and include all motorized routes open between 10/15 and 12/1. Motorized routes are weighted according to their expected use: any road considered public is weighted by a factor of 1 (i.e., 1 mile =1 mile) whereas any road considered private is weighted by a factor of 0.25 (i.e., 1 mile = 0.25 miles). This is based on research that indicates roads with less use have reduced impacts to elk (Perry and Overly1976, Lyon 1979, Witmer and deCalesta 1985, Rowland *et al.* 2000). Private roads are assumed to receive less use than public roads as they generally are only available for use by the private landowner. Elk security is analyzed according to the following: ***Security*** is defined as a proportion of an elk herd unit within the administrative boundary of the Helena Ranger District that consists of an area of at least 1000 acres in size that is at least ½ mile from a motorized route open to the public between 9/1 and 12/1. Security blocks are adjusted for constrictions less than or equal to ½ mile in width. Security is calculated across all ownerships within the administrative boundary. ***Intermittent Refuge Areas*** are defined as those areas at least 250 acres in size and less than 1000 acres in size that are greater than or equal to ½ mile from a motorized route open to the public

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
	Thermal cover must be at least 15 acres in size pre and post project implementation with a canopy cover of at least 60%. Road density information is derived from transportation database. Private roads are assumed to have less impact on elk than public roads. Rowland *et al.* (2000) examined the relationship of open, closed, and administrative roads on elk habitat use. Administrative roads (restricted vehicle use, not open to the public) are similar to private roads as far as vehicle use. Rowland *et al.* (2000) found that open roads have the greatest impact on elk habitat use. Based on this and other research (Perry and Overly1976, Lyon 1983, Witmer and deCalesta 1985) this analysis assigns a weight of 0.25 to private roads. Elk survey data are provided by MFWP area biologists for the respective hunting districts (MFWP 2002 – 2014). Elk analyses are also based on the *Montana Statewide Elk Management Plan* (2005a) The elk analysis is based on the guidelines found in the Framework for Project-Level Effects Analysis on Elk (MFWP and USDA 2013). The methodologies contained in this document are not direction and do not replace existing Forest Plan standards. For example, the security and habitat effectiveness analyses are NOT standards but methodologies used to describe effects to elk. All road analyses are based on Telegraph transportation data except for the elk security/intermittent refuge area analysis which is based on the Divide Travel Plan – Alternative 1.	between 9/1 and 12/1. Intermittent Refuge Areas are adjusted for constrictions less than or equal to ½ mile in width. Intermittent Refuge Areas are calculated across all ownerships within the administrative boundary. A cover consideration is also included in the security area analysis as follows: Cover should be distributed in a manner that mimics or approximates a natural range of variation (NRV). NRV is generally defined as the spatial and temporal variation in ***ecosystem*** characteristics under historic disturbance regimes during a reference period. A reference period should be sufficiently long to include the full range of variation produced by dominant natural disturbance regimes. Fire, wind, and insect/disease outbreaks are examples of disturbances. Provide cover, if available, in elk security areas to maintain and/or improve elk security in areas known to be used by elk or that have the potential to be used by elk. Provide cover, if available, between elk security areas to maintain habitat ***connectivity*** and facilitate seasonal movement. Invasive weed risk is assessed qualitatively based upon droughty sites where crown closure is low due to MPB, soils are disturbed by equipment, and mitigation measures (rapid re-vegetation, spot herbicide treatment, etc.) are applied.
Mule Deer	Data used to analyze effects to habitat are based on field observations and surveys. Mule Deer winter range is based on updated FWP range maps (2008). Hiding and thermal cover data are derived from R1-VMAP based in part on the following documents: *The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products* (USDA 2011) and *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (USDA 2009b). Hiding and thermal cover models are described in the Criteria for Wildlife Models Helena National Forest Version June 2009 (USDA 2009a). Mule deer survey data are provided by MFWP area biologists for Hunting District 215 within which the Project occurs as well as for adjacent hunting districts.	Analyses are based on site-specific information and scientific literature.

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
Canada Lynx	The Helena National Forest Plan was amended March 2007 by the *Northern Rockies Lynx Management Direction* (NRLMD). The NRLMD applies only to ***lynx habitat*** identified as occupied. The project area is considered occupied; therefore, the NRLMD applies (See USDA 2007a). Furthermore, lynx are listed on the Helena National Forest Species List, prepared by the U.S. Fish and Wildlife Service according to the January 8, 2015 species list. The project area is not in lynx critical habitat. Habitat estimates and maps are derived from R1-VMAP and Pfister *et al.* (1977) and are based on the *Eastside Assessment-Wide Wildlife Habitat Parameters for Results and Expected Trends* (2014). Methodologies and assumptions associated with these data are described in the following documents in addition to Pfister *et al.* (1977): *The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products* (USDA 2011) and *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (USDA 2009b). See also the *Vegetation Introduction* for additional information and assumptions. Data for lynx are derived from survey efforts and the Montana Natural Heritage Program (See http://nhp.nris.mt.gov/). The lynx is identified as an animal species of concern by the Montana Natural Heritage Program (accessed March 21, 2015).	Analyses are based on the NRLMD and Lynx Conservation and Assessment Strategy (Interagency Lynx Biology Team 2013). Because an updated version of R1-VMAP has been utilized for this analysis, field data will occur to validate the habitat values.
Wetland Habitats and Riparian Zones	Information used to analyze effects on ***wetland habitat*** and ***riparian zones*** is based on data summarized in the *Hydrology Specialist Report*. Information associated with wildlife in wetland habitats and riparian zones is derived from the *Partners in Flight Bird Conservation Plan Montana (*Montana Partners in Flight 2000), *Coordinated Implementation Plan For Bird Conservation In Western Montana* (Montana Steering Committee 2005) and *Montana's Comprehensive Fish and Wildlife Conservation Strategy* (MFWP 2005b).	Analyses are based on site-specific information and scientific literature. Landbird surveys are based on the *Northern Region Monitoring Program Point Count Protocol 2007* (Avian Science Center 2007a).

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
Other Prominent Issues		
Snags and Down Woody Debris Habitat	Snag and down woody debris data are derived from the Summary Database. Methodologies and assumptions associated with these data are described in the following documents: *R1 Grid Intensification using CSE Protocols – Field Procedures* (USDA 2010), *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (USDA 2009b), and FIA Field Guides, Methods, and Procedures at http://fia.fs.fed.us/library/field-guides-methods-proc/.. See also the *Forested Habitats of Special Concern Background Report* for additional information and assumptions. Snag data are also derived from the *Estimates of snag densities for eastside forests in the Northern Region (*Bollenbacher *et al.* 2008) which replaces the *R1 Snag Protocol* (Ritter *et al.* 2000). Treatments in grasslands and ***shrub*** habitats are assumed to have the potential for the greatest effects to dead wood habitat. Efforts to remove conifers in these habitats would create an immediate snag source as trees are killed through prescribed fire. However, as conifer colonization is set back, as is the goal in these biophysical settings, fewer large trees will be available for future snags. Intermediate harvest treatments and prescribed fire prescriptions should result in the retention of more snags than regeneration harvest prescriptions. Assumptions related to snag recruitment as a result of prescribed fire are described in the *Forested Habitats of Special Concern Background Report.* Down woody debris habitat is based on amounts of thousand and hundred hour fuels. These generally represent the larger down logs (Fischer 1981).	Analyses are based on site-specific information and scientific literature. Woodpecker surveys are based on *A Field Protocol to Monitor Cavity Nesting Birds* (Dudley and Saab 2003) and the *Northern Region Landbird Monitoring Program Field Methods* (Avian Science Center 2007a). See also the *Vegetation Introduction* and the *Forested Habitats of Special Concern Background Report* for scientific accuracy and methodologies associated with landscape level FIA data and FIA grid intensification plots.
Habitat Fragmentation	***Fragmentation*** effects are based on the impacts that proposed treatments have within and between stands on ***patch*** size integrity. Effects are described qualitatively.	Analyses are based on site specific information and scientific literature.

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
Travel Corridors and Linkage Zones	The Region 1 Connectivity Protocol (USDA 1997) was used as background concepts. The Telegraph project area lies within what has been characterized as the Continental Divide Linkage Zone although it is also referred to as the Continental Divide "travel corridor," "migration corridor," or "habitat corridor" (Walker and Craighead 1997). Connectivity is discussed relative to the local connectivity and regional connectivity (Servheen et al. 2001). Conceptual elements of linkages are described in Craighead and others (2001).	Analyses are based on site specific information and scientific literature.
Grizzly Bear	The grizzly bear are considered present in the project area according to the January 8, 2015 U.S. Fish and Wildlife Service Species List (See Project Record*).* Information used to analyze project effects to grizzly bears is derived literature contained within the *NCDE Grizzly Bear Conservation Strategy* (http://www.fws.gov/mountain-prairie/science/PeerReviewDocs/NCDE_Grizzly.pdf). The project area occurs in Zone 2 where the objective is to maintain existing resource management and recreational opportunities and allow agencies to respond to grizzly bear/human conflicts while providing the opportunity for grizzly bear dispersal between the Northern Continental Divide Ecosystem (NCDE) and other ecosystems. The grizzly bear is identified as an animal species of concern by the Montana Natural Heritage Program (accessed March 21, 2015).	Analyses are based on open roads and total roads in the Divide South landscape. Treatment effects on forage are based on habitat types that provide grizzly bear food sources (Zager *et al.* 1983, IGBC 1986). The habitat types include: Douglas-fir/bearberry, Douglas-fir/huckleberry, subalpine fir/alder, subalpine fir/bead lily, subalpine fir/blue joint, subalpine fir/grouse whortleberry, subalpine fir/huckleberry, subalpine fir/twinflower, subalpine fir/whitebark, and spruce types.
Wolverine	Data for wolverines are derived from survey efforts and the Montana Natural Heritage Program (See http://nhp.nris.mt.gov/). Effects to wolverines are based on models developed by Inman *et al.* (2013) and Copeland et al. (2010): ***areas of persistent spring snow, maternal habitat, primary habitat, male dispersal, and female dispersal***. The wolverine is also identified as an animal species of concern by the Montana Natural Heritage Program (accessed March 21, 2015).	Analyses are based on site-specific information and scientific literature. Methodologies for wolverine habitat are located in Copeland *et al.* (2010) and Inman *et al.* (2013).

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
Mature-Forest Dependent – American Marten	Data on martens are based field surveys and on the Montana Natural Heritage Program (See http://nhp.nris.mt.gov/). Habitat for martens is based on information provided in *Habitat Estimates For Maintaining Viable Populations of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, Pileated Woodpecker, American Marten, and Fisher* (Samson 2006). Throughout most of its distribution, American marten are reported to be closely associated with relatively ***closed canopy*** (>30-50%) (Buskirk and Ruggiero 1994, Coffin *et al.* 2002) and in some regions may utilize areas with canopy cover ≥ 25% (Chapin *et al.* 1997). For the purposes of this analysis, canopy cover ≥ 25% is utilized to predict marten habitat. R1-VMap canopy cover breaks coincide with this value (i.e., 25-40%, 40-60%, and 60%+). Habitat models used in Samson (2006) are described in the *Criteria for Wildlife Models Helena National Forest (*USDA 2009a*).* See that document for methods and assumptions. Model values are based on R1-VMap values and include: ***dominant*** tree types Douglas-fir, ponderosa pine, Engelmann spruce, subalpine fir, lodgepole pine, and aspen as well as mixed stands that include these types, tree sizes greater than 10" in diameter, and canopy cover ≥ 25%. Snag and down log data are also used. See also the *Vegetation Introduction* and the *Forested Vegetation Background Report* for additional information and assumptions. Habitat estimates and maps are derived from the HNF Intensified Grid Summary Database with the exception of fuel loading data that are derived from the R1 Summary Database. Methodologies and assumptions associated with these data are described in the following documents: *The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products* (USDA 2011), *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (USDA 2009b), and FIA Field Guides, Methods, and Procedures at http://fia.fs.fed.us/library/field-guides-methods-proc/. Snag and coarse woody debris data are also used. See above for snag and down log assumptions.	Effects to Snags and Down Woody Debris are also applicable to this analysis. The methodology to determine effects to snags are described above under Snags and Down Woody Debris. Analyses are based on site specific information and scientific literature. See also the *Forested Habitats of Special Concern Background Report, Vegetation Introduction,* and the *Forested Vegetation Background Report* for scientific accuracy and methodologies associated with landscape level FIA data and FIA grid intensification plots.
Old Growth Dependent - Northern	Data used to analyze effects to habitat are based on field observations. Goshawk habitat models are derived from *A Conservation Assessment of the Northern Goshawk, Black-backed Woodpecker, Flammulated*	Goshawks surveys are based on the *Northern Goshawk Inventory and Monitoring Technical Guide* (Woodbridge and Hargis 2006).

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
Goshawk	*Owl, and Pileated Woodpecker in the Northern Region USDA Forest Service (*Samson 2005), *Habitat Estimates For Maintaining Viable Populations of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, Pileated Woodpecker, American Marten, and Fisher* (Samson 2006), *Northern Goshawk Overview and Multi-level Analysis, Northern Region,* (USDA 2009c), and the *Criteria for Wildlife Models Helena National Forest* (USDA 2009a). See those documents for methods and assumptions. See also the *Vegetation Introduction* and the *Forested Vegetation Background Report* for additional information and assumptions. Model values are based on R1-VMap values and include the following: nest habitat - dominant tree types Douglas-fir, ponderosa pine, lodgepole pine, and aspen as well as mixed stands that include these types, tree sizes greater than 10" in diameter, and canopy cover $\geq$ 25%; foraging habitat - dominant tree types Douglas-fir, ponderosa pine, lodgepole pine, subalpine fir, and aspen as well as mixed stands that include these types and canopy cover $\geq$ 40%. Diversity matrices are also used to describe foraging habitat and the PFA (USDA 2009b). Samson (2005, 2006) and USDA (2009a) provide a detailed rationale on the basis for these structural characteristics used to describe goshawk habitat. Landscape level ***old growth*** estimates are non-spatial and are based on FIA and intensified grid data. Old growth polygons at the 3rd order drainage scale are mapped using stand exam data. Regeneration and intermediate harvest, precommercial thinning, and mixed severity prescribed fire are all assumed to remove nesting habitat. Regeneration harvest is assumed to remove foraging habitat; however, these treatments would most likely yield habitat for prey species different than those associated with the original stand. All other treatments in forage are assumed to retain sufficient structure to accommodate the prey species associated with the original stand. Habitat estimates and maps are derived from the HNF Intensified Grid Summary Database. Methodologies and assumptions associated with these data are described in the following documents: *The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products* (USDA 2011), *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (USDA 2009b), and FIA Field Guides, Methods, and Procedures at http://fia.fs.fed.us/library/field-guides-methods-proc/. The goshawk is also identified as an animal species of concern by the Montana Natural Heritage Program (accessed March 21, 2015).	Analyses are based on site specific information and scientific literature. Effects to goshawk habitat are based on impacts to habitat modeled according to Samson (2006) as described in *Criteria for Wildlife Models Helena National Forest (*USDA 2009a) AND based on changes in vegetation diversity as described in *Northern Goshawk Northern Region Overview: Key Findings and Project Considerations (*USDA 2009b). See reference for assumptions and a discussion of the scientific uncertainty surrounding goshawk conservation. See also the *Forested Habitats of Special Concern Background Report, Vegetation Introduction,* and the *Forested Vegetation Background Report* for scientific accuracy and methodologies associated with landscape level FIA (Forest Inventory and Analysis) data and FIA grid intensification plots as well as common stand exams. The PFA is based on a buffer of 730 meters around the known nest site which is equivalent to ~420 acres. PFAs are only identified for known nests since delineation of the PFA depends on the presence of a known nest. Home ranges are not mapped since home ranges can overlap amongst goshawk pairs. The home range analysis is based on an average home range size of 5,000 acres.

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
Old-Growth Dependent – Pileated Woodpecker	Data used to analyze effects to habitat are based on field observations. Data for pileated woodpeckers are also derived from the Montana Natural Heritage Program (See http://nhp.nris.mt.gov/). Pileated Woodpecker habitat models are derived from *A Conservation Assessment of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, and Pileated Woodpecker in the Northern Region, USDA Forest Service* (Samson 2005), *Habitat Estimates For Maintaining Viable Populations of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, Pileated Woodpecker, American Marten, and Fisher* (Samson 2006), and *Criteria for Wildlife Models Helena National Forest* (USDA 2009a). See those documents for methods and assumptions. See also the *Vegetation Introduction* and the *Forested Vegetation Background Report* for additional information and assumptions. Minimum habitat model values (USDA 2009a) are based on R1-VMap values and include: dominant tree types Douglas-fir, ponderosa pine, and aspen as well as mixed stands that include these types and tree sizes greater than 10" in diameter to include forage and nesting trees. Landscape level old growth estimates are non-spatial and are based on FIA and intensified grid data. Old growth polygons at the 3rd order drainage scale are mapped using stand exam data. Habitat estimates and maps are derived from the HNF Intensified Grid Summary Database. Methodologies and assumptions associated with these data are described in the following documents: *The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products* (USDA 2011), *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (USDA 2009b), and FIA Field Guides, Methods, and Procedures at http://fia.fs.fed.us/library/field-guides-methods-proc/. Snag and coarse woody debris data are also used. See above for snag and down log assumptions. The pileated woodpecker is also identified as an animal species of concern by the Montana Natural Heritage Program (accessed March 21, 2015).	Pileated woodpecker surveys are based on the *Northern Region Landbird Monitoring Program Field Methods* (Avian Science Center 2007a). Effects to Snags and Down Woody Debris are also applicable to this analysis. The methodology to determine effects to snags are described above under Snags and Down Woody Debris. Analyses are based on site specific information and scientific literature. See also the *Forested Habitats of Special Concern Background Report, Vegetation Introduction,* and the *Forested Vegetation Background Report* for scientific accuracy and methodologies associated with landscape level FIA (Forest Inventory and Analysis) data and FIA grid intensification plots.

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
Snag Dependent – Hairy Woodpecker	Data used to analyze effects to habitat are based on field observations. Data for hairy woodpeckers are also derived from the Montana Natural Heritage Program (See http://nhp.nris.mt.gov/). Hairy Woodpecker habitat models are derived from the *R1 Draft Model Set All Species* (USDA 1998) as described in the *Criteria for Wildlife Models Helena National Forest* (USDA 2009a), based on R1-VMap values and include: dominant tree types Douglas-fir, ponderosa pine, Engelmann spruce, and aspen as well as mixed stands that include these types (with the exception of Engelmann spruce), tree sizes greater than 10" in diameter, and canopy cover $\geq$ 10%. Habitat estimates maps are derived from R1VMAP. Methodologies and assumptions associated with these data are described in the following documents: *The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products* (USDA 2011) and *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (USDA 2009b). See also the *Vegetation Introduction* and the *Forested Vegetation Background Report* for additional information and assumptions. Snag and coarse woody debris data are also used. See above for snag and down log assumptions.	Hairy woodpecker surveys are based on the *Northern Region Landbird Monitoring Program Field Methods* (Avian Science Center 2007a). Effects to Snags and Down Woody Debris are also applicable to this analysis. The methodology to determine effects to snags are described above under Snags and Down Woody Debris. Analyses are based on site specific information and scientific literature. See also the *Forested Habitats of Special Concern Background Report, Vegetation Introduction,* and the *Forested Vegetation Background Report* for scientific accuracy and methodologies.
Migratory Birds	Migratory bird surveys evaluated for this project originate from the *Northern Region Landbird Monitoring Program* (1994-2004), and Montana Natural Heritage Program Database. The *Cornell Birds of North America* at http://bna.birds.cornell.edu/bna was used for additional habitat information; the North American Breeding Bird Survey Results and Analysis at http://www.mbr-pwrc.usgs.gov/bbs/bbs.html is used to identify trends.	Analyses are based on site-specific information and scientific literature. Surveys are based on the *Northern Region Landbird Monitoring Program Field Methods* (Avian Science Center 2007a).
Topics not Analyzed in Detail		
Aspen	Information on aspen is based on the *Forested Habitats of Special Concern Background Report* for additional information and assumptions.	Analyses are based on site-specific information and scientific literature. Effects are qualitative.
Whitebark Pine	Vegetation data and field reconnaissance were used to determine the extent of whitebark pine. Information associated with wildlife in whitebark pine habitats is derived from the *Partners in Flight Bird Conservation Plan Montana (*Montana Partners in Flight 2000) and the *Coordinated Implementation Plan For*	Analyses are based on site specific information and scientific literature. Effects are qualitative.

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
	Bird Conservation In Western Montana (Montana Steering Committee 2005). See also the *Forested Habitats of Special Concern Background Report.*	
Mature and Early Conifer Forests	Information on mature and early conifer forests is based on field observations and the *Forested Vegetation Background Report*.	Analyses are based on site-specific information and scientific literature. Analyses are qualitative.
Old Growth Forests	Old growth in the Telegraph project area is based on stand exam inventory and intensified grid data. Old growth definitions are based on Green *et al.* (1992). See the *Forested Habitats of Special Concern Background Report* for more detailed information on old growth forest methodologies.	Analyses are based on site-specific information and scientific literature. Effects are qualitative except for goshawks and pileated woodpeckers.
Edges and Ecotones	***Edge and Ecotone*** effects are based on the impacts that proposed treatments have on edges and ecotones.	Effects are described qualitatively.
Grasslands and Shrub Habitat	Vegetation data and field reconnaissance were used to determine the extent of grasslands and shrub habitat.	Analyses are based on site-specific information and scientific literature and are qualitative in nature.
White-tailed Deer, Moose, Black Bear, and Mountain Lion	Information for these big game species is derived from MFWP data, field observations, and other records.	These big game species are described qualitatively.
Wolves	Information on wolves is derived from MFWP (2003, 2009a, 2009b), Wildlife Services, field observations, and anecdotal data.	Wolves are described qualitatively.
Boreal Toad	Data on boreal toads are based on Werner *et al.* (2004), Maxell *et al.* (2003), and the Montana Natural Heritage Program (See http://nhp.nris.mt.gov/). The boreal toad is also identified as an animal species of concern by the Montana Natural Heritage Program (accessed March 21, 2015).	Boreal toads are described qualitatively.
Fisher	Data on fishers are based field surveys and on the Montana Natural Heritage Program (See http://nhp.nris.mt.gov/). Data are also derived from the Federal Register: June 30, 2011; vol. 76, no. 126, p. 38509, 38513. The fisher is identified as an animal species of concern by the Montana Natural Heritage Program (accessed March 21, 2015).	The fisher is described qualitatively.

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
Flammulated Owl	Data used to analyze effects to habitat are based on field observations and systematic surveys (Cilimburg 2006, Smucker and Cilimburg 2008). Data for flammulated owls are also derived from the Montana Natural Heritage Program (See http://nhp.nris.mt.gov/). The flammulated owl is identified as an animal species of concern by the Montana Natural Heritage Program (accessed March 21, 2015).	Flammulated owl surveys are based on the *Northern Region Landbird Monitoring Program Flammulated Owl Protocol* (Avian Science Center 2007b). Flammulated owls are described qualitatively.
Black-backed Woodpecker	Data used to analyze effects to habitat are based on field observations and data collected in areas associated with wildfire and in the Birds and Burns study area. The black-backed woodpecker is identified as an animal species of concern by the Montana Natural Heritage Program (accessed March 21, 2015).	Black-backed woodpecker surveys are based on *A Field Protocol to Monitor Cavity Nesting Birds* (Dudley and Saab 2003) and *Northern Region Landbird Monitoring Program Field Methods (*Avian Science Center 2006 (2007a). Black-backed woodpeckers are described qualitatively.
	Other	
Viability	Viability analyses are based on the Northern Region Viability Protocol (Samson 1997). Samson (2005 and 2006) in *A Conservation Assessment of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, and Pileated Woodpecker in the Northern Region* and *USDA Forest Service Habitat Estimates For Maintaining Viable Populations of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, Pileated Woodpecker, American Marten, and Fisher* summarizes the status of viability for the northern goshawks, pileated woodpeckers, and American martens. Habitat models are derived from *A Conservation Assessment of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, and Pileated Woodpecker in the Northern Region, USDA Forest Service* (Samson 2005), *Habitat Estimates For Maintaining Viable Populations of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, Pileated Woodpecker, American Marten, and Fisher* (Samson 2006), and *Criteria for Wildlife Models Helena National Forest* (USDA 2009a). Habitat estimates are derived from the HNF Intensified Grid Summary Database. Methodologies and assumptions associated with these data are described in the following documents: *The Region 1 Existing Vegetation Classification System and its Relationship to Region 1 Inventory Data and Map Products* (USDA 2011), *R1 Multi-level Vegetation Classification, Mapping, Inventory, and Analysis System* (USDA 2009a), and FIA Field Guides, Methods, and Procedures at http://fia.fs.fed.us/library/field-guides-methods-proc/.	Acre estimates for existing habitat for northern goshawks, marten, and pileated woodpeckers are derived by multiplying the percent habitat estimates (derived from the summary database) by total forested acres on the HNF (978,799 acres). Viability analyses the remaining species include an examination of the abundance and distribution of elk habitat compared to elk population data.

Wildlife Parameter	Assumptions and Information Used	Methodologies and Scientific Accuracy
Cumulative Effects Analysis	The Forest Activity Tracking System (FACTS) and the Schedule of Proposed Activities (SOPA) are used to identify past, present, and reasonably foreseeable projects.	The impacts of past activities on species' specific habitat are based on changes to stand structure relative to species' habitat requirements.

Analysis Areas

The *Forest Service NEPA Handbook* provides direction for identifying appropriately sized analysis areas for given species and habitats. The Telegraph Project area is of sufficient size to assess cumulative effects for some species with small home ranges, such as boreal toads. For most species, including elk and wolverines, the project area is too small to accurately identify cumulative effects. Figure 54 illustrates the analysis scales used to assess the direct, indirect, and cumulative effects of project alternatives on all of the species and habitats included in this report. Table 119 describes the analysis areas used for each species and habitat analyzed in this report.

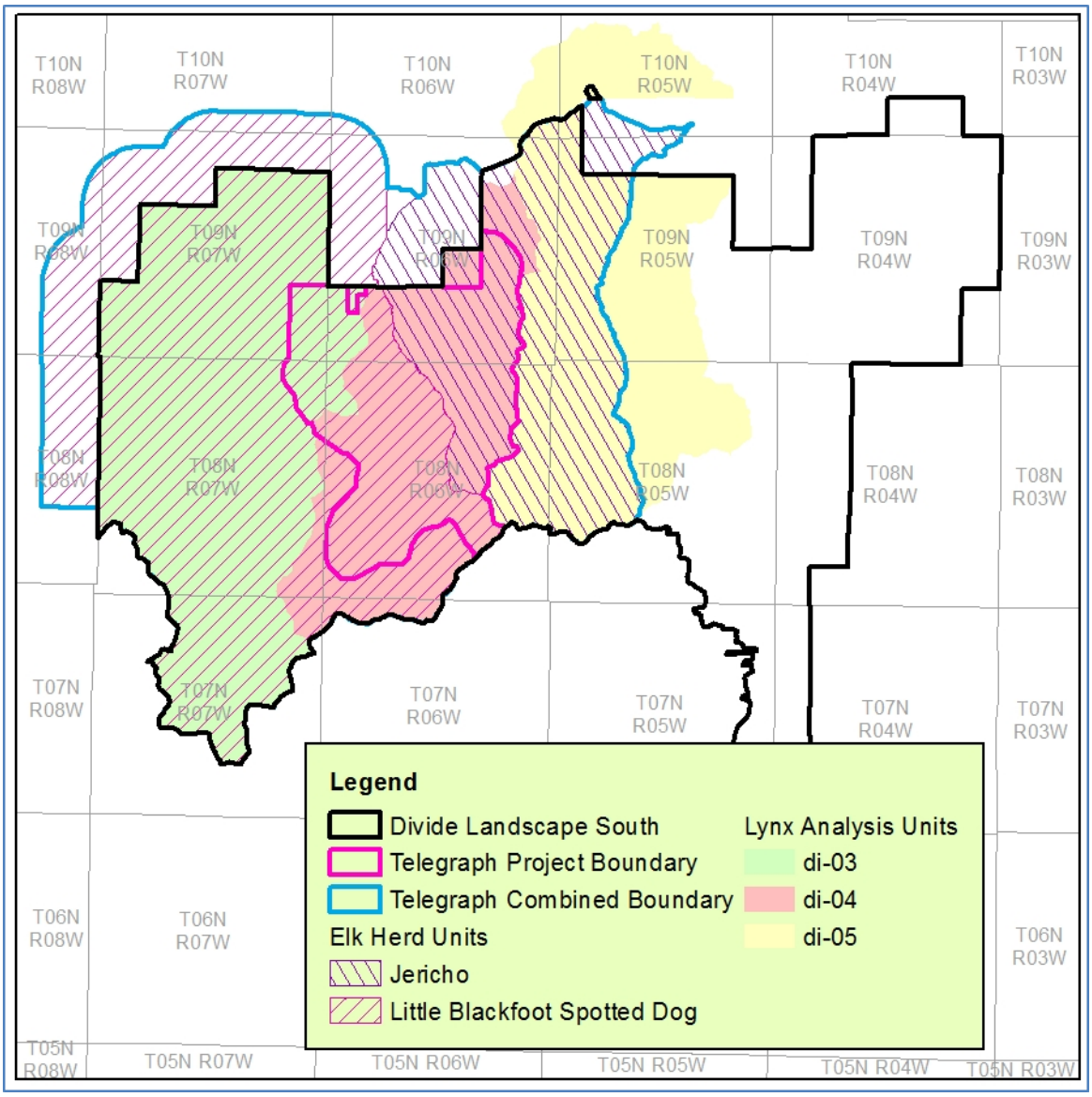


Figure 54. Wildlife analysis areas

Table 119. Scale of analysis for species and habitats within the Telegraph project that are fully analyzed

Wildlife Species and Habitats	Analysis Area
Big Game Species	
Elk	Herd Unit
Mule Deer	Combination Boundary
TES Species	
Grizzly Bear	Divide Landscape - South
Canada Lynx	Lynx Analysis Unit
Fisher	Project
Wolverine	Divide Landscape - South
Black-backed Woodpecker	Project Area
Flammulated Owl	Project Area
Boreal Toad	Project Area
Townsend's Big-eared Bat	Project Area
Other Management Indicator Species	
Northern Goshawk	Combination Boundary
Pileated Woodpecker	Combination Boundary
Hairy Woodpecker	Combination Boundary
American Marten	Combination Boundary
Habitats	
Mature and Early Conifer Forests	Project Area
Old Growth	Project Area, Third Order Drainage
Wetland Habitats and Riparian Zones	Project Area
Aspen	Project Area
Whitebark Pine	Project Area
Grasslands and Shrub Habitats	Project Area
Snags and Down Woody Debris[1]	Project Area
Travel Corridors and Linkage Zones	Divide landscape - South
Fragmentation, Edge, and Ecotones	Project Area
Additional	
Migratory Birds	Analyzed in the context of their associated habitats
Viability	Forest

Driving Issues

This section looks in detail at the current status of four key issues: Elk, Mule Deer, Canada Lynx, and Wetland Habitats and Riparian Zones.

Rocky Mountain Elk

Affected Environment

General Perspective: Considerations Pertinent to Management

The Rocky Mountain elk (*Cervus elaphus nelsoni*), although it evolved in isolation from other elk during the Pleistocene glaciation, is today little different from other subspecies of elk in North America or, for that matter, from most subspecies in Europe and Asia (O'Gara 2002, p. 47-62). Though reduced to small remnants across the west by the late 1900s, Rocky Mountain elk populations are now robust. Montana Fish, Wildlife and Parks, the Forest Service, and other agencies manage elk to provide a surplus for hunters while holding populations well above levels required for viability. Although the well-being of local subpopulations of elk is sometimes threatened by human development, overharvest, and habitat shortcomings, the overall population viability of elk in the northern Rockies has not been at risk since the early 20th century (Cooperrider 2002, p. 518-521).

Elk are one of the more manageable wildlife species: their habitat needs are well studied and they respond readily to habitat change and population manipulation. Because of their influence on plant community composition and structure, their competitiveness with other herbivores, and their role as a food source for numerous carnivores (including humans), some biologists consider elk to be a ***keystone species*** in Rocky Mountain ecosystems (Cooperrider 2002, p. 518-524). Elk are *management indicators* for hunted species on the HNF and most other National Forests in Region 1—a role that may be misplaced because of their adaptability and generalist tendencies (Cooperrider 2002, p. 523-524).

Elk occur in a variety of habitats including mountain forests and meadows, grasslands, shrublands, and highly managed forests (Skovlin et al. 2002, p. 531-532). Prior to Euro-American settlement, elk in Montana were commonly observed in the grasslands and river bottoms of the Great Plains year-round. It is likely that these plains dwelling populations spread well to the east and intermingled with those of now-extinct eastern elk subspecies (O'Gara 2012, p. 55-56). Today, however, due to habitat alteration in the valleys and on the prairies (mostly from livestock and crop raising) and the extirpation of elk from areas of human settlement, most elk find summer range in mountain grasslands, meadows, and conifer forests, and descend to ranges in the foothills and valleys only in winter (Skovlin et al. 2002, p. 531-537).

Managing for elk has become increasingly complex as human activities have affected habitat quality and access. Management requires meeting basic habitat needs and understanding the socioeconomic value of elk. Primary considerations in elk management (Lonner 1991) include:

- Maintaining habitat security to protect elk during the hunting season;
- Preserving/recovering desired elk population characteristics as determined by elk managers and distributions relative to land management;
- Satisfying the growing demand for quality hunting and non-hunting experiences.

Methodologies have evolved over the years to measure the status of elk populations and their vulnerability to land management practices, hunting, wildlife viewing, and the ever-increasing

presence of people throughout elk habitat. These approaches are generally organized around seasonal habitat needs: Summer range, winter range, and hunting season security habitat.

Elk Management Units

Coordinating HNF and MFWP Elk Management

Helena Forest Plan standards and guidelines for big game are designed to maintain habitat conditions on the National Forest that help MFWP meet its goals for local elk populations. MFWP's primary tool in managing elk is the manipulation of hunting regulations: setting harvest quotas for different sex/age classes, defining hunting areas, setting seasons, arranging for block management on private lands. The Forest Service is able to influence the equation by managing vegetation (cover and forage) and controlling hunter vehicle access on different parts of the Forest. In spite of this reasonably well-defined division of responsibility, management coordination remains complicated by technical issues.

For one, the quality of aerial survey data on which MFWP bases much of its annual population estimates can vary widely from year to year and from one hunting district to another. This is a function of weather conditions; snow cover; variable elk movement patterns; type of aircraft; timing; and inherent viewing difficulty imposed by local topography, forest vegetation, and artificial obstructions (powerlines, fences) [Legislative Audit Division 2002, p. 21-36]. The survey data (along with harvest statistics) are key to determining what adjustments MFWP needs to make to its hunting regulations each year. Trends in this data over time also suggest what the HNF needs to consider in terms of cover distribution and vehicle restrictions on its road and trail system. Changes to these components, particularly forest cover, are difficult, if not impossible to make on a year-to-year basis as elk populations shift.

Another problem stems from a mismatch in scale of analysis units. MFWP sets elk population objectives, makes population estimates, and adjusts hunting regulations for *hunting districts*, which, in the Divide landscape average about 250,000 acres (around 400 mi^2) and cover as much private, State, BLM, and municipal land as they do National Forest. The HNF, on the other hand, organizes its habitat management around ***elk herd units*** (EHUs), which in the Divide landscape may be as small as 35,000 acres, but average a bit less than 60,000 acres (around 90 mi^2) [see figure 54]. The problem, then, is to determine how conditions in an elk herd unit contribute to the population status of elk on a hunting district 3 to 8 times its size given the diversity of conditions in other herd units and non-Forest land that feed into the scenario.

In many cases, it is possible to scrutinize the MFWP flight data and divide hunting districts into distinct segments in terms of how local elk populations fare in each area. In HD 215, for example, MFWP biologists usually divide the elk count into northern and southern sectors—with the northern population group influenced more by conditions on the HNF and the southern groups more by conditions on the Beaverhead-Deerlodge NF toward Butte.

Local Elk Management Units

HNF Habitat Management: Elk Herd Units

Historically, the term "elk herd unit" has been used to define the total area used by a herd of elk in the course of one years' movement from summer to winter range—which, in the Divide landscape, inevitably includes areas outside the National Forest boundary. The area used by an elk herd may be quite fluid from one year to the next depending on forage condition, weather, snow cover, human disturbance, and so on. In addition, elk that spend the summer together on the National Forest may split into 2 or more groups when descending to winter range and diverge to different wintering areas.

Some of these elk may remain on or close to the National Forest; others may move well out into the valleys and foothills away from the Forest boundary and not return until spring.

To complicate matters, the Forest Service (USFS) typically applies the term “elk herd unit” to fixed analysis units that serve to delineate habitat blocks for reasonably coherent groups of elk. In any given year, however, the biological herd unit defined by the movement of the elk may not coincide with the static unit mapped by the Forest Service. The Divide landscape has been divided into 6 elk herd units (EHUs)—delineated in 2003 by HNF and MFWP biologists (and modified in 2009). Herd units include all lands within HNF boundaries, public and private, and adjacent land out to 1.5 miles beyond the boundaries—excluding obvious areas of non-habitat, such as the City of Helena. This extension delineates an off-Forest area used by elk that may remain at least partly connected to the National Forest throughout the winter and may be influenced by resource management there. Most herd unit boundaries have been drawn along primary drainage bottoms so that the EHUs encompass relatively cohesive regions of elk summer range at higher elevation. EHUs are used to calculate compliance with Forest Plan big game standards 2, 3, and 4a (*HFP*, pp. II/17-18).

In table 120, “Total Acres in EHU” includes all public and private land within administrative boundaries of the HNF plus the 1.5-mile extension out onto non-Forest land. The category “EHU Acres within HNF Administrative Boundaries” is larger than “Total Acres of HNF land within EHU” due to non-Forest inholdings inside the administrative boundary. These two categories indicate the proportion of each EHU over which the HNF has management control. A map of the two local elk herd units in figure 55 shows both the on-Forest herd units and the 1.5-mile extension beyond the Forest boundary.

Table 120. Elk herd units (EHU) that encompass the Telegraph project area

Elk Herd Units (EHUs)	Total Acres in EHU	EHU Acres within HNF Administrative Boundaries	Total Acres of HNF land within EHUs	% of EHUs in Telegraph Project Area
Spotted Dog–Little Blackfoot	82,314	63,561	47,261	17%
Jericho	35,345	29,363	23,521	27%
Combined Total	117,659	92,924	70,782	20%

Spotted Dog-Little Blackfoot Elk Herd Unit

The Spotted Dog–Little Blackfoot EHU (figure 55) is a complex unit. It occupies 82,314 acres of public and private land between Telegraph Creek to the east and Spotted Dog Creek to the west. Its southern end encompasses the headwaters of the Little Blackfoot River in the Electric Peak Roadless Area. Currently, 43 percent of the herd unit is in non-Forest ownership. About 16,300 acres are in private inholdings on the National Forest and another 18,753 acres in private and State ownership in the 1.5 mile extension beyond the Forest boundary.

Most of the Spotted Dog–Little Blackfoot herd unit functions as summer range for elk, mule deer, moose, black bears, lynx, coyotes, mountain lions, and others. It is amply forested—most typically by mature lodgepole pine that originated with stand replacing fires around 1900. Much of the forest canopy in these stands is now dead from bark beetle infestation—although stands dominated by smaller diameter trees have managed to resist the beetle. Productive wet habitat occupies the headwaters of the unit’s multifarious streams, but large wet meadows are limited. Some of the most conspicuous are located in upper Ontario and Bison Creeks, around Slate Lake, and at Blackfoot

Meadows near the origin of the Little Blackfoot River [see the section on *"Wetland Habitats and Riparian Zones"* for a more complete accounting of wet meadows].

There has been considerable timber harvest around Treasure Mountain and along Ontario and Telegraph Creeks, as well as in the upper Spotted Dog drainage to the west—all with attendant road systems. But, because of the extent of the Roadless Area, overall summer habitat effectiveness is very good. Montana Fish, Wildlife and Parks biologists recognize the Spotted Dog and upper Little Blackfoot country on the HNF, along with adjacent private and State land to the west, as a fertile area for elk [the northern part of Hunting District 215]. Winter surveys in the last decade have typically counted 400 to 500 elk west of the National Forest in this region (R. Vinkey, personal communication, 2005-2014). The 2010-2014 surveys counted over 1,000 elk in this area. The percentage of antlered bulls, however, is lower than desired (MFWP *Elk Surveys in HD 215, 2010-2014)*.

The Spotted Dog – Little Blackfoot EHU affords excellent security for elk through as much of the hunting season as snow conditions allow. The largest block of security is associated with the Electric Peak Roadless Area in the southern half of the unit. Most problems with elk security involve lower elevation security habitat that comes into play after elk have been forced out of higher elevation roadless areas by snow and deteriorating forage later in the hunting season. Cover and road density is at issue in the Negro Mountain, Treasure Mountain, lower Telegraph Creek, and Spotted Dog Creek areas.

In addition to taking advantage of security habitat on the National Forest, many elk, beginning in September, drop down into the Wildlife Management Area immediately west of the Forest. Until recently, most of this land (about 27,000 acres) was owned by the Rock Creek Ranch Corporation, and MFWP had identified it as a problem area because of the refuge it provided for substantial numbers of elk on ground where public hunting was highly restricted [*Montana Elk Management Plan* (MFWP 2005a), Deerlodge EMU]. In September 2010, the State was able to purchase a large portion of the private holdings and establish the Wildlife Management Area. The area is open to public hunting—but with limitations (the main restraint being that most of the area is closed to motor vehicles) [see summary in the Helena *Independent Record*, Oct. 21, 2010 at the MFWP website: http://fwp.mt.gov/news/article].

Jericho Elk Herd Unit

The Jericho Mountain EHU [figure 55] lies south of U.S. Highway 12, extending westward from Tenmile Creek over the Continental Divide to Telegraph Creek. It includes private land in the valleys off its northern edge and encompasses a total of 35,345 acres—29,364 acres within HNF administrative boundaries. Aside from the valleylands to the north, most private land in the EHU is on old mining claims—including part of the town of Rimini. Approximately 33 percent of the EHU is in private ownership. Much of the northern half of the herd unit is occupied by the 9,440-acre Jericho Mountain Inventoried Roadless Area, located mostly on the east side of the Divide in the Tenmile Creek watershed, but lapping westward into the Telegraph Creek drainage in the vicinity of Mike Renig Gulch and Jericho Mountain. This largely unroaded habitat block provides most of the fall elk security in the Jericho EHU. The Telegraph project area occupies the northwest quarter of the herd unit.

Some of the montane grasslands in the northern end of the unit above Lazyman and Mike Renig Gulches provide winter habitat for elk in many years. The rest of the unit is fall/spring transitional range and summer range, with viable summer habitat concentrated in the southern half toward the headwaters of Tenmile and Telegraph Creeks and their tributaries. Most of the herd unit is covered with mature forest (much of it deteriorating from mountain pine beetle infestation). Grasslands occur

in the northern end of the unit and at a few locations along the Divide. Wet meadows also break the forest continuum in some areas: those in Flume Gulch, Sure Thing Swamps, Sally Ann Creek, and upper Ontario Creek in the Telegraph Project area are particularly productive as summer wildlife habitat.

Extensive clearcutting (mostly in the 1970s and 1980s) in the greater Hahn Creek and upper Telegraph Creek drainages west of the Divide also serves to disrupt the contiguity of the mature forest. The bulk of this harvest is in the Telegraph Project area. Cutting units are now dominated by regenerating conifer saplings, many of which provide hiding cover for big game animals and habitat for snowshoe hares and the lynx that prey upon them. Lynx are resident in this area year-round, as are wolverines. The Tenmile drainage, east of the Divide, serves as part of the water supply for the City of Helena, and as a result, has seen very limited timber harvest on public land over the past several decades. Forest cover is ubiquitous, but as with other areas in the Divide landscape that are dominated by pine forests, mountain pine beetle has killed a majority of the overstory trees. Most of these trees remain standing, but increasing numbers have been falling over the last year or so.

Historic logging (dating from the late 19th and early 20th centuries) and mining have generated far-flung road systems, some still open to vehicle use, others closed. Summer habitat effectiveness—based on areas free from motorized use—is quite good, however. Because the herd unit is relatively close to the City of Helena and other local population centers, fall hunting pressure is high.

Montana FWP Population Management: Hunting Districts

The Telegraph Project area falls entirely within a single elk/deer hunting district: HD 215, which lies west of the Continental Divide and south of U.S. Highway 12. The Project area's eastern border, however, abuts a second district—HD 335, which lies east of the Divide and south of Highway 12. Elk readily move back and forth between the two districts over the Divide. The combination boundary overlaps both of these districts, and it also edges into the southern end of HD 343 north of Highway 12. HD 293, also north of Highway 12, does not overlap any part of the project area or combination boundary, but it does provide winter range for some Project area elk. This assessment will deal mostly with HDs 215 and 335.

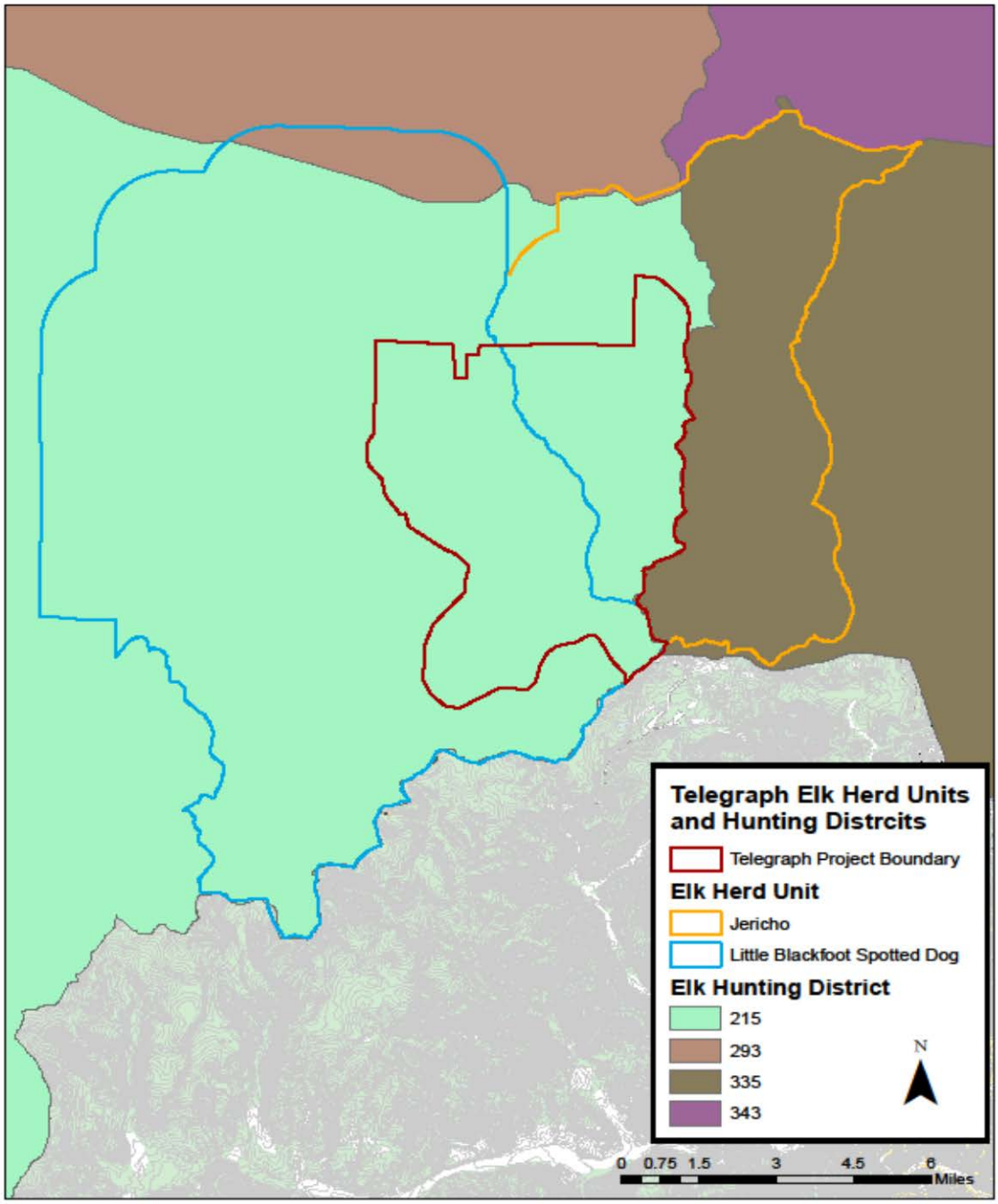


Figure 55. The Telegraph Project area in relation to the two local elk herd units and four local hunting districts

The Project area lies entirely in HD 215 but is split between the 2 herd units. The east boundary of the Project area and of HD 215 is the Continental Divide. The boundary separating HD 215 and 335 from HD 293 and 343 is U.S. Highway 12.

MFWP garners much of its information as to the status of elk populations in each hunting district from annual aerial surveys of winter range. Most surveys are flown between mid-January and mid-

March when most elk are in the open in traditional wintering areas. Aerial surveys are not intended to be complete counts, but are designed to provide relative between-year comparison of the number of elk visible, bull/cow ratios, calf/cow ratios, and so on. This provides information on trends that can then be used to adjust regulations from year to year. An estimate of actual population size, if needed, can be obtained by applying a "visibility bias correction factor" [Legislative Audit Division 2002, p. 21-36].

Hunting District 215

Hunting District 215 ("East Deerlodge") is a large unit that lies west of the Continental Divide and south of U.S. Highway 12, extending west to Interstate 90 and south across the Beaverhead-Deerlodge NF. It takes in the Spotted Dog–Little Blackfoot EHU, as well as western portions of the Jericho EHU. These 2 herd units together cover 90 mi² within HNF boundaries and occupy the northeastern 16 percent of the hunting district, which covers roughly 565 mi². The Project area accounts for less than 7 percent of HD 215.

The northern portion of HD 215 (about 45 percent of the district) covers the southwest quadrant of the Divide landscape (118 mi²) and the private and state lands northeast of Deerlodge (142 mi²). MFWP considers this to be a key area for elk. An average of 67 percent of the elk in the hunting district have been counted on these northern winter ranges since 2000, and the population has been increasing steadily since around 2005. Table 121 summarizes some of the data from MFWP aerial surveys conducted on winter (and occasionally, spring) range in HD 215 since 1982.

Table 121. Numbers of elk observed and bull/cow and calf/cow ratios during aerial winter range surveys in HD 215 compared to the Montana Elk Plan objectives

Year	Number of elk counted	Bulls/100 cows	Calves/100 cows
1999	--	--	--
2000	--	--	--
2001	--	--	--
2002	799	5	32
2003	--	--	--
2004	465	13	38
2005	894	6	35
2006	953	6	40
2007	--	16	31
2008	1,365	--	--
2009	1,759	21	38
2010	1,716	18	34
2011	1,957	19	37
2012	2,206	14	17
2013	2,493	12	19
2014	2,234	--	--
Average last 5 years	2,121	15	27
Objective	1,120-1,680	≥ 10	≥ 30

Data are from the Montana Fish, Wildlife and Parks (MFWP) website and from MFWP aerial survey reports (fwp.mt.gov/fishAndWildlife/management/elk).

In the northern sector (45 percent) of HD 215, elk winter range is located in the valleys and hill country west of the HNF and north of Cottonwood Creek (which flows into the Clark Fork River at Deer Lodge). Winter range counts are usually conducted sometime between late January and mid-March (depending on weather conditions and plane availability). Occasionally, spring surveys have been done instead of or in addition to the winter counts. Spring surveys, typically run in late April and early May, find most of the elk in the open mountain grasslands on the western and northern edges of the southern Divide landscape on or near HNF ground.

In table 121, the total number of elk shown for 2004 to 2005 is an underestimate—stemming from factors associated with the flights in those years; but the trend of steadily increasing population over the past decade is evident. The population is well above the objective of 1,120 to 1,680 elk in this district. The bull/cow ratio, on the other hand, while still above MFWP objectives, has not improved. Beyond that, the percentage of mature bulls in the population has decreased in recent years, with bulls older than 1.5 years accounting for only about 2 percent of the population in 2012 and 2013. This is an indication of hunting pressure too heavy for the available security on fall range. Overall bull numbers have remained adequate only because of a profusion of spike bulls [2012, 2013 Elk Surveys in HD 215; R. Vinkey, personal communication 2014].

Table 121 also shows that calf numbers are down in 2012 and 2013, usually an indication of disruptive weather, poor adult nutrition, or heavy predation. Currently the reason for the drop-off in calf production/survival is unknown, but there has been no sign of an increase in predation pressure in this area. A number of wolf packs have centered their activity along the western edge of the HNF and in the adjacent ranchlands since 1995, but until 2012, calf/cow ratios remained in the range of 30-40 calves/100 cows year after year (and the overall population continued to increase). With the removal of wolves from the Endangered Species List and the advent of the State wolf hunting season in 2010, the ability of wolves to impact livestock and big game populations in this area has been minimal. Wolves attacking livestock have been dispatched quickly, and there has been no evidence of their having built up sufficient strength to measurably affect the local elk population. So, something else is at work here.

Security areas available to elk in the northern part of HD 215 in the Jericho and Spotted Dog–Little Blackfoot elk herd units cover a substantial amount of ground in large part due to the Electric Peak Roadless Area in the southwest corner of the Divide landscape. The problem for local elk is that, because of its elevation and topographic position, much of this area becomes unavailable to them during part of the hunting season as snow builds up and the forage base shrinks. This is true for most of the other security areas in this part of the Forest as well. How long elk are able to remain in National Forest security areas depends on fall weather in any given year, but often they are forced down into transitional and winter ranges on the edge of the Forest and on private/State lands where hunting season security can be marginal.

Until recently, elk moving off the Forest to the west had been able to settle in a large block of private ranchland in the Spotted Dog country, which had been off-limits to public hunting. Elk began moving to this winter range area as early as the start of the bow season in September. The move may be a direct response to pressure from bow hunters and motorized recreation on the Forest, but it may also reflect an established pattern of migration down to secure and benign valley habitat regardless of other circumstances. MFWP felt that the refuge provided by this private land suppressed hunting opportunity and allowed the elk population to maintain itself well in excess of *Montana Elk Management Plan* objectives (although mature bull numbers remained low) [MFWP 2005a]. In August 2010, the State was able to purchase most of this land and convert it to a Wildlife Management Area. Public hunting is now allowed, but most of the area is off-limits to motor vehicles, which tempers the effect.

In spite of the change in ownership and management, elk continue to move to this off-Forest area and recent population trends in HD 215 still hold. In response, the Fish and Game Commission increased the number of B-licenses for cow elk in this district in from 150 in 2008 to 200 in 2011 and 400 in 2012. Nonetheless the upward population trend continues. At the same time, mature bull numbers remain very low and, in spite of the burgeoning cow population, calf numbers over the past 3 years have dropped to half of what had been the norm for over a decade.

Hunting District 335

Hunting District 335 ("Helena South") is a relatively compact unit that lies east of the Continental Divide and south of U.S. Highway 12. It encompasses the eastern half of the Jericho EHU and abuts the Telegraph Project area in HD 215 along its eastern border on the Divide. HNF lands make up the western 55 percent of the hunting district, with the eastern portion of the Jericho EHU accounting for about 13 percent of the district. The eastern reaches of HD 335 extend out over private, BLM, and State land in the adjacent foothills and Prickly Pear Valley south of Helena. The northern end extends off the Forest to U.S. Highway 12 between Helena and MacDonald Pass.

Much of the area east of the National Forest boundary is occupied by grassland and shrubland with patches of forest. Much of the area is ranchland, but there is also considerable human settlement—towns, subdivisions, individual dwellings—along the major drainages and eastward toward Interstate 15. Also, the industrial mining complex at Montana Tunnels has usurped a broad area in the foothills in the Clancy Creek drainage. Most of the viable elk winter range in HD 335 is located in this region east of the HNF boundary. A smaller area of winter range is located along the northern border of the district between the Forest boundary and Highway 12. Some of the elk that spend the summer and fall in HD 335 winter here, while others continue northward across the highway to winter range into HD 343.

As is typical with most hunting districts in this area, elk security is centered on traditional unroaded areas on the National Forest, but also depends to a certain extent on blocks of private land where public hunting is limited to one degree or another. HD 335 supports 2 relatively large elk security areas—one centered in the Lazyman Gulch Roadless Area southwest of Helena and another in the Jericho Mountain Roadless Area on the west side of the upper Tenmile Creek drainage (and extending over the Divide into the Telegraph Project area). A few other security areas are scattered about the National Forest portion of the district—some fairly small and serving more as intermittent refuge areas than as "full service" security areas capable of holding elk through the hunting season.

Despite the checkered security, the elk population in HD 335 has remained relatively consistent in structure and size over 3 decades, meeting MFWP objectives for numbers, bull/cow ratios, and calf production and survival in most years [table 122]; this, in spite of its proximity to Helena, which leads to more hunting pressure than in most hunting districts in Region 3. Recent road closures under the *Clancy-Unionville Vegetation and Travel Management Project* have helped to expand fall security in this area.

Table 122. Results of aerial surveys of elk winter range in HD 335

Year	Number of elk counted	Bulls/100 cows	Calves/100 cows
1999	380	8	17
2000	614	18	38
2001	513	11	56
2002	529	13	18
2003	569	12	32
2004	418	12	42
2005	555	13	35
2006	771	10	27
2007	776	13	35
2008	667	12	15
2009	450	-	-
2010	388	13	32
2011	670	19	45
2012	998	16	28
2013	827	9	23
2014	1,187	10	26
Average last 5 years	814	13	31
objective	480 - 720	≥ 10	≥ 30

MFWP winter range surveys (table 122) show that, on average, the elk population remained in the 570-580 range prior to 2004. Since then, it has moved upward, with counts for the last three winters exceeding the upper range of MFWP objectives by a considerable amount. MFWP biologists have felt that this trend has been driven by mild winters, increased travel restrictions in the Clancy-Unionville area of the HNF, and fewer hunting permits for antlerless elk (*MFWP HD 335 Elk Survey 2005,* 2007). The counts for 2009 and 2010 are an anomaly in this otherwise positive trend. As in some other local districts, MFWP believes that the lower counts in these years were a function of a less effective survey method and of elk having moved off winter range by the time surveys were conducted [see *Post-season Survey of Elk in HD 335* for 2010 and 2011]. There was no evidence of a sudden increase in hunter success, elevated natural mortality, or decreased calf production/ survival that might have initiated a downward trend in elk numbers. By 2011, the count was back up to where it had been prior to 2009, and well within the population objective for HD 335 (600 elk ±20 percent).

Bull/cow ratios have been fairly consistent over the last five years, averaging 13 bulls/100 cows. The 2011 count was the highest in the last 15 years at 19 bulls/100 cows. The objective for the hunting district is a minimum of 10 bulls/100 cows. Mature bulls (over 2 ½ years old) have accounted for only about 2 percent of the count during this period. This statistic can be somewhat volatile from one year to another—partly because hunter success at killing bulls is variable but also because the older bull elk have an aptitude for eluding detection. The current percentage of mature bulls does appear to be a clear improvement over those of past decades. As with the bull/cow ratio in general, this is probably a result of road closures on the National Forest and targeted hunting regulation by MFWP.

Calf/cow ratios have been more variable over the last several years, ranging from 15 calves/100 cows (2008) to 45 calves/100 cows (2011). The average for the last 5 years is 31 calves/100 cows—which is typical of hunting districts in this area and indicates a level of calf production and survival sufficient to maintain current elk populations under a normal regime of hunting and natural predation. The lower numbers for 2012 and 2013 are consistent with a drop in calves counted in other local hunting districts in those years, and thus may reflect general weather/climate phenomena.

MFWP feels that elk in HD 335 are being impacted by livestock grazing, partly on the HNF, but more so on privately-owned winter ranges. Because natural forage is limited, elk turn to agricultural fields and haystacks stockpiled for winter livestock feed. This, in turn, has led to ranchers requesting special hunts to trim elk numbers. MFWP believes that the big Montana Tunnels mine east of the Forest on Clancy Creek has reduced winter range opportunity for elk (and more so for mule deer) in the area southwest of Jefferson City east of the Forest boundary.

Hunting District 343

Hunting District 343 ("Helena North") lies east of the Continental Divide and north of U.S. Highway 12. It does not take in either of the elk herd units that encompass the Telegraph Project area, but it does include a small segment of the combination boundary where it extends north of U.S. Highway 12. As well, a few of the elk that summer in the Jericho EHU may sometimes move northward to winter ranges in the south end of HD 343. The district extends north to Flescher Pass on the Lincoln Ranger District.

With the exception of the 2009 and 2010 surveys, which were beset by technical difficulties, counts in this district have shown a stable population over the last 15 years, ranging from 630 elk in 2012 to 973 elk in 1999. Counts over the last 3 years have ranged from 630 to 650 animals. These are well within the population objective for HD 343, which is 700 elk (±20 percent = 560–840 elk) [see *2013 Post-season Survey of Elk in HD 343* for a 25 year summary]. Bull/cow ratios have averaged 13 bulls/100 cows since 1998, which is considered a "moderate" ratio and is in excess of the hunting district objective of 10 bulls/100 cows. Likewise, calf/cow ratios have averaged 29 calves/100 cows since 1998—although the counts for the last few years have dropped into the 18-24 range, mirroring similar trends in neighboring districts.

Hunting District 293

Hunting District 293 ("South Lincoln-Nevada Creek") lies west of the Continental Divide and north of U.S. Highway 12. It does not include any of the Telegraph combination boundary, but it does include the tip of the Spotted Dog-Little Blackfoot EHU where its 1.5 mile off-Forest extension inches north of Highway 12 near Elliston. Elk from this EHU do in fact range into the southern edge of HD 293 in winter and spend up to 4 months in the grasslands and timber patches there. Some of the elk moving to and from these wintering areas use the Telegraph Project area as transitional and summer range. There have been no problems for these elk on their winter habitat or with movement between summer and winter range.

HD 293 is sharply divided between its northern and southern halves, both in terms of geography and the challenges facing the elk populations in the two areas. In the northern region, which is centered in the Blackfoot Valley of the Lincoln Ranger District, the size and structure of the population has been dramatically altered over the past five years, mostly as a result- of abnormally high rates of predation (a combination of black bears, grizzly bears, wolves, mountain lions). Elk population numbers are down, as is calf survival. In the southern half of the district—the area influenced by Forest management in the Divide landscape—predation has not been an obvious problem, and herd numbers, bull/cow ratios, and calf survival continue to be in line with MFWP objectives.

Habitat Considerations

Elk Summer Range

The Nature of Summer Range

From late spring through late summer, elk need secluded calving areas and summer habitat rich in nutritional forage. Prior to European settlement, these conditions were widespread across much of the landscape, and elk in Montana were commonly observed in the grasslands and river bottoms of the Great Plains year-round. However, due to habitat alteration in the valleys and on the prairies (most often from livestock and crop raising) and the extirpation of elk from areas of human settlement, most elk now find summer range in mountain grasslands, meadows, and coniferous forests, descending to ranges in the foothills and adjacent valleys only in winter (Skovlin et al. 2002).

Adult bulls usually make the move toward summer range in early spring, seeking out the patchy interface between emerging green-up and the snowline. Cows, yearlings, and spike bulls usually remain in wintering areas into mid spring and then slowly move upslope following spring green-up toward summer range at higher elevation. Calving occurs either on spring transitional range or on summer range, depending on how far advanced the green-up is from mid-May to early June in any given year. The ability of cow elk to maintain high quality nutrition leading up to the birth of calves in late May and early June is thus dependent on the character of transitional range as well as that of summer range.

Key habitat components for elk on summer range include a mix of hiding cover, open foraging areas (ideally, small enough so that no point is more than 600 ft from a forest edge), forested forage, and riparian sites (including some open water) (Thomas 1979, p. 109-121). The same habitat characteristics apply to calving areas; but of particular importance are open water sources for lactating cows and low-level cover, such as logs, deciduous shrubs, conifer regeneration, for concealing calves (Thomas 1979, p. 120). Research suggests that the quality of summer range—via its ability to contribute to late summer nutrition—may be the most important variable in determining annual variation of herd growth (Stewart et al. 2005; Cook 2002, p. 305; Cook et al. 1996).

As a general rule, the resources that elk need to thrive on summer range are well distributed across mid-high elevation habitats on National Forest lands across western and central Montana. The degree to which elk perceive these resources as “available” to them, however, is another matter. While natural factors, such as intense predation, may constrain elk use of certain habitats, it is human activity—particularly activity enabled by open roads and motor trails—that is the primary factor limiting habitat availability on elk summer range. The amount of habitat that elk are actually able to use on a regular basis has been described as “habitat effectiveness” (Christensen *et al.* 1993). This effectiveness begins with the natural capacity of the range to provide cover, forage, water, and special habitat features, and is then modified by the distribution and density open roads and trails, competition from domestic livestock, and vegetation patterns created by timber harvest.

Elk Summer Range in the Telegraph Project Area

The *Forest Plan* Glossary defines big game summer range simply as “a range, usually at higher elevation, used by deer and elk during the summer…” (*HFP*, p. VI/16). Working maps of big game range in the Divide landscape prepared for the *Helena Forest Plan* (1981) do not delineate summer range as a whole. Given this deficiency, most *Forest Plan* big game analyses since the early 1980s have interpreted summer range as (1) all land inside HNF boundaries, regardless of elevation, or (2) all HNF lands *not* shown as winter range on the 1981 maps. Summer range under either of these interpretations is extensive, covering true higher elevation “summer ranges” as well as lower elevation “transitional ranges” used mostly in spring and fall.

In this analysis, summer range is described as follows:

- In discussing the ecology of elk summer range in the Telegraph area, this analysis adheres to the more traditional view of summer range as higher elevation habitat where most of the elk are found during the "summer"—between the time calves are born (late May to early June) and the first big frosts begin to push elk out of many key summer habitats (generally in mid to late September).
- In determining compliance with *Forest Plan* big game standard 3, which requires maintaining 50 percent of summer range as hiding cover *(HFP*, p. II/17), summer range is considered the entire herd unit. This interpretation incorporates ground that serves primarily as transitional range and that is used only incidentally or occasionally in summer.

Most of the Telegraph Project area has functioned as elk summer range at one time or another. Exceptions are obvious non-habitat sites such as cliffs, talus slopes, very steep slopes, larger bodies of water, and certain areas severely altered by humans. Many high elevation areas are occupied by elk in summer year after year regardless of the weather regime, vegetation condition, or other ephemeral circumstances. Other areas are used in summer only under special conditions, such as extremely late snow melt, severe drought, elevated predation, or displacement by human activity.

In general, areas at lower elevation in the northern end of the Project area serve primarily as transitional range. One small area on the west side of Mike Renig Gulch has even been classified as "winter range" [see the following section on *"Winter Range"*]. The degree to which the rest of the area is consistently occupied by elk during the summer depends on characteristics of local habitat. Areas of suitable habitat that focus elk activity during most summers are categorized as "key summer habitat" (for purposes of habitat effectiveness) or "important summer habitat" (for purposes of *Forest Plan* big game standard 7). These are the areas that contain the "key habitat components" discussed below.

The following sections discuss three approaches to assessing the quality of elk habitat on summer range and gauges the status of the Telegraph Project area with regard to each of them.

Forest Plan Big Game Standard 3: Hiding Cover on Summer Range

Analysis Approach

Forest Plan big game standard 3 employs hiding cover as the primary determinant of summer range capability. The standard specifies 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 (*HFP*, p. II/18). Big game standard 5 then adds the corollary that the minimum size for a block of hiding cover will be 40 acres in order to be tallied as "*Forest Plan* hiding cover." Standard 3 also sets parameters for thermal cover, which has been identified as an important component of big game summer ranges. But, the standard applies the requirement only to winter range.

The use of hiding cover as a summer range standard is based on work summarized in Thomas (1979, p. 109-121, 130-133). Thomas recommended a ratio of 40 percent forested cover (20-30 percent hiding and 10-20 percent thermal cover) to 60 percent foraging areas (clearcuts, meadows, open forest) as an optimal mix of habitat structure on mid-elevation elk summer ranges in the Blue Mountains of Oregon. He felt that deviation from these ratios in either direction would lower habitat capability for elk. Thomas also presented an index of summer habitat effectiveness based on road density (p. 122-123) but did not attempt to combine it with the hiding ***cover/forage*** ratio.

Management guidelines for areas east of the Continental Divide in Montana have not relied on a single cover/forage ratio in evaluating summer range quality because of the variability in forest cover (30-70 percent) used by productive eastside elk populations [USDA 1978 , p. 2]. Lyon (cited in Leege, 1984, p. 10-11) concluded that habitat relationships in summer are far more complex than can be defined by cover/forage ratios, especially since elk habitat needs change drastically during that period (from calving and nursing through intense foraging to mating). These conclusions were based on field tests of cover/forage ratio guidelines which failed to improve predictions made by road density models alone.

Status of the Project Area and Other Local Management Units

Forest Plan big game standard 3 is relevant to the Telegraph Project area in that proposed project alternatives would remove some of the cover currently provided by standing dead trees. In areas not treated, hiding cover provided by beetle-killed pine trees will be gradually disappearing over the next decade as those trees come down of their own accord. In both cases, summer range suitability as measured by the amount of hiding cover will decrease. Table 123 shows that both of the two elk herd units that cover the Telegraph Project area currently retain more than 50 percent hiding cover (as measured by the MFWP method) and are thus in compliance with *Forest Plan* big game standard 3.

Table 123. Status of the 2 elk herd units that cover the Telegraph Project area as per Helena Forest Plan big game standard 3, which requires 50% MFWP hiding cover on summer range

Elk herd units	% *Forest Plan* Hiding Cover on Summer Range	Complies with *Forest Plan* Big Game Standard 3?
Jericho	73%	Yes
Spotted Dog–Little Blackfoot	65%	Yes

Habitat Effectiveness

Analysis Approach

Habitat effectiveness (HE) is another broad measure of summer range quality in common use. Since the availability of basic habitat components tends to be satisfactory on most summer ranges, variations in habitat effectiveness are related most often to the opportunity to avoid human activity. Opportunity for seclusion—or the lack thereof—on the National Forest is primarily a function of open roads, which, if abundant enough, can shunt elk away from habitat sites that they would prefer to use. Habitat effectiveness is thus based on ***open road density*** (ORD) and provides a measure of the extent to which roads erode the availability of otherwise suitable habitat on elk summer range (Christensen *et al.* 1993). Open road density is translated to habitat effectiveness via a curve derived from Perry and Overly (1977) and the *Montana Cooperative Elk-Logging Study* (Lyon 1979). The latter study recommends minimum HE of 50 percent (= ORD of less than 2.0 mi/mi²) in summer range areas being managed specifically for elk. Habitat effectiveness is not a *Forest Plan* standard.

A problem with habitat effectiveness as an index of habitat functionality is that it measures open road density over broad areas (typically, elk herd units) without considering how roads are distributed. Roads that pass through key habitats (wet meadows, riparian areas, nursery areas, aspen stands, etc.) degrade the capability of elk summer range to a greater extent than those that traverse areas of less importance. This kind of impact on localized and sometimes poorly mapped habitat features is difficult to quantify over an area as large as the combination boundary or even a herd unit. This is another reason to qualitatively look at local habitat components in the project area—to see how they are affected by roads and how proposed vegetation treatments may add to the effects.

Status of the Project Area and Other Local Management Units

Habitat effectiveness in the Jericho and Spotted Dog-Little Blackfoot EHUs was calculated using an index developed by Lyon (1983) and employed by Christensen *et al.* (1993), who recommend habitat effectiveness levels of at least 50 percent on elk summer range as a whole and 70 percent in areas of key habitat (productive sites where elk consistently concentrate). While open road density for each elk herd unit can be measured via the Forest road database, the same information is not available for "key summer habitat." Key habitat has not been delineated, although the accounting of local summer habitat components in the next section and the tally of important wetland and riparian sites in a following section gives some sense as to the distribution and integrity of key habitat. Habitat effectiveness for local herd units is shown in table 124.

Table 124. Habitat effectiveness (HE) on elk summer range in the two herd units overlapping the Telegraph project area

Elk herd units	Elk Herd Unit Square Miles	Miles of Open Roads during the Summer	Open Road Density (mi/mi²) on Summer Range	% Habitat Effectiveness
Jericho	55	70	1.2	56%
Spotted Dog–Little Blackfoot	129	161	1.2	56%

Note: The recommended minimum HE is 50%.

Local Summer Habitat Components

Analysis Approach

While area-wide indices such as habitat effectiveness and percent hiding cover can provide a general sense as to the adequacy of elk summer range, a more site-specific examination of local sites and habitat features is needed to determine how a particular range functions and what effect management activity may have on its integrity. The results of numerous studies of elk summer range are discussed by Skovlin *et al.* (2002, p. 535-548), and serve as the basis for this analysis. This is supplemented with recommendations from the *Montana Cooperative Elk-Logging Study* (Lyon *et al.* 1985, p. 1-13), which have been incorporated into the *Forest Plan* as big game Standard 6 (and are displayed in detail in *HFP Appendix C*). Based on these summaries, important components of elk summer range are (1) widespread moist sites, (2) summer thermal cover (provided by mature forest), (3) habitat diversity (vigorous ***juxtaposition*** of vegetation types, abundant ecotone), (4) strategically located hiding cover, and (5) areas away from human activity. In addition to these general components, elk behavior on summer range also generates a need for calving areas, timbered travel lanes, and wallows. Calving sites are addressed in a separate section below. Travel corridors and wetland habitats (where wallows are established) are discussed as separate topics later in the report.

Photo 1. Early summer elk range on Treasure Mountain in the west-central part of the Project area. Close-canopied lodgepole pine forest (now mostly dead) predominates, but numerous small openings, open-grown forest, and ecotone are interspersed throughout. In late June 2012, cow elk were grazing in this mesic grass/forb opening; others were bedded along the forest edge, and calves were hidden further back in the timber.

Photo 2. Summer elk habitat at Sure Thing Swamps on the Continental Divide in the southeastern part of the Project area. This extensive complex of sub-irrigated meadow and multi-aged forest, coupled with scant human presence, provides an ideal environment for elk from early summer green-up to fall frost. High quality forage and water are readily available and summer thermal and hiding cover are close at hand. The prevalence of subalpine fir, Engelmann spruce, and young lodgepole pine will ensure that the forest remains largely green and intact in spite of beetle-induced mortality in mature lodgepole pine.

Key Habitat Components in the Project Area

These habitat elements can be surveyed and evaluated on a local basis—as in a small project area or treatment unit—but they are difficult to assess in detail over broader areas, such as elk herd units or, in this case, the 23,669 acre Telegraph Project area. In this case, all important summer habitat sites that might be directly affected by proposed project units have been surveyed including areas surrounding treatment units and transportation routes. Fieldwork throughout the Project area has revealed the location and status of most of the important summer habitat sites areas as they relate to alternative proposals.

Calving Areas

Assessment

While elk calving areas are associated with summer range, they also occur on transitional range along routes where cows are moving between wintering and summering areas. All of the key attributes of elk summer range summarized above are also important to successful calving and nursery areas. But, in addition, an abundance of effective low-level cover—deadfall, thickets of regenerating conifers, dense shrub growth (sagebrush being frequently used)—is key to hiding calves from predators and humans.

The *Helena Forest Plan* addresses elk calving areas by restricting motorized use in known calving and nursery areas during peak use: late May–mid June for calving, late June–late July for nursing. The problem has been that many calving areas are difficult to pinpoint, varying from year to year depending on snow-melt and the progress of spring green-up. Likewise, nursery areas are rather mobile, moving with the herd, and they may encompass broad, amorphous areas. In general, almost any area where groups of cow elk are observed between mid-May and late July can be considered to be serving as a calving or nursery area. And, like much of summer range, these sites are not well mapped.

Status of the Project Area and Other Local Management Units

Calving and nursery areas are widely dispersed across the Project area but they occur most frequently at higher elevations often at or near the heads of drainages where human interference is unlikely. Such sites provide good forested cover, access to water, high-quality forage, and, often, separation from regular human activity. The Continental Divide ridge and the heads of drainages that originate there provide a good example of the kinds of areas cow elk use for concealing and nursing young calves. In particular, the ridge north of Jericho Mountain is broad, thickly forested, unroaded, and flanked by numerous springs and seeps at the heads of streams flowing off east and west. Forested forage is available and open parks scattered off the ridge provide more robust foraging opportunities for the cows [*Photos 1 and 2*] [see also *Photo 18* in the section on *"Habitat Fragmentation"*]. Other examples of calving/nursery areas in the project area are shown in *Photo 3]*.

Photo 3. An elk calving area along the Continental Divide above Mike Renig Gulch. Numerous drainage-head springs just off the Divide provide good sources of water and forage for cow elk. Logs and clumps of understory conifers provide cover for calves.

Fall Range and the Hunting Season

Elk Management in the Hunting Season

The current elk hunting season in Montana runs for a total of 12 weeks, with the bow season beginning around the first of September and the rifle season around the 3rd week in October. Elk management during this period focuses on maintaining population numbers well above viability thresholds, protecting selected sex and age classes from over-harvest, providing public hunting opportunity, and attempting to balance elk distribution across public and private lands. While these functions are primarily a responsibility of Montana Fish, Wildlife and Parks (MFWP), the HNF works to complement their efforts by managing elk habitat on the National Forest. The goal has been to provide security habitat that allows a reasonable number of elk to escape hunters so that MFWP does not have to reduce the allowable harvest or shorten the hunting season (USDA 1986). On the other hand, the Forest needs to provide enough access via roads and trails so that hunters have a fair opportunity for success—thus preventing excessive numbers of elk from piling up on private ranchland during the winter.

Each year, MFWP reviews bag limits and other regulations for each hunting district and makes adjustments, as needed, based on the results of hunter surveys, check station counts, and winter range aerial censuses. In most parts of the state, regulation emphasizes maintaining a robust reproductive segment of the population by limiting the number of hunting permits for cows. With no limit on the number of adult bulls that can be taken in most hunting districts covering the HNF (HD 380 in the Elkhorn Range being an exception), MFWP depends on the Forest Service to provide habitat security on the National Forest to protect enough bulls to meet objectives [typically greater than 10 bulls/100 cows].

Elk Vulnerability and Security

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" (Lyon and Christensen 1992). Elk *vulnerability* is the reverse of security. This analysis focuses on security during the hunting season, when the primary issue is more one of hunter access and less one of displacement of elk from preferred habitat—which is a key issue on summer range.

In the Divide landscape (as on much of the HNF), elk security/vulnerability during the hunting season can be a primary determinant of elk abundance and population structure. While the ability of elk to survive the hunting season is influenced by a number of environmental circumstances, analysis and management strategies in recent decades have focused on two factors: roads and hiding cover.

Several studies have documented the effect of roads on elk security, population structure, and hunter success (Edge and Marcum 1991; Leptich and Zager 1991; Unsworth and Kuck 1991; Gratson and Whitman 2000). These have demonstrated that, except in aberrant circumstances, open roads influence elk distribution during the hunting season and targeted road closures can lower the kill rate in a given area. Increasingly, displacement of elk from roaded public land into more remote terrain or to off-limits private land early in the fall can depress hunter success rate throughout the remainder of the season.

The precise role of hiding cover is more elusive. Some studies and analysis methodologies have emphasized cover as a primary factor for elk in the fall and have attempted to quantify its contribution to security—as a counterweight to open road density (Lyon 1979; Perry and Overly 1976). A majority of management approaches, however, while recognizing that cover is often important in allowing elk to elude hunters, have concluded that the influence of cover can be overwhelmed by a surplus of open roads and the hunting pressure that they facilitate (Christensen *et al.* 1993; Henderson et al. 1993, p. 111; Lyon and Christensen 1992; Lyon and Canfield 1991; Thomas 1979, p. 104-105) (see also the discussion in Skovlin et al. 2002, p.550-554).

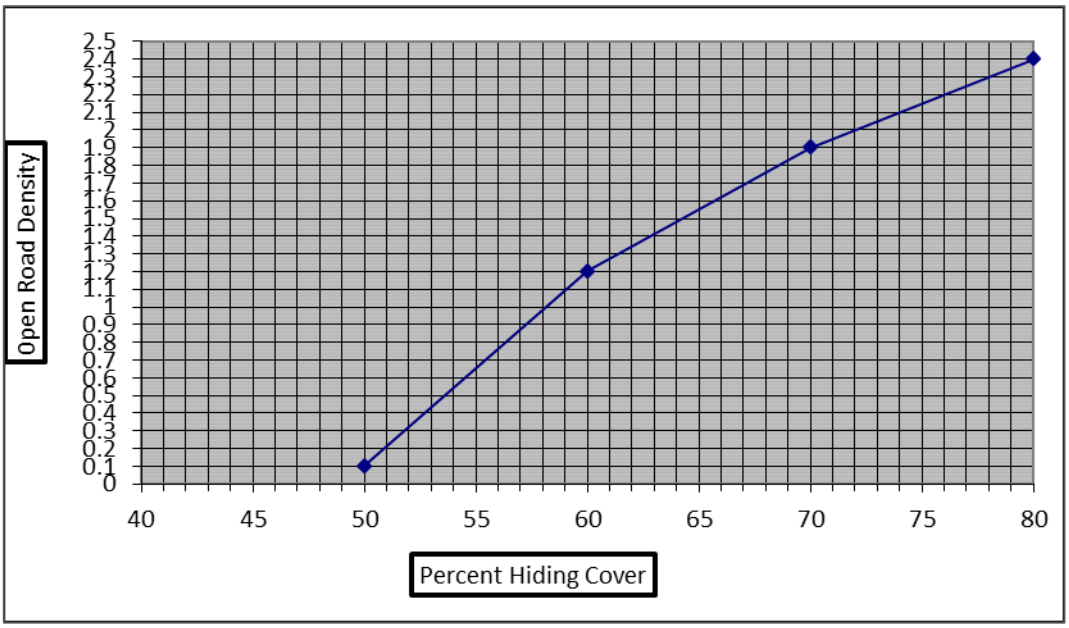
The abundance and distribution of effective hiding cover needs to be examined more carefully in the more open elk ranges east of the Continental Divide (as on much of the HNF) and may be taken more for granted in the dense forest environments of western Montana and northern Idaho (Hillis *et al.* 1991). Managing for key blocks of cover that field observation demonstrates are important to hunted elk is probably a more effective strategy than attempting to maintain a specified minimum acreage of hiding cover within a herd unit without examining how it is distributed and used by elk.

Another factor contributing to elk security is land ownership pattern. In recent years, more elk have been finding fall refuge on large blocks of private land off the National Forest. This occurs when ranchers or other owners of large parcels near the Forest prohibit or restrict public hunting. In parts of the Divide landscape, elk have been quick to identify the security value of these private lands. Some recent studies in Montana have concluded that, given the choice, many elk prefer unhunted sanctuaries on private land to traditional security areas on public land (Proffitt *et al.* 2013; MFWP 2011c). Proffitt's study found that cow elk, in particular, are drawn to private land refuges, while most mature bulls tend to rely on traditional security areas on the National Forest. The impetus to move to private land prior to or early in the hunting season may be driven by inadequate security and/or an overabundance of hunters and motorized recreationists on public lands. Later in the season it may be generated by accumulating snow and scarce forage. It may be also that elk are naturally drawn to valley and bottomland habitats that, prior to the arrival of Eastern settlers, represented the core of their traditional range. Whatever the reason, these private sanctuaries are acting as valleyland and foothills "security areas" that augment traditional security provided by unroaded areas on public land.

Hiding Cover / Open Road Density Index

Analysis Approach

The current *Helena Forest Plan* standard for measuring elk security/vulnerability during the hunting season [big game standard 4a (*HFP*, p. II/17 – II/18)] uses an index that combines open road density and hiding cover. Forest roads are calculated at 100 percent of their length, private roads at 25 percent. Hiding cover is derived from canopy cover (using the MFWP definition) via a *Forest Plan* formula (*HFP*, top of page II/18). Cover needs to occur in stands at least 40 acres in size to qualify as "*Forest Plan* hiding cover." Compliance is determined via the graph in figure 56, which has been drawn using the points in the table at the top of *Forest Plan* page II/18.



Note: Points below the curve are in compliance with the standard; points above the curve are out of compliance.

Figure 56. Graph derived from MFWP hiding cover (crown closure) and open road density points used to measure compliance with Forest Plan big game standard 4a

The index is applied to individual elk herd units (EHUs), which include all land, public and private, within the elk herd unit.

This measure of elk vulnerability during the hunting season was derived from research and habitat models devised in the 1970s and early 1980s that were originally designed to measure habitat effectiveness for elk on summer range in western Montana—particularly in areas where timber sales were methodically subtracting forested cover and unroaded habitat (Lyon 1979). Nonetheless, it has been employed as an index of elk hunting season security in a number of Forest Plans in Region 1.

Status of Local Elk Herd Units

As can be seen in figure 55 the Telegraph Project area is split between two elk herd units: the eastern 40 percent of the area falls within the Jericho Mountain EHU and the western 60 percent lies within the Spotted Dog–Little Blackfoot EHU. These herd units have been described in the previous section *"HNF Habitat Management: Elk Herd Units."* Table 125 displays current levels of *Forest Plan* hiding cover (in blocks greater than 40 acres), open road density during the general hunting season (October 15 to December 1), and compliance with *Forest Plan* big game standard 4a.

Table 125. Current hiding cover and open road density on fall elk range

Elk Herd Units	Spotted Dog – Little Blackfoot	Jericho Mountain
Total Square Miles (mi²) in the EHU	129	55
Weighted Open Road Miles (mi) in hunting season	138	70
Open Road Density (mi/mi²) in hunting season	1.1	1.3
Total Acres in the EHU	82,314	35,345
Acres of *Forest Plan* Hiding Cover	53,149	25,810
Percent *Forest Plan* Hiding Cover	65%	73%
Does the result comply with standard 4a?	**Yes**	**Yes**

Note: These conditions are likely to remain relatively stable for the next 4 to 5 years. After that, stands will begin to drop out of hiding cover status, so that eventually both herd units will be far out of compliance with standard 4a

Table 125 shows that the both EHUs comply with *Forest Plan* big game standard 4a. This can be verified by plotting open road density against percent hiding cover on the graph in figure 56.

Hiding Cover in the Project Area

Open road density and percent hiding cover in the project area have not been calculated at the project level since, for purposes of determining *Forest Plan* compliance, the herd unit serves as the analysis scale. However, the general character and distribution of cover within the project area and how elk make use of it locally are described below.

Shrubs and regenerating conifers are sparse in the understories of a majority of the forest stands in the project area—particularly in the "clean" understories of the ubiquitous lodgepole pine stands. As a result, when beetle-killed trees begin to come down in earnest, this cover will disappear. Currently, typical lodgepole stands, such as the one shown in *Photo 4*, support roughly 400 trees per acre, which generally allows clean sight distances of no more than 100 feet. Once half of these trees are on the ground—probably in another 5 to 7 years—sight distances will extend out beyond 200 feet and the stand will no longer qualify as hiding cover. Given the virtual absence of regeneration in stands such as this, hiding cover from new trees, which should begin appearing once the canopy opens up, is unlikely to be available on this site for another 30 to 40 years.

Stands of sapling conifers in old cutting units, however, will remain intact and serve as a primary source of hiding cover over the next several decades (*Photos 5 and 6*. These stands currently occupy a bit over 15 percent of the project area.

Photo 4 Hiding cover provided by tree trunks in a mature/pole stand of lodgepole pine in upper Telegraph Creek. Most overstory trees have been killed by mountain pine beetle, and hiding cover will be disappearing as trees fall over the next 5 to 10 years. This view is from 2012.

Photo 5 Hiding cover provided by saplings in a 25-year-old clearcut in upper Ontario Creek. The cover provided by these bushy young conifers is typical of the 20- to 40-year-old cutting units throughout the Project area. Density in this stand is about 900 trees per acre. Most of these stands can be thinned to 300 to 350 trees per acre (11- to 12-foot spacing) and still provide hiding cover.

Photo 6 Hiding cover as provided by a more open-grown sapling stand in Mike Renig Gulch. Although tree density here is a bit less than 300 trees per acre, sight distances throughout most of the unit remain below 200 feet—as required for "hiding cover."

Elk Security Areas

Analysis Approach

An alternative way of assessing elk security/vulnerability is to look at the size and distribution of elk security areas in a given herd unit or group of units. The basic methodology was developed by Hillis and others (1991) and has been in general use in the northern Rockies for over 20 years. Hillis et al. defined an elk security area as a block of non-linear, mostly forested habitat at least 250 acres in size with all boundaries at least ½ mile from open roads. The HNF has modified this approach for more open east-side Forest habitats: in the Divide landscape (and the Blackfoot landscape), minimum size for a bona fide elk security area is now 1,000 acres [based on discussions between MFWP and the HNF, 2013-2014]. These are areas large enough and generally diverse enough (in terms of cover, forage, and terrain) to hold elk throughout the hunting season. Smaller non-motorized areas (250-1,000 acres), while unlikely to provide long-term security, are recognized as useful intermittent refuge areas for elk attempting to elude hunters—and in parts of the Divide landscape they are the only "security" enclaves available. Therefore, it's important to preserve the integrity of the smaller intermittent refuge areas; but in determining percent security in a given elk herd unit, total acreages only of the security areas larger than 1000 acres are included.

Under this system, the first objective is to maintain as much of each elk herd unit as possible in security areas with a goal of 50 percent. The ultimate objective is to provide enough secure habitat that under all but extraordinary circumstances, *Montana Elk Plan* objectives and *Helena Forest Plan* objectives will be met. Thus, if MFWP population objectives are being consistently met within the surrounding hunting district—or that portion of the hunting district subject to influence by the elk herd unit in question—then the existing security level, regardless of the percentage, is probably adequate. In some cases, failure to meet MFWP population objectives may be due to factors other

than habitat, such as intense predation or severe weather. Occasionally, it is also a function of poor viewing conditions or timing of aerial surveys that frustrate the ability of MFWP biologists to get accurate population counts.

Security areas are delineated for the portions of elk herd units that lie within HNF administrative boundaries, including non-Forest inholdings, on elk "fall" (or "hunting season") range. In the case of the Divide landscape, it is assumed that all of a given elk herd unit—or at least that portion of it on the Forest—could potentially serve as elk fall range under one set of circumstances or another. So, the portion of the elk herd unit within the administrative boundary of HNF is used to determine security.

Elk Security in the Project Area and Surrounding Herd Units

Figure 57 shows the distribution of elk security areas in the Jericho Mountain and Spotted Dog–Little Blackfoot EHUs and in the Telegraph Project area. Altogether, the 2 herd units support 2 security areas (3,435 in the Jericho EHU and 18,880 in Spotted Dog-Little Blackfoot) and 5 smaller intermittent refuge areas, ranging from 264 to 923 acres. The Spotted Dog–Little Blackfoot EHU includes one full-sized security areas and four smaller intermittent refuge areas, and as can be seen in table 126 (below), 30 percent of the EHU is taken up by elk security areas. The bulk of the security is centered in the Electric Peak Roadless Area in the southern 1/3 of the herd unit. The Jericho EHU includes one security area—entirely in the Jericho Mountain Roadless Area—that occupies a little more than 12 percent of the herd unit.

There are about 2 miles of roads that are closed yearlong in elk security areas in total. Given the size of the two security areas, the presence of these closed roads are not expected to compromise security.

Currently, elk security measured in this way is not a *Forest Plan* standard. It is merely a supplementary measure that helps us gauge elk security/vulnerability in these herd units.

Table 126. Percent of elk security in the Jericho and Spotted Dog-Little Blackfoot EHUs

Elk Herd Units	Spotted Dog – Little Blackfoot	Jericho	Combined EHUs
Total Acres within HNF administrative boundaries	63,561	29,364	92,925
Acres in Elk Security Areas	18.880	3,435	22,315
Percent of the elk herd units in security areas	30%	12%	24%

The Telegraph Project area itself includes parts of both security areas—in the Electric Peak Roadless Area and in the Jericho Mountain Roadless Area (*Photo 7*), both of which are extensive. The Project area also encompasses two smaller intermittent refuge areas one of which is southeast one of Treasure Mountain (figure 57); the other is just to the west of Jericho Mountain.

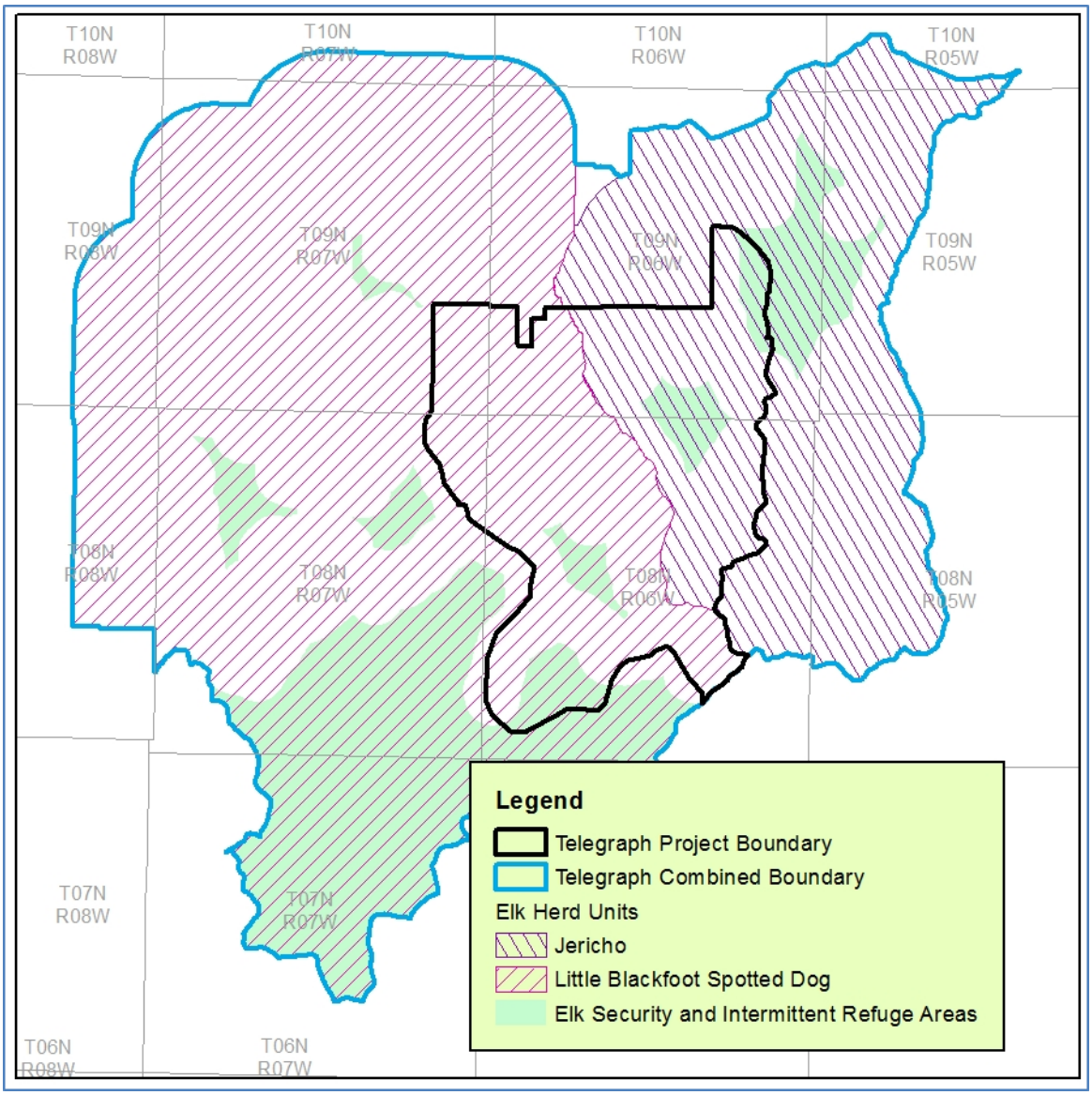


Figure 57. Elk Security Areas in the Jericho Mountain and Spotted Dog-Little Blackfoot EHUs and in the Telegraph Project area

Photo 7 View northeastward from Jericho Mountain into part of the elk security area centered on the Jericho Mountain Roadless Area (See figure 57). The area is mostly forested, and hiding cover is ubiquitous. Good fall forage is less well distributed—available in a few grassland parks along the Continental Divide and in smaller forest openings. In spite of substantial beetle-kill, this area should remain secure because of its size, rough terrain, remaining green trees, and stacked deadfall that will make movement difficult for hunters.

Only 7 percent of the project area falls within elk security areas. This suggests that a number of elk that summer in the project area probably move into security areas beyond project area boundaries during the hunting season or that they take advantage of smaller pockets of cover, rough terrain, and other sites in roaded country that allow them to elude hunters outside of security and intermittent refuge areas. If this is the case, it will become more difficult for these elk to remain in these non-security areas during future hunting seasons as beetle-killed trees fall and hiding cover diminishes.

The degree to which these security areas in the project area contribute to the hunting season mortality in HD 215 and HD 335 is unknown. It is likely that elk inhabiting these areas in summer perceive a larger portion of the southern Divide landscape to be part of their hunting season survival strategy. Elk may range widely in the fall, moving wherever necessary to achieve the best balance between security and foraging opportunity. Therefore the combined security acreage for the two herd units shown in table 126 — 22,315 (24 percent) — is probably a more realistic estimate of what is available to project area elk. This view is bolstered by the fact that elk populations in surrounding hunting districts remain at or above MFWP objectives.

The elk security situation in HD 215 and HD 335 is discussed in more detail in the previous section dealing with *Montana FWP Population Management: Hunting Districts.*

Comparing Security/Vulnerability Measures

Forest Plan big game standard 4a attempts to quantify both hiding cover and open road density and then merge them into a single number that can indicate the viability of an area to protect bull elk in

the hunting season. This is a reasonable approach since (1) it is intuitively obvious to hunters and wildlife biologists that ducking into hiding cover is an effective means for elk to avoid being detected and shot and (2) research continues to find that low open road density correlates well with areas that bull elk choose to inhabit during the hunting season [see the recent study by Proffitt *et al.* 2013]. The problem has not been with the reality of hiding cover and open roads as key factors in elk security but rather with the numerical formulas that have been used to integrate them, the sensitivity of these formulas to what is going on in the elk population, and the thresholds used to trigger red flags for management.

While the relationship between open road density and hiding cover can be informative, it does not account for the spatial arrangement and size of unroaded patches, topography as a mediator of hunter access, the distribution of forage, and other factors that influence the ability of elk to survive the hunting season. Forest stands that do not meet the definition of hiding cover may prove to be secure areas for elk where local conditions of topography, remoteness, and environmental barriers impede hunter access. Conversely, blocks of hiding cover situated in roaded country may be highly insecure. Hiding cover has a role to play but it is not synonymous with security (Lyon and Canfield 1991; Unsworth and Kuck 1991; Lyon and Christensen 1992; Christensen et al. 1993).

The security area approach, while recognizing the role of hiding cover as a key component of elk security does not attempt to quantify it precisely. Instead, it emphasizes the size and distribution of unroaded areas large enough to dilute hunting pressure and allow elk enough varied habitat in which to elude hunters and carry on with daily life.

Winter Range

The Nature of Winter Range

Traditionally, the availability of suitable winter range has been seen as the key limiting factor for most elk populations (see Polfus *et al.* 2011; Lyon and Christensen 2002, p. 559). 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 over by domestic livestock, and are occupied by elk when temperatures are low and snow may limit access to forage. Under these conditions, elk catabolize fat and muscle and may lose 25 percent or more of their body weight in severe winters and 10 percent in moderate to normal winters (Cook 2002, pp. 305-310). 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 ranges (Cook 2002, p. 305).

In the Divide landscape, as well as across much of the HNF, a large proportion of elk winter range lies on private land—or other non-Forest lands—in lower elevation foothills and valleys. Big game habitat on these lands is outside the jurisdiction and control of the National Forest. Elk winter range for both Forest and not-Forest lands has been delineated on broadscale maps by MFWP [MFWP 2011a, 2011b].

Managing Winter Range: Cover, Forage, and Energy Balance

Helena Forest Plan standards for elk winter range focus on two things: (1) providing adequate thermal cover (stands of trees ≥40 feet high with at least 70 percent ***canopy closure***) and (2) restricting disturbance from motor vehicles. Thermal cover in stands larger than 15 acres needs to account for at least 25 percent of winter range in each elk herd unit, and vehicle traffic through elk wintering areas is to be restricted to those few primary roads and snowmobile trails needed to access other parts of the Forest. The *Plan* does not address forage on winter range.

For several decades, *thermal cover* has been one of two pivotal habitat elements at issue on big game winter ranges (forage being the other). In winter, thermal cover stands curtail snow accumulation, block wind, and, under the right conditions, moderate temperature under the canopy. However, the value of thermal cover—widely accepted as a key component of elk winter range in the 1970s and 1980s (Thomas 1979; Beall 1976)—has been called into question by more recent research (Skovlin *et al*. 2002). A review of experimental tests aimed at probing the value of thermal cover to big game animals (Cook *et al.* 2005) concluded that the thermal cover benefit attributed to dense forest structure was probably not operative across a considerable range of climate, including most elk winter ranges in Montana.

Recently, Thompson and others (2005) have made a case for the importance of forest cover on Montana elk winter ranges. They argue that elk benefit from solar radiation in open habitats only as long as forage is adequate and accessible—the norm in most winters. But when forage is scant or buried by deep or crusty snow, elk use up stored energy reserves at a higher rate, and the metabolic cost of remaining in open grassland or shrubland becomes too high. In those cases, elk switch to an energy conservation strategy, moving to forest cover, becoming less active, and subsisting on low quality forest forage.

The forest formation advocated by Thompson *et al.* (2005) is not the classic continuum of ≥70 percent canopy closure, but rather, a cover/forage mosaic where patches of dense cover are intertwined with more open-canopied forest and small openings. This provides an environment with manageable snow conditions and useful forage [deciduous shrubs, elk sedge, young conifers (esp. Douglas-fir), and arboreal lichens—species that thrive in more open forest conditions]. Thompson *et al.* (2005) provides no shorthand descriptive term for this habitat formation; but it is *not* "thermal cover." Field monitoring by MFWP biologists has shown that even when elk spend daylight hours foraging in open grasslands, they most often retreat to these kinds of mature forest stands to bed down at night (T. Carlsen, A. Grove: personal communication 2012).

Timber harvest or other overstory modification in thermal cover will inevitably lead to a loss of overstory density and of thermal function. On the other hand, carefully planned selective harvest in mature stands that creates the mix of forest structure described by Thompson et al. (2005) may improve the suitability of such stands as winter cover for elk.

Project Area Winter Range

Virtually all of the Telegraph project area consists of elk summer range and spring/fall transitional range. The northeast corner of the project area has been mapped as big game winter range. With the exception of a small patch of riparian and grassland habitat (less than 50 acres), most of this range is covered with mature, closed-canopy conifer forest (*Photo 8*).

This area isn't normally used by elk in winter. Rather, it serves as transitional range for animals moving toward summer range in spring and back toward wintering areas in the fall. In Mike Renig Gulch, stands immediately along the Forest boundary are almost pure Douglas-fir and still green, but further upslope lodgepole pine is mixed in and the overstory is beginning to open up *[see Photo 3]*. In its current state, very little of this forest exhibits canopy closure dense enough to qualify as *Forest Plan* thermal cover. However, these stands do provide the kind of habitat to which elk will retreat during severe winter conditions or where they bed down at night after foraging in adjacent private grasslands. Except in extremely mild, low-snow winters, however, elk do not begin moving into these forests until late April or early May when winter conditions have abated—thus the more accurate characterization as "transitional range." Primary elk winter range is located on private and state lands to the north and east.

Photo 8. Douglas-fir forest with lodgepole pine in the northeast corner of the Project area—the only part of the area classified as *elk winter range*. More than 90 percent of this "winter range" is occupied by forest stands such as these. Since elk normally do not move through here until April or May, the area actually functions most often as *transitional range*.

Elk Habitat and Population Trends

Habitat Status and Trend

Elk habitat patterns in the Telegraph project area remained relatively stable from around 1990, when the last major timber sale in the area was completed, and 2006, when the initial effects of the mountain pine beetle infestation became evident. Changes during that time were generated by small local projects and by gradual regeneration of older harvest units. Now, habitat in the project area and in surrounding elk herd units is in the midst of a dramatic transformation in the aftermath of the pine beetle outbreak, which has been ongoing for much the past decade. Dead trees dominate the overstories of lodgepole pine and ponderosa pine forests over tens of thousands of acres. Currently, enough standing dead trees remain to preserve hiding cover, screening cover, and forested forage throughout most of these stands, but over the next 5 to 10 years, this cover will be disappearing as trees fall. Most of the thermal value of these stands is already gone. For the next several years, forest cover will be provided by stands of Douglas-fir, subalpine fir, Engelmann spruce, aspen, and some stands of surviving ponderosa pine. Many stands of younger lodgepole pine, too small to have been attacked by the beetles, will continue to provide hiding and screening cover.

Although the basic habitat components on which elk depend will remain readily available on the landscape, their relative abundance, arrangement, and character will be shifting. For the next several years, hiding cover, thermal cover, screening cover, and forested forage will be less available. Open foraging areas, palatable forage in general, and calf concealment sites will become more widespread. Travel routes will shift because of the proliferation of stacked deadfall. Younger forest stands—particularly sapling lodgepole pine—will become more important as hiding cover. The juxtaposition of cover and foraging areas will be altered, as will the character of forested wetland sites. Edge and

ecotone habitat will increase. The internal configuration of security areas will change as cover disappears, sight distances increase, internal foraging opportunities expand, and hunter access becomes complicated by coarse woody debris.

While these trends in habitat can be predicted in general, the specific ways in which they play out on the ground in the Telegraph project area and in local elk herd units is difficult to predict. Extensive survey work over the next decade will be needed in order for MFWP and the HNF to decipher the new patterns and adjust management schemes to the new reality of post-beetle elk range.

Population Status and Trend

The Status of Elk in the HNF Plan Area

In the early 1980s, the total elk population on the HNF was estimated at about 5,000 (4,900 elk in 1981) (*HFP*, p. V/5). The *Helena Forest Plan* (released in 1986) sought to improve this number by devising big game standards designed to provide enough habitat on the National Forest to support 6,400 elk by 2000. This was in support of MFWP goals for harvestable elk (*HFP*, p. V/5). Currently, MFWP aerial survey data indicate that at least at least 11,349 elk inhabit hunting districts centered on the HNF, and that at least 14,736 elk inhabit all of the districts that overlap the Forest to some degree. Accounting for elk that spend most or part of their time on non-Forest land or on the Beaverhead-Deerlodge NF, the number of animals in these districts that make up the HNF population is still well in excess of 6,400.

The Status of Local Elk Hunting Districts

The status of hunting district (HD) 215, which encompasses the entire Telegraph Project area, and HD 335, which abuts it along its eastern border, are discussed in some detail in the previous section *"Montana FWP Population Management: Hunting Districts."* Both of these hunting districts have been meeting or exceeding MFWP objectives for total elk numbers and bull/cow ratios for most of the past decade (see table 121 and table 122). In HD 215, total elk counts over the past 2 years have averaged 2,364 animals—well above the district objective of 1,120 to 1,680 elk. Likewise, in HD 335, counts for the past 2 years have averaged 1,007 elk, which is well in excess of the district objective of 480 to 720 elk. Elk numbers continue to hold up, despite the deterioration of forest cover in pine stands across both hunting districts. The loss of hiding cover over the next decade may reveal something about the importance of this component to the maintenance of robust elk populations in these districts.

Effects of the Mountain Pine Beetle Outbreak

It seems unlikely that habitat changes generated by the mountain pine beetle outbreak will negatively impact elk productivity or those aspects of survivorship that are not related to human intercession. The forage base will expand as forest canopy declines and ground vegetation increases, improving prospects for productivity, if anything. The opportunity to hide and protect calves should not be diminished by the loss of canopy cover, and in fact, should improve with the increase in deadfall, shrubs, and young conifers. So, there should be no increased loss of young calves to predation. Although forested hiding cover will be substantially less than it is now for the next 20 to30 years, enough will remain for adaptable animals such as elk to adjust to the new patterns.

To the degree that survivorship during the hunting season is related to hiding cover in roaded areas, the potential for hunter success on public land should increase in the short run. Elk that remain in areas with an open road network during the hunting season are more dependent on local hiding cover than those that retreat into large security areas. Most elk, however, are dependent on security areas (on public and private land) to survive the hunting season. These areas will remain intact, since their effectiveness is primarily a function of open road distribution rather than of hiding cover. Decrease

in hiding cover within these units will undoubtedly affect elk use patterns as they adapt to the new arrangement of cover, forage, and accumulated woody debris. This may be problematic in the smaller intermittent refuge areas (250 to 1,000 acres), but less so in the large, diverse security areas, such as in the Electric Peak and Jericho Mountain Roadless Areas where habitat options abound. Distance from motorized routes, however, will remain the key factor allowing elk to survive the hunting season.

The ongoing loss of forest cover throughout local hunting districts may eventually require shifts in motorized access management by the HNF and changes in hunting regulation by MFWP. The combination of elk adaptability and the capacity of management agencies to quickly respond to observed changes in local elk populations will ensure the populations continue to meet *Montana Elk Management Plan* objectives for HDs 215 and 335.

Environmental Consequences

The following measures are evaluated to analyze effects to elk:

- Summer range Forest Plan Standard 3 for hiding cover (p. II/17) and habitat effectiveness by Elk Herd Unit (EHU)
- Hiding cover/open road densities Forest Plan Standard 4(a) by EHU (p. II/17)
- Hunting season elk security by Elk EHU
- Winter Range Forest Plan Standard 3 for thermal cover by EHU (p. II/17) and Forest Plan Standard 4(c) (p.II/18)

Desirable Habitat Conditions

√ Hiding Cover within each elk herd unit to meet FWP population objectives
√ 50% summer habitat effectiveness by elk herd unit
√ Hiding cover/open road density to support an extended hunting season
√ Adequate security habitat by elk herd unit

Effects Common to All Alternatives

Untreated portions of the project area will continue to progress through succession regardless of alternative. Disturbance processes including climate change, insect and disease, and fire will continue to influence the project area. Insect infestations will continue to create snags. Large areas of untreated stands would remain on the landscape where natural snag creation and attrition processes would proceed unabated and would continue to shape elk habitat.

Effects Common to All Action Alternatives

Summer Range and Calving Areas

Summer range habitat effectiveness measures how much of a given area elk are likely to use during the non-hunting season. It is a function of suitable habitat components (cover, forage, wet sites, travel routes) and reduced human disturbance (generally measured in terms of open roads and motorized trails) (Christensen et al. 1993). Timber harvest and burning in all action alternatives would reduce cover while improving foraging capability. The increase in foraging habitat would improve habitat effectiveness to a greater degree than cover loss would diminish it; that is, in most areas proposed for treatment, quality forage is limited while screening cover provided by conifers, alive and dead, is abundant.

Treatment effects generally fall into three categories:

- Some of the regeneration harvest would remove trees currently providing hiding cover.
- Intermediate harvest would remove live trees from within stands that currently provide hiding cover to the extent that they would no longer meet the Forest Plan definition of hiding cover.
- Prescribed fire treatments would consume dead and dying trees currently providing cover. Conversely, prescribed fire would improve spring forage habitat in all action alternatives (Long et al. 2008a, Long et al. 2008b) which would be benefit elk during calving and nursing periods due to increased nutritional demands associated with lactating.

All known elk calving and nursery areas would be protected during project implementation under all action alternatives.

Elk Security during Hunting Season

Timber harvest and prescribed fire in the action alternatives would remove conifers from stands that are currently providing elk hiding cover. This would potentially increase forage but would reduce tree density that currently provides hiding cover. Maintaining hiding cover in the project area is important to maintain big game habitat capability and hunting opportunity.

The action alternatives propose timber harvest and prescribed fire within existing elk security areas and intermittent refuge areas. Timber harvest or prescribed fire should not reduce the effectiveness of security areas given the distance of these areas from open roads, the irregularity of the terrain, and the value of additional fall forage within security areas. Timber harvest and prescribed fire could reduce the effectiveness of the intermittent refuge areas due to their smaller size. However, removal of conifers would increase sightlines and diminish screening cover that is useful to animals during hunting season.

Winter Range

There is very little thermal cover on elk winter range and only within the Jericho herd unit. Droughty, unproductive winter range sites aren't capable of growing the Forest Plan defined levels of crown closure needed to meet the thermal cover definition. Furthermore, the mountain pine beetle related tree mortality in the project area has reduced canopy cover below thresholds necessary to provide much thermal cover during the winter. Precommercial thinning in thermal cover on winter range could reduce some of the thermal cover effectiveness. Primary issues related to winter range include the disruption of wintering animals by human activity and potential increases in noxious weeds at the expense of native forage plants.

Alternative 1

Direct and Indirect Effects

Summer Range and Calving Areas

Hiding Cover

Alternative 1 will maintain the status quo with regards to Forest Plan Standard 3 for at least another 1 to 5 years after which enough dead trees will have fallen to begin the erosion of cover throughout much the herd units. The Jericho herd unit contains approximately 73 percent hiding cover; the Spotted Dog – Little Blackfoot herd unit contains approximately 65 percent hiding cover. Both herd units meet big game Standard 3 (50 percent). Table 127 summarizes hiding cover by elk herd unit and alternative.

Table 127. Percent of elk hiding cover on summer range by elk herd unit and alternative

Elk Herd Unit	Alternative 1/ Meets Forest Plan Standard	Alternative 2 / Meets Forest Plan Standard	Alternative 3/ Meets Forest Plan Standard
Jericho	73%/Yes	66%/Yes	69%/Yes
Spotted Dog – Little Blackfoot	65%/Yes	60%/Yes	62%/Yes

Field surveys in the project area indicate that a majority of the project area still provides hiding cover—most of it from standing tree trunks (see *Photo 4* and Appendix B in the Wildlife Specialist Report). Over the next decade, most of this cover will pass away as beetle-killed pine trees, which dominate the area, come down. After 10 years, both herd units will support so little hiding cover that they may be unable to satisfy the requirements of standard 3. In essence, there is nothing that can be done to prevent inexorable natural processes from pushing the herd units out of compliance with the current Forest Plan hiding cover standard. Hiding cover—and compliance with the standard—will return slowly as regenerating conifers fill in over the next few decades.

Habitat Effectiveness

Habitat effectiveness is a function of suitable habitat components (cover, forage, wet sites, and travel routes) and reduced human disturbance (generally measured in terms of open roads and motorized trails) (Christensen *et al.* 1993). It is not a Forest Plan standard. Because there would be no change in road access, habitat effectiveness would be unchanged in alternative 1. This level of habitat effectiveness as described under the existing condition and in table 128 is above the recommended 50 percent threshold.

Table 128. Open Road Densities (ORD) and Elk Habitat Effectiveness (HE) on Summer Range by Elk Herd Unit by Alternative

Elk Herd Unit	Alternative 1 ORD /% HE	Alternative 2 During Implementation ORD/ %HE	Alternative 2 Post Implementation ORD/ %HE	Alternative 3 During Implementation ORD/ %HE	Alternative 3 Post Implementation ORD/ %HE
Jericho	1.2/56%	1.3/~56%	1.2/56%	1.3/~56%	1.2/56%
Spotted Dog – Little Blackfoot	1.2/56%	1.3/~56%	1.2/56%	1.3/~56%	1.2/56%

Local Summer Habitat Components and Calving Areas

In the past, the closed-canopied lodgepole pine forests that have dominated much of the project area for several decades provided effective summer thermal relief and decent hiding cover. The gentle/rolling terrain in much of the project area often makes for poor drainage and allows wet meadows, bogs, and other riparian and wetland sites to develop across a broad area, providing excellent summer forage. Some of the older forest stands both in and beyond the project area have accumulated sufficient deadfall to provide concealment for calves and bedding spots for adults.

Now that a large majority of the forest habitat in the project area is dominated by standing dead trees, the summer thermal function of these stands has mostly disappeared. The tree trunks still provide cover but over the next decade this component will fade away as with the downfall of the snags. As hiding cover declines opportunities to conceal calves and to locate screened bedding sites, on the

other hand will increase dramatically. None of this would affect the distribution of water across the area in any dramatic way, although the absence of mature tree cover might allow surface water to emerge at some sub-irrigated sites: but this resource will remain relatively constant for lactating cows and for reliable forage production. Under alternative 1, these conditions will unfold in this manner across the entire project area. See also the following sections: *Wetland Habitat and Riparian Zones, Habitat Fragmentation, Travel Corridors and Linkages,* and *Edges and Ecotones*.

Elk Security during the Hunting Season

Hiding Cover/Open Road Densities

There are no direct effects to hiding cover or open road densities under alternative 1. Both the Jericho and Spotted Dog – Little Blackfoot herd units currently meet Standard 4a (table 129). Over time, the portions of the project area dominated by Douglas-fir stands will move through succession, become denser and closed canopied, increasing susceptibility to wildfire, insects, and disease. Vertical structure will tend towards dense even-aged or uneven-aged conditions, conditions favorable for hiding cover. Conversely, as trees that have died as a result of the mountain pine beetle outbreak fall to the forest floor, the conditions that provided hiding cover will be lost.

Table 129. Hiding cover and open road densities by herd unit and alternative

Alternative	Herd Unit	Acres of Hiding Cover/Percent	Open Road Density* Post-Implementation (During Implementation)	Meets Forest Plan Standard (During Implementation)
Alternative 1	Jericho	25,810/73%	1.27	Yes
	Spotted Dog – Little Blackfoot	53,149/65%	1.06	Yes
Alternative 2	Jericho	23,423/66%	1.27 (1.33)	Yes (Yes)
	Spotted Dog – Little Blackfoot	49,328/60%	1.06 (1.10)	Yes (Yes)
Alternative 3	Jericho	24,454/69%	1.27 (1.29)	Yes (Yes)
	Spotted Dog – Little Blackfoot	50,801/62%	1.06 (1.08)	Yes (Yes)

*Decimals are carried to two to show changes in ORD during and post project implementation

Hunting Season Elk Security

Security habitat for elk is important during the hunting season relative to elk vulnerability, population structure, and hunter success. Under alternative 1, elk security would remain at its present level with security areas comprising about 12 percent and 30 percent of the Jericho and Spotted Dog – Little Blackfoot herd units, respectively (table 130*).* Further, there are approximately 3,139 and 17,196 acres of hiding cover within security blocks in the Jericho and Spotted Dog – Little Blackfoot elk herd units, respectively. No new vegetation manipulation would occur in the project area, and shifts in hiding cover would be a function entirely of natural processes.

Table 130. Percent of elk security areas and acres of hiding cover remaining in security areas within each elk herd unit by alternative

Herd Unit	Alternative 1 (percent security/acres hiding cover)	Alternative 2 (percent security*/acres hiding cover)	Alternative 3 (percent security/acres hiding cover)
Jericho	12%/3,139	12%/2,821	12%/3,074
Spotted Dog – Little Blackfoot	30%/17,196	30%/16,770	30%/16,873

*Security percentages do not change between alternatives post-project implementation since security is not determined by the amount of hiding cover in a security area.

Alternative 1 would produce no new open roads (the main determinants of security area boundaries) and thus would have no immediate effect on the configuration or effectiveness of any elk security area.

Winter Range and Thermal Cover

Relatively little winter range falls on the HNF. Alternative 1 would not directly alter thermal cover; however, over time, thermal cover will decrease where the mountain pine beetle mortality is concentrated as dead trees fall over the next several years. It will be several decades before those forested stands dying from mountain pine beetle will be of a sufficient age to provide any canopy cover at all, let alone thermal cover. In areas where thermal cover is comprised of Douglas-fir stands, cover would continue to be provided. However, over time, without disturbance these stands may become subject to stress related mortality.

Alternatives 2 and 3

Direct and Indirect Effects

Summer Range and Calving Areas

Hiding Cover

Table 127 summarizes the effects to elk hiding cover on summer range. Alternative 2 would result in the removal of 2,254 acres of hiding cover within the Jericho herd unit and 3,629 acres within the Spotted Dog – Little Blackfoot herd unit (although “Forest Plan hiding cover” would decline by 2,387 acres in the Jericho EHU and 3,821 acres in the Spotted Dog – Little Blackfoot EHU —since some of the remaining cover acre blocks would now be less than 40 acres and would no longer qualify as “Forest Plan” hiding cover). Alternative 3 would result in the removal of 1,307 acres of hiding cover within the Jericho herd unit and 2,218 acres within the Spotted Dog – Little Blackfoot herd unit; Forest Plan hiding cover would decline by 1,356 acres in the Jericho EHU and 2,348 acres in the Spotted Dog – Little Blackfoot EHU. Both herds unit would meet Forest Plan Standard 3 upon implementation of either action alternative.

Currently, about 87 percent and 84 percent of the treatment units in alternatives 2 and 3, respectively, still provide hiding cover—most of it from standing tree trunks (see *Photo 4*). Over the next decade, most of this cover will pass away anyway as beetle-killed pine trees, which dominate the area, come down. Hiding cover in treatment units will return slowly as regenerating conifers fill in over the next few decades.

Intermediate harvest, proposed on 81 acres in the Jericho EHU and 302 acres in the Spotted Dog – Little Blackfoot EHU (table 131) in both alternatives 2 and 3 would result in the removal of live

trees and dead and dying trees, reducing hiding cover in treatment units. Openings created in the canopy would promote development of herbaceous and woody vegetation within a few years of treatment, resulting in an increase in forage that may last for 10 years (Wisdom et al. 2005).

Regeneration harvest would also result in the removal of hiding cover. The reduction in canopy cover combined with site preparation would increase herbaceous and woody vegetation and elk forage for 10 to 20 years, although this will decline over time (Wisdom et al. 2005, Hayden et al. 2008). The availability of forage for elk would depend on its proximity to cover and generally the highest elk use would occur within approximately 300 to 500 feet of cover, with use decreasing with increasing distance from edges/cover (Wisdom et al. 2005).

Table 131. Acres of Forest Plan hiding cover treated, by treatment type and action alternative (based on R1-VMap)

Herd Unit	Regeneration Harvest	Intermediate Harvest	Precommercial Thinning	Prescribed Fire
Jericho				
Alternative 2	1,053	81	556	564
Alternative 3	453	81	366	408
Spotted Dog – Little Blackfoot				
Alternative 2	2,228	302	812	287
Alternative 3	1,273	302	583	60

Low- severity burning would reduce down woody debris, some tree seedlings/saplings, and understory cover. There would be some overstory mortality, although this would be scattered and stands would continue to meet the Forest Plan definition of hiding cover.

Prescribed fire is routinely used to create or enhance elk habitat and has been shown to encourage early spring green-up, improve transition range, reduce conifer encroachment, increase palatability, and stimulate regeneration of aspen (Leege 1979, Sachro et al. 2005, Hillis and Applegate 1998, Van Dyke and Darragh 2007, Long et al. 2008a, Long et al. 2008b, Canon et al. 1987). Forage would increase within a few years of treatment and would remain high for 10 to 12 years. Year-round forage species that would be expected to increase include shrubs such as ceanothus (Crotteau et al. 2012), Rocky Mountain maple, and serviceberry.

Burning in shrub and grasslands has also been shown to increases both production and nutritional quality that benefit elk (Van Dyke and Darragh 2007) and low severity fire generally has the greatest benefit to elk when a mosaic of burned and unburned lands is available (Long et al. 2008a).

Units proposed for mixed-severity burning would experience a long-term reduction in overstory cover, although the response of the understory would vary over time. Grasses and ***forbs*** would become established within one to two years of treatment, whereas shrubs and tree seedlings would become established within five years (Hirsh 2012, Collins and Stephens 2012, Crotteau et al. 2012). While there would be a stand level reduction in cover in fire created openings, the interspersion of burned and unburned land would enhance landscape level habitat by providing a mosaic of forage and cover. For summer ranges, Thomas (1979) suggests openings from 10 to 40 acres are used by elk, whereas use is greatly reduced on larger openings. It is difficult to determine the size and spatial arrangement of openings created by mixed severity burning. Because cover would be retained in a

majority of the project area, it is expected that many of the openings created by mixed-severity burning would be within 300 to 500 feet of hiding cover and provide forage for elk within a few years of treatment (Wisdom *et al.* 2005).

Elk use of the landscape will change as elk seek out places where hiding cover remains post-treatment. Alternative 2 would result in more changes to elk use of the landscape than alternative 3 due to more acres of hiding cover being treated. Elk may be temporarily displaced during harvest and burning activities; however mitigation measures such as limiting harvest to a single drainage at a time are in place that will minimize that disturbance (See Mitigation/Design Elements).

Habitat Effectiveness

Alternative 2 would result in 8.5 miles of temporary roads being built and 3.4 miles for alternative 3, which would be closed to the public and would be obliterated at project's end. Project operations would also require use of 30 and 26 miles of roads in alternatives 2 and 3 respectively of closed roads as haul routes, which would also remain closed to public vehicle use. This use would undoubtedly displace any elk that would normally be making use of local habitat during the life of the project, but it would not influence open road habitat effectiveness as computed by Lyon (1983) and Leege (1984). Even if included in the calculations, the change in open road density would be too small to move the habitat effectiveness percentages (See table 128). In the long term, habitat effectiveness in both the Jericho and Spotted Dog – Little Blackfoot herd units will remain above 50 percent.

Project operations (cutting and skidding trees, hauling logs) are likely to redistribute elk on summer range, more so in alternative 2 than alternative 3. Mitigation measures will serve to minimize some of the impacts associated with Project activities. For example, logging activities will be confined to a single drainage at a time, which will increase the probability of immediate return by displaced elk. Also, the temporary roads will be closed to the public which should reduce some of the displacement of elk.

Elk population parameters affected by summer range conditions (esp. total population numbers and calf/cow ratios) have steadily increased over the past 10 years in terms of population numbers and until 2012, calf/cow ratios remained in the range of 30 to 40 calves/100 cows year after year. Calf numbers were down in 2012 and 2013, usually an indication of disruptive weather, poor adult nutrition, or heavy predation. Short-term changes in habitat effectiveness during project implementation are not expected to influence population or calf/cow numbers since effects would be short-lived.

Local Summer Habitat Components and Calving Areas

Treatments proposed in alternatives 2 and 3 would remove dead trees that would otherwise fall and provide concealment for calves and bedding spots for adults, more so in alternatives 2 than 3. However, because 71 percent of the project area would remain untreated in alternative 2 and 82 percent in alternative 3, ample deadfall will be available across the project area to provide concealment and bedding spots, more so in alternative 3.

Neither alternative will have a significant impact on summer thermal habitat. A large majority of the forest habitat in the treatment units is dominated by standing dead trees; as such, the summer thermal function of these stands has mostly disappeared anyway. The removal of vegetation under either alternative shouldn't affect the distribution of water across the area in any dramatic way, although the removal of mature tree cover might allow surface water to emerge at some sub-irrigated sites. Also, the overlap of project activities with the elk calving period is typically limited due to wet conditions during the spring. Overall, this resource should remain relatively constant for lactating

cows and for reliable forage production. To minimize the potential for project activities to displace elk from suitable birthing areas the design feature is applied to all management activities:

> *If elk calving (late May through mid-June) or nursery areas (late June through July) are identified prior to or during project implementation, management activities will be delayed during active periods.*

See also the following sections: Wetland Habitat and Riparian Zones, Habitat Fragmentation, Travel Corridors and Linkages, and Edges and Ecotones.

Elk Security During the Hunting Season

Hiding Cover/Open Road Densities

Under alternative 2, open road densities during the hunting season would remain constant. The newly constructed temporary roads (8.5 miles) and the closed roads to be used as haul routes (30 miles) would not be open to motorized use by hunters. These roads would receive "administrative use" by HNF personnel and equipment operators during the hunting season, which would temporarily perturb any elk or deer in the vicinity of the road, but it would not result in long-term displacement or put them more at risk from being shot. Unlike "habitat effectiveness" which focuses solely on the extent to which open roads displace elk from otherwise suitable habitat on summer range, the open road density component of standard 4a also measures the potential for hunters to probe into fall elk habitat and kill elk. If the 38 miles of closed and temporary roads were added to the open road mileage for the Jericho and Spotted Dog – Little Blackfoot herd units, open road density in that herd unit would increase from 1.27 mi/mi² to 1.33 mi/mi² in the Jericho EHU and from 1.06 mi/mi² to 1.10 mi/mi² in the Spotted Dog – Little Blackfoot EHU. Whether it is included in the calculation or not, the impact on elk vulnerability would be inconsequential.

Alternative 2 would remove an estimated 5,883 acres of hiding cover from treatment units. Hiding cover would decline by 7 percent in the Jericho EHU and 5 percent in the Spotted Dog – Little Blackfoot EHU: these 2 herd units would remain in compliance with Standard 4a. See table 129.

Open road densities during the hunting season would also remain constant under alternative 3. The newly constructed temporary roads (3.4 miles) and the closed roads to be used as haul routes (26 miles) would not be open to motorized use by hunters. If the 20.4 miles of closed road were added to the open road mileage for the Jericho and Spotted Dog – Little Blackfoot herd units, open road density in that herd unit would increase from 1.27 mi/mi² to 1.29 mi/mi² in the Jericho EHU and from 1.06 mi/mi² to 1.08 mi/mi² in the Spotted Dog – Little Blackfoot EHU; again, inconsequential.

Alternative 3 would remove an estimated 3,525 acres of hiding cover from treatment units. Hiding cover would decline by 4 percent in the Jericho EHU and 3 percent in the Spotted Dog – Little Blackfoot EHU: these two herd units would remain in compliance with Standard 4a.

Hunting Season Elk Security

Effects to elk security are described in table 130 and table 131. Both alternatives include utilization of currently closed roads and construction of temporary roads in security areas during the hunting season (September 1 to December 1). About 1 mile of temporary road would be built in security areas in alternative 2 and an additional 4 miles of closed roads would also be utilized for project implementation. No temporary roads would be built in security in alternative 3; about 3 miles of closed roads would also be utilized for project implementation. Post-implementation temporary roads would be obliterated and all existing roads would be returned to their pre-project status.

Treatments proposed in security areas would result in the reduction in hiding cover in both the Jericho and Spotted Dog – Little Blackfoot EHUs (table 132) in both alternatives.

Table 132. Acres of Forest Plan hiding cover treated, by treatment type and action alternative in security areas by herd unit (based on R1-VMap)

Herd Unit	Regeneration Harvest	Intermediate Harvest	Precommercial Thinning	Prescribed Fire
Jericho				
Alternative 2	294	0	46	0
Alternative 3	37	0	46	0
Spotted Dog – Little Blackfoot				
Alternative 2	347	0	100	0
Alternative 3	245	0	90	0

Elk would be displaced from areas of management activity to more secure areas during project implementation. Restricting project activities to only a single drainage at a time will reduce these impacts as well as prohibiting recreational use of firearms by anyone working within areas closed to the general public (See Mitigation/Design Elements).

Winter Range and Thermal Cover

Winter range in the project area is confined to the Jericho EHU. Thermal cover, however, occurs in both herd units. Table 133 summarizes the effect to winter range, and thermal cover on that winter range, within the Jericho EHU as well as the overall effects to thermal cover in both herd units. Treatments proposed in elk winter range under alternative 2 include 60 acres of intermediate harvest, 750 acres of regeneration harvest, and 236 acres of precommercial thinning. There are approximately 17,419 acres of elk winter range within the Jericho EHU. Treatments comprise about 6 percent of that area in alternative 2.

Alternative 3 includes treatments on approximately 3 percent of winter range: 60 acres of intermediate harvest, 323 acres of regeneration harvest, and 212 acres of precommercial thinning.

Table 133. Effects to winter range and thermal cover by herd unit and action alternative

Herd Unit	Regeneration Harvest	Intermediate Harvest	Precommercial Thinning	Prescribed Fire
Jericho All Winter Range				
Alternative 2	750	60	236	0
Alternative 3	323	60	212	0
Jericho Thermal Cover Winter Range				
Alternative 2	4	--	14	0
Alternative 3	4	--	8	0

Herd Unit	Regeneration Harvest	Intermediate Harvest	Precommercial Thinning	Prescribed Fire
Jericho Thermal Cover Non-Winter Range				
Alternative 2	59	13	123	142
Alternative 3	8	13	21	100
Spotted Dog – Little Blackfoot Thermal Cover Non-Winter Range				
Alternative 2	261	173	66	73
Alternative 3	127	173	50	6

*There is no overlap with thermal cover on winter range in the Spotted Dog – Little Blackfoot Herd Unit; therefore there is no treatment overlap.

Harvest and mixed-severity prescribed fire treatments would remove thermal cover. Because the Jericho EHU is currently below Forest Plan thresholds for thermal cover on winter range a site-specific amendment would be needed to proceed with either alternative.

Treatments on winter range that promote openings, particularly on southerly aspects, will benefit elk as they rely on radiant heat in open areas for thermal gain (Cook et al. 1998, p. 41-48). Some of these treatments would reduce canopy cover in forested stands. However, stands within which intermediate harvest is proposed would retain residual trees that could provide some relief from winter weather where residual trees are retained in a clumpy configuration. Additional treatments in grasslands and shrublands should improve forage habitat on winter range by removing competing conifers and improving winter forage. Burned areas would be treated for noxious weeds which would result in an increase in native forage plants, particularly bunchgrasses used by elk as winter forage. Mitigation measures are in place that minimize disturbance to elk during timber harvest operations, particularly avoiding logging operations during the winter on winter range (see Mitigation/ Design Elements).

Thermal cover outside of winter range within the Jericho herd unit will be treated in alternative 2 with regeneration harvest on 59 acres, intermediate harvest on 13 acres, precommercial thinning on 123 acres, and prescribed fire on 142 acres. Alternative 3 treatments include regeneration harvest on 8 acres, intermediate harvest on 13 acres, precommercial thinning on 21 acres, and prescribed fire on 100 acres.

Thermal cover within the Spotted Dog – Little Blackfoot herd unit will be treated in alternative 2 with regeneration harvest on 261 acres, intermediate harvest on 173 acres, precommercial thinning on 66 acres, and prescribed fire on 73 acres. It is assumed that only the mixed-severity prescribed fire would result in a reduction of thermal cover (i.e., low severity prescribed fire would not reduce thermal cover). Alternative 3 treatments include regeneration harvest on 127 acres, intermediate harvest on 173 acres, precommercial thinning on 50 acres, and prescribed fire on 6 acres.

Some temporary roads would be built in elk winter range; approximately 2 miles under alternative 2 and 0.7 miles under alternative 3.

Wintering elk historically have made use of open forest environments on winter range when snow conditions allow. The proposed treatments in thermal cover on winter range should create conditions that are attractive to wintering ungulates (as per Thompson et al. 2005).

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on elk habitat in the context of the myriad of other past, present, and future effects on elk habitat from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. Table 134 summarizes the key items that are taken into consideration for the cumulative effects analysis for elk habitat. See also Appendix E in the Wildlife Specialist Report, *Cumulative Effects,* for more information.

Table 134. Cumulative effects considerations for elk habitat

Parameter	Discussion
Spatial Boundary	The spatial boundary needs to be expanded to the point at which elk habitat is no longer measurably affected. The elk herd unit satisfies this requirement because this is the scale at which the effects to elk habitat can be examined at the stand or treatment unit. It also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1960s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the elk herd unit.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the age class, density, and species composition of the elk habitat that comprise the project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, private land timber harvest, livestock grazing, special use permits, the forestwide Roadside Hazard Tree Removal and Fuels Reduction Project, among others.
	Ongoing and future activities include the Red Mountain Flume/Chessman Reservoir project, Tenmile South Helena project, livestock grazing, noxious weed treatments, annual road maintenance, Divide Travel Plan, Big Game Forest Plan Amendment, and private land timber harvest.
Measurement Indicators	Measurements include effects to elk hiding and thermal cover and open road densities.
Thresholds	Forest Plan Standards provide thresholds applicable to hiding cover on summer range, thermal cover on winter range, and the relationship of hiding cover to open road densities during the hunting season.
Methods	Past, ongoing, and reasonably foreseeable activities are described quantitatively based on acres of elk habitat affected. Impacts of past activities are based on the FACTS database and summarized according to the types of treatments recorded in the database.
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized.

Past Activities

The primary activities that have eroded elk security in the cumulative effects area over the past century have been (1) the removal of forested cover by timber harvest and fire (earlier in the 20th century) and (1) ubiquitous road construction. Forest Service timber harvest and fuels treatments have been active over several decades in the project area and beyond, creating a widespread pattern

of early-seral and mid-seral habitats amidst mature forest. Some cutting/burning units have been large enough (before they've developed screening saplings) that elk use them as foraging areas only near the edges. Others are small enough to contribute to the kind of cover/forage mosaics that allow animals to feed in close proximity to cover in several directions. The expansion of the open road system has reduced the size of elk security areas. Few permanent open roads have been constructed on Forest lands in the past 25 years. Most new roads have been short access routes to private inholdings. In a number of other cases, previously closed roads have been temporarily opened to allow access for log hauling, mineral exploration, and other activities that have locally complicated elk security patterns for a period.

Past Forest Service timber harvest has resulted in the treatment of 1,479 acres of forested stands in the Jericho herd unit and 5,591 acres in the Spotted Dog – Little Blackfoot herd unit. Several hundred acres on private land have also been harvested since the 1980s (table 135*)*. Additionally, the Forestwide Hazardous Tree Removal and Fuels Reduction Project has resulted in the removal of 350 acres of hiding cover and 11 acres of thermal cover in the Jericho herd unit and 563 acres in the Spotted Dog – Little Blackfoot herd unit. Today, these treatments are reflected in the existing condition which is currently at Forest Plan standards in both herd units for hiding cover and below the Forest Plan standard for thermal cover. Many of the roads that have been built to facilitate timber harvest remain on the landscape today and are reflected in open road densities in the existing condition.

Fuels activities that occurred in the past in elk habitat in the past mainly focused on reducing surface fuels. Many of these areas that were treated prior to the 1980s have returned to their 'pre-treatment' conditions especially in favorable growing conditions that accelerate understory development. Hiding cover has most likely developed in these areas. Fuels activities that have occurred since the 1980s have also reduced surface fuels and created more open conditions that favor shrub and grassland development.

Table 135. Past Forest Service timber harvest activities and their impacts on existing elk habitat

Decade	Herd Unit	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Jericho Herd Unit	Regeneration Harvest	610	Past regeneration harvest treatments currently provide hiding cover for elk but it is unlikely that these areas provide thermal cover today. In areas of intermediate harvest, some hiding cover characteristics may be present as well as some thermal cover except in areas where trees have died as a result of mountain pine beetles.
		Intermediate Harvest	16	
	Spotted Dog – Little Blackfoot Herd Unit	Regeneration Harvest	2,469	
		Intermediate Harvest	248	
Forest Service Timber Harvest 1980s through 1990s	Jericho Herd Unit	Regeneration Harvest	640	Past regeneration harvest does not provide hiding or thermal cover today. Areas that were harvested with intermediate treatments may provide hiding cover characteristics in those stands that are generally more productive (i.e., cool, moist types). Thermal cover has not yet developed in these areas.
		Intermediate Harvest	20	
	Spotted Dog – Little Blackfoot Herd Unit	Regeneration Harvest	2,044	
		Intermediate Harvest	296	
Forest Service Timber Harvest 2000 to 2014	Jericho Herd Unit	Regeneration Harvest	43	Past regeneration harvest does not provide hiding or thermal cover.
		Intermediate Harvest	150	
	Spotted Dog – Little Blackfoot Herd Unit	Regeneration Harvest	16	
		Intermediate Harvest	518	

The most influential natural event reducing forest cover in recent years is the mountain pine beetle outbreak (beginning around 2006). The pine beetle outbreak has not yet noticeably diluted hiding cover in most areas because tree trunks that provide much of the cover in mature stands are still upright. But this is about to change over the next decade, although its impact on elk security is unpredictable at this point.

Ongoing Activities

Ongoing activities that have effects to elk habitat are summarized in table 136.

Table 136. Ongoing activities that may impact elk habitat

Activity	Effects to Elk Habitat
Red Mountain Flume/Chessman Reservoir Project	The Red Mountain Flume/Chessman Reservoir project overlaps with a small portion of the Jericho herd unit. Approximately 4 acres of hiding cover are being. Effects to elk are minimal.
Timber Harvest on Private/Non-NFS land	Timber harvest reduces hiding and thermal cover and creates early seral conditions.
Livestock Grazing	Ongoing grazing has the potential to reduce the amount of forage available for elk but not to the point that summer or winter range conditions are limiting for elk.

Reasonably Foreseeable Activities

Three reasonably foreseeable actions with implications for elk summer range and calving areas are planned in the cumulative effects area: (1) the Divide Travel Plan, which proposes a variety of changes to current vehicle routes and is likely to improve habitat effectiveness on some elk summer ranges and security during the hunting season, as well as closing some routes with site-specific problems for elk; (2) the Forest Plan Programmatic Amendment for Big Game Security for the Divide Travel Plan which proposes to update big game Standard 4a with a security area concept; and (3) the Tenmile/South Helena Vegetation Project, which would remove dead trees and thin young conifer stands on greater than 20,000 acres just west of the Continental Divide, eliminating hiding and thermal cover and opening up new foraging areas sooner rather than later.

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next several years. Private lands within the combination boundary but outside of the project area are a mix of lodgepole pine-dominated stands with a similar history and lower elevation stands dominated by Douglas-fir. Much of the lower elevation component has also been subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain. Elk habitat may be impacted if timber harvest occurs in hiding or thermal cover.

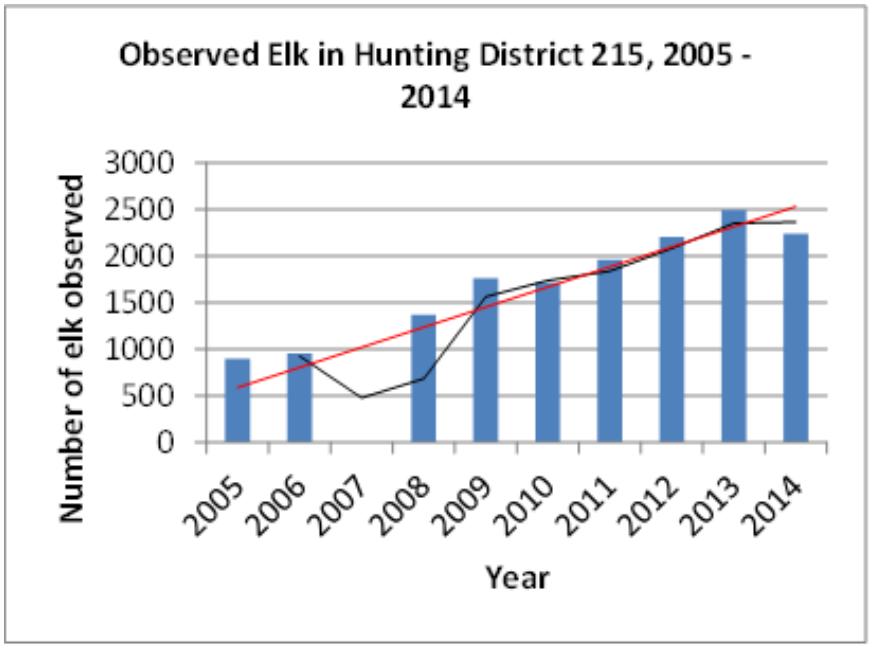
Cumulative Effects Conclusions

Alternative 1 would contribute to the effects of past timber harvest because forested stands that are killed by mountain pine beetles would revert to early ***seral stages*** similar to those early seral stands that were created as a result of regeneration harvest from the 1980s through today. These areas would no longer provide thermal cover for several decades. Early seral stands, after several years, will, however, provide hiding cover. These stand conditions would add to those areas that were regenerated through timber harvest from the 1980s through today. As the landscape continues to change due to mountain pine beetle mortality under alternative 1, the resultant early seral stages would add to those created during implementation of the Roadside Hazard Tree Project and the Red Mountain Flume/Chessman Reservoir project.

Implementation of alternative 2 or 3 would contribute to the effects associated with past timber and fuels activities that have partially defined the existing condition. Specifically, the project area would become more open in the short term while stands regenerate and develop understories. Thermal and hiding cover would be removed in both alternatives 2 and 3, adding to those impacts associated with

past timber harvest and fuels activities. Implementation of either alternative 2 or 3 would contribute to the effects associated with the ongoing Red Mountain Flume/Chessman Reservoir project, private land timber harvest, and grazing, and the proposed Tenmile/South Helena project. As stands are thinned, conditions will favor production of herbaceous and shrub habitats that are attractive to livestock for grazing. Alternatives 2 and 3 would also add to the impacts associated with annual road maintenance due to temporary road construction associated with those alternatives. Cumulatively, these activities may temporarily disrupt animal movement. Travel plan implementation, however, should offset impacts associated with alternatives 2 and 3 because it will result in the creation of large unroaded areas that should provide some additional secure habitat.

The Forest Plan programmatic amendment for big game is anticipated to improve the Forest's ability to effectively manage elk habitat during the hunting season. That analysis concluded that the elk security area methodology provides a reasonably accurate picture of elk security across the landscape, is responsive to proposed changes in open road patterns, and correctly directs management to areas that need further attention. Alternatives 2 and 3 are designed and analyzed to compliment this effort.



Note: The black line represents the annual fluctuations in numbers of elk observed; the red line indicates trend.

Figure 58. Observed elk in HD 215, 2005-2014

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

Elk numbers have steadily increased in HD 215 over the last several years while bull/cow ratios have tended to be erratic (See MFWP HD 215 Elk Surveys 2005, 2006, 2009–2014 in project record) (figure 58). The percentage of mature bulls in the population has decreased which may be an indication of hunting pressure too heavy for the available security during the hunting season. Calf numbers have also been down in the past two years; the reason for the drop off in calf production/

survival is unknown but does not appear to be a result of an increase in predation pressure. Several of the challenges faced by elk managers in this HD center on access and elk movement onto private land as well as housing development and an extensive motorized route network.

Selection of alternative 1 precludes any immediate loss of hiding or thermal cover. The tree mortality associated with the mountain pine beetle predisposes the project area to further losses in hiding and thermal cover. Natural changes associated with the mountain pine beetle outbreak would generate short- and mid-term shifts in the elk habitat use patterns on summer range. Elk in the project area would be likely to make more use of areas with a modicum of surviving green trees associated with productive foraging areas. They would be looking for effective patches of hiding cover as well as summer thermal cover (most often associated with stream bottoms with spruce, fir, and Douglas-fir). Accumulations of woody debris would suppress forage development to a certain extent, but forage would be more robust and widespread than under the previous forest canopies. As deadfall accumulates, new opportunities for concealing calves would arise.

Implementation of alternative 2 or 3 would result in the removal of hiding and thermal cover, more so in alternative 2. This would put the Jericho herd unit that currently does not meet Forest Plan Standard 3 for thermal cover further out of compliance. This would require a site-specific exemption from the standard in order for the project to proceed. This exemption is justified because the action alternatives would have no more impact on thermal cover than alternative 1 due to the mountain pine beetle.

Implementation of alternative 3 would result in retaining more hiding and thermal cover in the short term which could be important in light of the recent tree mortality associated with the mountain pine beetle outbreak. However, in the long term local barriers to movement may be created as dead trees fall. This could provide some security for elk but it could also impede their movement and lengthen the time it takes for those stands to redevelop into hiding and thermal cover. The temporary road construction associated with the action alternatives could result in short-term displacement of elk.

Timber harvest and prescribed fire associated with the action alternatives would also remove conifers from winter range (in addition to thermal cover). The removal of conifers from winter range would increase forage but could render these stands less effective at moderating temperature and snow depth. However, Cook et al. (1998, p. 41-48) indicate that thermal cover may be of little value to wintering elk; they may be better able to maintain body condition by taking advantage of the solar radiation associated with open habitats. Overall, while forest cover would decrease on winter range, the removal of conifers from grasslands, shrublands, and forest understories would increase foraging options for elk on winter range (Van Dyke and Darragh 2005).

Those applicable sections from the Recommendations from the Final Report of the Montana Cooperative Elk-Logging Study, 1970–1985 for Coordinating Elk and Timber Management are included as design elements to minimize effects to elk during implementation of the project. These include:

- Logging activity will be confined to a single drainage at a time with all work completed in the shortest time frame possible. Prior to logging, the project wildlife biologist will work with the pre-sale forester to compartmentalize drainages in order to meet this mitigation measure.
- Logging operations will be prohibited during the first two weeks of the general rifle season in order to maintain big game habitat capability and hunting opportunity.
- All temporary roads will be closed to the public.

- Recreational use of firearms will be prohibited for anyone working within an area closed to the general public.
- Road construction will not occur in elk winter range.
- Slash clean-up inside clearcuts will be reduced below 1.5 feet.
- Timbered areas adjacent to winter foraging areas will be retained.
- Timber harvest on winter range will be scheduled outside of the winter period.

In the long term implementation of any of the action alternatives should provide the desired habitat conditions of adequate hiding cover to support desired levels of elk, improved forage on winter range, and adequate levels of habitat effectiveness and hunting season security. Cover should regenerate in a manner that mimics or approximates a natural range of variation (NRV). Cover will continue to be available in elk security areas; cover would be retained between elk security areas to maintain habitat connectivity and facilitate seasonal movement.

Regulatory Framework and Forest Plan Consistency

Elk are a management indicator for commonly hunted species; as such they are intended to be a bellwether of the effects of management activities on representative wildlife habitats with the objective of ensuring that viable populations of existing native and desirable non-native animal species are maintained.

Federal laws and direction applicable to management indicator species include the National Forest Management Act (NFMA), the Forest Service Manual, and the Helena National Forest Plan. The NFMA requires the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" [16 U.S.C. 1604(g)(3)(B)]. All alternatives are consistent with this requirement. Elk habitat would continue to be abundant and well-distributed and species' viability would be maintained across the Forest. See also the Viability Analysis Section.

Compliance with Big Game Standard 3 – Hiding Cover on Summer Range and Thermal Cover on Winter Range

Big game Standard 3 (HFP, p. II/17) requires that hiding cover on elk summer range be maintained at or above 35 percent (or, on in this case, 50 percent using the MFWP crown closure criterion). Hiding cover must be in blocks of at least 40 acres to be tallied as Forest Plan hiding cover. Both action alternatives would result in the reduction of hiding cover but not to the extent that the Jericho and Spotted dog – Little Blackfoot herd units would fall out of compliance.

Standard 3 also requires that thermal cover on winter range be maintained at or about 25 percent in blocks of at least 15 acres. Under alternative 1, the Jericho herd unit fails to meet the thermal portion of this standard. Alternatives 2 and 3 would further reduce thermal cover on winter range. A site-specific exemption to the standard would be required for either action alternative. Because this thermal cover will be lost by natural means in the next decade or so and because alternatives 2 and 3 are not expected to negatively impact the elk population in HD 215, an exemption to the standard would be in order.

Compliance with Big Game Standard 4a – Hunting Season Security

Big game Standard 4(a) (HFP, p. II/17-18) requires implementation of an aggressive road management program to maintain or improve big game security (habitat capability and hunting opportunity). Both herd units currently meet Standard 4a and would continue to do so under either action alternative.

Compliance with Forest Plan Standard 4(b)

Forest Plan Standard 4(b) requires that elk calving grounds and nursery areas be closed to motorized vehicles during peak use by elk. This is usually from late May through July. While the project area has not been mapped by MFWP or the HNF as a calving ground/nursery area, some calving probably occurs around the meadows and heads of drainages in the project area. Elk with calves probably remain in the general area during the nursing period. A number of roads in and around the project area have been open to public vehicles for several decades without problems for calf production and survival. The temporary roads planned for the project would not be open to public use. Project operations would not occur during the calving season. If nursery sites are discovered during the course of the project, operations would be modified to avoid the sensitive areas. Both action alternatives would be consistent with this standard.

Compliance with Forest Plan Standard 4(c)

Forest Plan Standard 4(c) (HFP, p. II/18) requires that all winter ranges will be closed to vehicles between December 1 and May 15. Logging activities will be scheduled outside of the winter to address this standard.

Compliance with Forest Plan Standard 6 – Montana Elk-Logging Study Recommendations

Forest Plan Standard 6 (Forest Plan II/19 and C/1 -11) requires that the recommendations embodied in the Montana Cooperative Elk-Logging study (Appendix C of the Forest Plan) be followed during timber sale and road construction projects. There are a total of eleven recommendations some of which have been incorporated as design elements as previously described. The following discussion describes the project's consistency with each of the eleven recommendations.

1. Security during logging operations – The action alternatives are consistent with this recommendation. Design elements have been incorporated that confine logging to a single drainage at a time to minimize disturbance to elk. Also, logging activities will be completed in the shortest time frame possible. Use of firearms will be prohibited for anyone working within an area closed to the general public.

2. Redistribution of elk – The action alternatives are consistent with this recommendation which requires that timber sales be planned in a manner that does not redistribute elk onto adjacent or nearby property. Management challenges associated with HD 215 do include redistribution of elk to private land (MFWP 2005, pp. 190-193). The redistribution of elk that is currently occurring in HD 215 would not be exacerbated by the action alternatives.

3. Traditional home range use by elk – This recommendation is intended to ensure that timber harvest and road construction are planned to minimize impacts to elk and elk hunting. The action alternatives are consistent with this recommendation since all temporary roads will be closed to the public during logging operations and decommissioned post-implementation.

4. Road construction and design – This recommendation is intended to maintain the integrity of elk movement patterns and provide security for unimpeded movement. The action alternatives are consistent with this recommendation in so far as security either remains the same post-implementation, and all temporary roads will be closed to the public during implementation and decommissioned afterwards. There may be some temporary disruption to traditional movement patterns; however, ample blocks of unroaded areas exist that will provide alternative travel ways.

5. Road management – This recommendation is also intended to maintain elk security through management of road densities. Implementation of the action alternatives does not affect open road placement.

6. Area closures during the hunting season – This recommendation is intended to ensure that travel restrictions are carefully considered relative to elk management objectives so that hunting opportunities aren't unnecessarily impacted. This recommendation is not applicable to the Telegraph project.

7. Clearcuts – This recommendation is intended to ensure that forage produced through clear-cutting is available to elk. The action alternatives are consistent with these considerations since slash clean up inside clearcuts would be reduced to less than 1.5 feet and all temporary roads will be closed to the public. Openings would be generally less than 100 acres. However, in order to meet the purpose and need for the project, some treatment units are greater than 100 acres. This is to address the mortality in lodgepole pine stands associated with the mountain pine beetle. A site-specific amendment would be needed for either action alternative.

8. Cover type – This recommendation is intended to ensure that cover types, important to elk, are considered during planning and implementation of silvicultural practices. The action alternatives are consistent with this recommendation since cover type data are available forestwide (via R1-VMap) and have been utilized for the Telegraph project to identify cover and forage.

9. Moist sites – This recommendation is intended to ensure that the integrity of moist sites is maintained since these areas comprise important components of elk habitat. Design elements have been developed to retain green trees, standing snags, and coarse woody debris in and around the fringes of those sites that occur in treatment units. This should preserve their utility for elk and other wide-ranging species as well as for smaller resident mammals, birds, and amphibians.

10. Elk/cattle relationships – This recommendation is intended to ensure that forage that may be created as a result of timber harvest remain available to elk. The action alternatives are consistent with this recommendation since cattle and elk currently comingle where they overlap.

11. Winter range – This recommendation states that timbered areas adjacent to primary winter foraging areas should be managed to maintain the integrity of cover and timber harvest should be scheduled outside of the winter period. There are some treatment units within which winter logging in winter range is proposed under both action alternatives. Implementation therefore would require a site-specific amendment to allow the project to proceed.

As indicated, two of the 11 elk logging study recommendations would need a site-specific exemption in order for the project to proceed. Despite this amendment and its anticipated impacts to elk, elk populations within the project area and across the Forest as a whole should continue to remain robust. Elk are fairly resilient animals. Ernest Thompson Seton (as cited in RMEF 1997) postulated that 10 million elk lived in North America prior to European settlement. By 1907, there were less than 100,000. In Montana, elk were widely distributed during the era of exploration. As Montana was 'settled,' elk began to decline were completely eliminated from eastern Montana by the early 1900s. Today, elk are abundant; their ability to withstand near extirpation at the turn of the last

century strongly suggests that they can withstand large openings in an otherwise dead forest and minor disturbances on winter range.

There are six management areas within the project area; of those, only Management Area W-1 has direction relevant to elk habitat (direction is in *italics*):

Compliance with Management Area W-1

(1) *Wildlife habitat improvement practices, including road management, prescribed fire, and other techniques, will be used to maintain and/or enhance the quality of big game and nongame habitat* - Several miles of roads will be closed and/or decommissioned under all action alternatives. Prescribed fire goals include improving grass and shrublands which would be beneficial to elk.

(2) *Maintain adequate thermal and hiding cover adjacent to forage areas; this generally means providing at least 25 percent [thermal] cover, where available, on identified winter range*. Currently, there is no overlap with W-1 and identified elk winter range within the project area so this portion of the standard is not applicable. Elsewhere in W-1, alternative 2 would result in the removal of approximately 62 acres of thermal cover; alternative 3 would result in the removal of 19 acres of thermal cover. The removal of thermal cover would actually create openings in areas that are otherwise contiguous which in turn should create forage opportunities for elk. As such, all action alternatives are consistent with this standard.

Monitoring

One of the goals of the Forest Plan is to “maintain and improve the habitat over time to support big game and other wildlife species.” In order to accomplish this goal, the above standards are in place as well as a monitoring plan to ensure that management activities accomplish Forest Plan goals. Monitoring element C4 (Forest Plan p. IV/8) is the element that is applicable to the Telegraph project with regards to elk and focuses on those management areas that include a wildlife emphasis as part of the overall goals and objectives. The management area identified in element C4 that occurs within the project area is W-1. An analysis of cover/forage ratios, open road densities, and livestock impacts on elk habitat potential has indicated that the effects of implementing the Forest Plan are generally occurring as predicted in the case of elk (Forest Plan Monitoring and Evaluation Report, Fiscal Years 2008 to 2010). Outyear monitoring will occur in the project as part of Forest Plan monitoring specific to element C4.

Mule Deer

Affected Environment

General Perspective: Considerations Pertinent to Management

Of the two deer species that inhabit the HNF, the mule deer (*Odocoileus hemionus*) is the more common. In spring, summer, and fall, mule deer are most often found in montane habitats from the foothills on up into the high alpine zone, whereas white-tailed deer (*Odocoileus virginianus*) focus much of their activity on riparian bottomlands, lowland forest, and agricultural lands in the valleys—most of it off the Forest (Foresman 2012, p. 384-393). In winter, both species occupy winter ranges in the lower foothills and valleys, sometimes living in close proximity to one another when deep snow forces them into the same areas (field observations, 1978 to 2014).

Like elk, the mule deer serves as a management indicator species (MIS) for hunted wildlife on the HNF. Most big game standards and guidelines in the *Helena Forest Plan*, however, are directed specifically at elk—the assumption being that management aimed at the needs of elk will

automatically take care of mule deer (and other big game species). This is true to a degree, but deer are different enough from elk that resource management—vegetation manipulation, in particular—needs to account for certain local habitat configurations that are important specifically to deer (Pac et al.1991, pp.276-280). Favorable habitat features include local patches of hiding cover, dense thermal cover stands on winter range, palatable shrubs on winter range, diversity of forbs on summer range, structurally diverse forest (irregular canopy, complex layering, understory patchwork), tight juxtaposition of cover and forage, and topographic diversity (Mackie et al. 1998, p. 40-66, 135-138; Pac et al. 1991, pp. 274-280).

Mule deer populations have exhibited pulses of population increase/decrease over periods of 10-20 years. In the 1970s, these changes were tied to overhunting, but more recent cycles have been driven primarily by local climate conditions (drought, severe winter), which suppress fawn recruitment. In some areas, these factors have been aggravated by predation and hunting, which elevate adult mortality (Mackie et al. 1998, p. 123-128). While direct manipulation of these processes in order to stabilize and recover depressed mule deer populations is beyond the scope of habitat managers, maintenance of favorable habitat can ameliorate some of the negative impacts (Mackie *et al.* 1998, p. 135-138).

Mule Deer Habitat Considerations

As with elk, a majority of mule deer in the Divide landscape over-winter on private and State land in the foothills and valleys. Unlike elk, however, not all deer move *en masse* to high elevation summer ranges. Some may remain in the valleys all year: the deer population in the City of Helena, for example, is a year-round resident population, distinct from adjacent migratory groups [this is a mixed population of mule and white-tailed deer]. Some of the other deer that winter in the valley move only a short distance up onto neighboring HNF land where they remain through the fall. This is an example of what Pac *et al.* (1991, p. 97) call “adjacent” seasonal ranges. More continue on to more distant summer ranges at higher elevation—an example of “distinct” seasonal ranges (Pac *et al.* 1991, p. 97). These migrating deer tend to follow the spring green-up as it spreads from the valleys up through the foothills and into the montane summer ranges in June.

Mule deer are in the rut for much of the hunting season in October and November, and bucks are often on the move within their fall ranges. Because deer are less inclined than elk to move off local ranges to security areas several miles away (Mackie *et al.* 1998), they often rely on local hiding cover to avoid hunters. Thus, local blocks of hiding cover outside unroaded security areas are often more important to deer than to elk. Small patches of cover (considerably less than the 40 acres recommended for elk) can provide effective escape enclaves for mule deer.

As a rule, the quality of summer range (not winter range) is the primary factor regulating deer numbers (Mackie et al. 1998, p. 131; Pac et al. 1991, p. 279). In mountain and foothills environments, summer habitat should provide high forage quality (of leafy forbs) and security for fawn rearing. Management should emphasize habitat diversity (Mackie et al. 1998, p. 136). Mature and over-mature conifer stands with multiple layers, numerous openings, abundant edge, and inclusions of other diverse micro-communities are ideal (Mackie et al. 1998, p. 49, 55; Pac et al. 1991, p. 279). A balance of high-quality forage, summer thermal cover, and screening/hiding cover are important for raising fawns and building energy reserves for winter survival and future fawn production.

While summer nutrition may be the key factor that provides deer the wherewithal to survive the winter, effective winter habitat is also important, allowing animals to hold onto as much of their accumulated body weight as possible. Pac and others (1991, p. 276) emphasize the need to manage mule deer winter ranges as *maintenance habitat* where animals can conserve energy. Their studies in

the Bridger Range of southwest Montana suggest that forage characteristics are often of secondary importance and that local topography and the abundance of conifer stands that can ameliorate snow depth and temperature are the key factors. The conclusion that thermal cover (≥70 percent canopy closure) is seldom a key habitat component for elk on winter range [see previous discussion of elk winter range] does not necessarily apply to deer. Research indicates that mule deer are more dependent on thermal characteristics of forest cover than are elk. At least on some winter ranges, deer appear to require dense stands of mature timber with canopy closure in excess of 60 percent to withstand prolonged bouts of severe winter weather. While typically deficient in forage, these stands can provide a favorable thermal environment and minimize snow depth (Mackie et al. 1998, p. 52, 136; Pac et al. 1991, p. 77, 276, 279).

While deer are more likely than elk to become habituated to open roads and attendant human activity (as common observation across the HNF and adjacent lands will attest), most deer do in fact avoid roads as much as possible (Rost and Bailey 1979). As a result, regular vehicle traffic will lower habitat effectiveness, reducing the amount of habitat that deer find suitable for foraging, resting, raising young, and escaping from perceived danger. The impact of roads on deer summer habitat in general can be estimated via the "habitat effectiveness" indices calculated for elk summer range. But, as with elk, the specific roads that limit the ability of deer to use key habitat sites are the primary disruptive influence.

Deer in many sub-populations have adapted to living in close proximity to humans, especially in winter (as in numerous local subdivisions and in the City of Helena). But, those that winter on less-settled agricultural lands and in the foothills are more likely to try to avoid humans in winter. Some researchers have noted that in order to minimize all responses by mule deer to snowmobiles or hikers, they would have to be more than 350 meters away (Freddy *et al.* 1986). Perry and Overly (1976) recommended a distance of one half mile away to prevent disturbance and displacement of mule deer. They found that mule deer were interrupted more often, and longer, by persons afoot than by snowmobiles.

Mule Deer Population Considerations

Mule deer numbers have cycled up and down over past decades, hitting low points in the 1970s, 1990s, and again, beginning in 2012. MFWP does not survey deer as rigorously as elk in the Divide landscape—picking them up incidentally during elk winter range flights—and as a result, population estimates are often murky. However, the aerial surveys of elk/deer winter ranges, check station data, hunter surveys, and field observations by biologists provide enough information on population trends to allow the Fish and Game Commission to make yearly adjustments in the allowable mule deer harvest.

As discussed earlier, the Telegraph Project area falls entirely within hunting district (HD) 215 west of the Continental Divide; but it borders HD 335 east of the Divide, and deer move back and forth between the 2 districts across the Divide. The combination boundary falls primarily within these 2 districts as well, but a small segment edges into HD 343 north of Highway 12 [see figure 54 and figure 55 in previous sections].

In these districts, *antlered* deer harvest is managed via the general deer license or by B license permits—both of which allow an unlimited number of hunters but restrict the take to one antlered deer per hunter. This set-up has remained in place for several decades in spite of fluctuations in the deer population. The allowable harvest of *antlerless* deer, however, has varied over time and between districts, and has been the primary mechanism for making adjustments in response to population shifts revealed by field data. During the population ebb of the 1990s, no antlerless harvest was permitted, thus protecting the reproductive segment of the population. In 2001, with local

populations increasing east of the Divide, a total of 50 B-licenses for antlerless deer became available in HDs 335 and 343. The number of antlerless B-licenses in these districts peaked at 500 in 2008 and by 2013 had dropped to 300 licenses as deer numbers again looked to be falling off. In HD 215 west of the Divide, no antlerless deer B-licenses were issued until 2008 when 50 licenses were permitted. This number dropped to 25 in 2012.

All this is now about to change, however, as numbers of mule deer are once again dropping precipitously (by 60 to 90 percent) across much of Montana. Reasons for the current population decline are multiple: they include the aforementioned cyclical trends in deer populations, increase in disease (more a problem for white-tailed deer), harsh winter conditions in 2011–2012, and, in some areas, a rise in predator populations. Shifts in habitat quality and road patterns have not been implicated in the decline. In response, the Fish and Game Commission has eliminated B-licenses for both antlered and antlerless deer across much of the state. In the case of the 3 districts overlapped by the Telegraph combination boundary, the general antlered mule deer harvest for the rifle season has been eliminated—although in HDs 335 and 343, this harvest has been shifted to antlered B-licenses. There is no longer an antlerless B-license option in those districts. In HD 215, where the Telegraph Project area sits, the only rifle season opportunity comes in the form of 50 B-tags for antlerless mule deer on private land. The end result of the new regulations is that hunters are limited to one deer, and pressure is taken off of reproductive females [see *Helena Independent Record:* 2013 Dec. 13, 2013 and Jan. 5, 2014; Montana 2014 Hunting Regulations: http://fwp.mt.gov/hunting/regulations].

Mule Deer Population Status and Habitat in the Project Area

Wildlife field surveys in the project area since 2009 and throughout the Upper Little Blackfoot Watershed since 1992 indicate that, even with area-wide populations at a low ebb, mule deer are common and widespread. Most of the Project area serves as spring, summer, and fall range, and mule deer are present across much of the area from mid-April into November. There is a fringe of potential winter range in mature forest and open riparian habitat along the northern and western edge of the project area, but it is occupied only occasionally during winters or parts of winters when snow cover is not a factor.

The project area offers a diversity of habitat types, seral stages, vegetation structure, and productivity levels. The mature lodgepole pine forests that dominate much of the project area vary widely in the kind of hiding and summer thermal cover they provide and the quality and abundance of forested forage. While some of the older stands on productive sites support palatable forbs in the understory, ground cover in a majority of stands is characterized by less palatable fare, such as pinegrass and grouse whortleberry, or by needle mats bereft of worthwhile forage. Foraging opportunity for deer in these stands is in the forest openings and along edges. Douglas-for stands, in general, provide more conducive foraging conditions for mule deer.

Much of the juxtaposition of different habitat structures throughout the project area has been created by past timber harvest—typically clearcuts of less than 40 acres—that have been punched into the mature forest continuum. Most timber harvest occurred prior to the early 1990s, and these sites are now dominated by sapling conifers with robust ground vegetation—habitats that provide mule deer with a diversity of summer forage amidst hiding and screening cover. Natural openings—most of them relatively small—also provide numerous foraging sites of varying quality throughout the forest. The most effective are those that also qualify as riparian or wetland sites—wet meadows and smaller openings along streams, around springs, and in drainage-head basins.

Mule deer have been observed to make use of most habitat configurations in the Project area to one degree or another. They tend to forage most often in riparian and wetland sites, in open habitats (clearcuts; natural grasslands and meadows) with an abundance of forbs, in aspen stands, and along

edges and ecotones (primarily between mature forest and natural openings or early seral forest). They will, however, forage in the understories of forest stands where ground vegetation is well-developed, particularly on hot summer days or when keeping a low profile during hunting season. While they most often bed down in mature forest environments, they will do so in any site that provides some concealment and a vantage point from which they can anticipate potential threats. The same is true for areas where they conceal fawns, though sites with a supply of shrubs or logs are used most frequently.

The effect of the mountain pine beetle outbreak to this point has been to substantially cut down on the availability of effective summer thermal cover. Deep shade is now available only in stands of green Douglas-fir, subalpine fir, Engelmann spruce, and a few patches of aspen. Defoliation of the mature lodgepole pine forest has not yet produced a flush of new growth in understory vegetation, but eventually, forage quality and abundance should increase over broad areas. Likewise, because most beetle-killed trees are still standing, hiding and screening cover remain largely intact. This cover will diminish substantially over the next 5 to 10 years. Accumulation of deadfall will also serve to alter mule deer travel routes and provide for new concealed resting sites and areas for hiding fawns. Mule deer are adaptable animals, and it is unlikely that these changes will significantly reduce the ability of the project area to support populations similar to what have inhabited the area in past decades.

Environmental Consequences

The following measures are evaluated to analyze effects to mule deer:

- Effects to ***reproductive*** habitat
- Effects to summer habitat
- Security during the hunting season
- Effects to winter range

Desirable Habitat Conditions

√ Early successional habitats where forbs, grassy plants, and shrubs dominate
√ Mosaic of habitats that can provide food and cover
√ Effective winter range

Effects Common to All Alternatives

Untreated portions of the Project area will continue to progress through succession regardless of alternative. Disturbance processes including climate change, insect infestations, disease, and fire will continue to influence the project area. At any given time, the project area will comprise a variety of successional stages. Some of the thermal cover on winter range will be reduced by mountain pine beetle-related mortality or through timber harvest.

Effects Common to All Action Alternatives

Effective ***mule deer reproductive habitat*** (fawning and lactation periods) generally is located at intermediate elevations in diverse, mesic montane forests with dependable sources of succulent, high quality forage. Timber harvest and burning in all action alternatives would reduce cover in the short term rendering some areas unsuitable as fawning habitat until the understory regenerates. Several hundred acres of uneven-aged forests will remain in the project area, however. These uneven-aged stands provide a mosaic of high quality forage and security for fawn rearing.

Mule deer summer habitat usually consists of subalpine-alpine and shrub grassland habitats. Timber harvest and prescribed fire in the short term would remove conifers that may provide cover and will also temporarily reduce forage availability until shrubs and forbs are rejuvenated. In the long term, harvest and burning treatments will result in patterns of habitat that are desirable to mule deer – i.e., early successional habitats where forbs, grasses, and shrubs dominate interspersed with cover.

Security during the hunting season is provided by well-distributed patches of cover and limited road access. Impacts of roads on mule deer, especially during the hunting season, have been well-documented (Thomas 1979 pp. 104-127, Witmer et al. 1995 as cited in Hayden et al. 2008, Stewart et al. 2002). All action alternatives would result in the removal of some cover and in temporary road construction and use of roads closed to the public for haul routes.

During the winter, mule deer move to lower elevations of the project area. Timber harvest will result in the removal of some thermal cover on mule deer winter range, the effects of which will last for several decades as treated stands move through succession. Prescribed fire will reduce forage in the short term but forage is expected to improve as shrubs re-sprout and become more nutritious.

No old growth would be treated under any action alternative. Old growth stands provide both thermal benefits and snow interception because of their structure and canopy cover (Kirchhoff and Schoen 1987). As a result deer expend less energy travelling through shallower snow in these stands and they find more rooted forage that remains snow-free (Parker et al. 1984).

Alternative 1

Direct and Indirect Effects

There are no direct effects to mule deer habitat under the alternative 1. In areas of mountain pine beetle-related tree mortality, forage habitat should increase as the tree canopy continues to open up and competition from conifers is reduced. Conversely, shrub and grassland habitats will continue to undergo competition from conifers and will most likely continue to decline with a subsequent reduction in forage habitat.

Early successional habitat is important for mule deer; in the absence of fire, the mountain pine beetle is the primary disturbance factor creating this type of mule deer habitat. Should a fire ignite in the project area today, it’s likely to be large and hot. Hot fires affect the ability of an area to regenerate and reduce site productivity which could lead to long-term changes in mule deer habitat.

Alternative 1 will not necessarily render the project area more suitable for mule deer. Thermal cover will continue to decline in stands susceptible to mountain pine beetle; however, most of the forested stands on mule deer winter range are mixed conifer so these stands will continue to ameliorate the effects of winter.

Alternatives 2 and 3

Direct and Indirect Effects

Implementation of alternative 2 would result in the regeneration of 3,484 forested acres; intermediate harvest is proposed on 434 forested acres; precommercial thinning on 1,786 acres, and prescribed fire is proposed on 1,050 acres including both forested and non-forested acres. Regeneration harvest would remove cover in the short term while improving forage habitat. Because deer are attracted to young clearcuts during snow free months because of their forage value (Yeo and Peek 1992), regeneration harvest treatments should be beneficial to mule deer. Intermediate harvest, as well as prescribed fire in forested areas, would also reduce cover while creating conditions favorable to

forage production. Trees that remain post-treatment should provide some hiding cover as should untreated areas. Prescribed fire in grass and shrublands would reduce standing biomass of ground vegetation and improve the forage quality in these habitats.

No thermal cover would be treated within mule deer winter range under either action alternative. Other thermal cover outside of mule deer winter range would be treated as follows: 325 acres of regeneration harvest, 186 of intermediate harvest, 203 of precommercial thinning, and 215 of prescribed fire. Those acres treated with intermediate harvest or prescribed fire should still provide some snow intercept properties post-treatment while also resulting in breaks in the canopy cover that would allow sunlight to reach the forest floor to produce forage habitat.

Alternative 3 would result in 139 acres of regeneration harvest, 186 acres of intermediate harvest, 79 acres of precommercial thinning, and 106 acres of prescribed fire. Effects are similar to those described for alternative 2 except that fewer openings would be created in alternative 3.

Both action alternatives include consideration of aspen. It would be favored in treatment units where it occurs. Aspen is a preferred forage species for mule deer.

Approximately 8.5 miles of temporary road construction would occur as part of alternative 2, 3.4 miles as part of alternative 3. In addition, 30 miles of closed roads would be used as haul routes in alternative 2; 26 miles in alternative 3. Temporary roads would be decommissioned post project implementation.

Project activities may disrupt and displace mule deer for the duration of those activities. Mitigation measures that are in place for elk should also minimize impacts to mule deer. These include: (1) confining logging activity to a single drainage at a time so that mule deer have undisturbed areas into which they can displace during logging activity and (2) prohibiting public use on temporary roads.

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on mule deer habitat in the context of the myriad of other past, present, and future effects on mule deer habitat from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. Table 137 summarizes the key items that are taken into consideration for the cumulative effects analysis for mule deer habitat. See also Appendix E in the Wildlife Speicalist Report, Cumulative Effects, for more information.

Table 137. Cumulative effects considerations for mule deer habitat

Parameter	Discussion
Spatial Boundary	The spatial boundary is expanded to the point at which mule deer habitat is no longer measurably affected. The combination boundary satisfies this requirement because this is the scale at which the effects to mule deer habitat can be examined at the stand or treatment unit. This boundary also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1960s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the herd unit boundaries.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the age class, density, and species composition of the mule deer habitat that comprise the Project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, private land timber harvest, livestock grazing, special use permits, the forestwide Roadside Hazard Tree Removal and Fuels Reduction Project, among others.
	Ongoing and future activities include the Red Mountain Flume/Chessman Reservoir project, Tenmile South Helena project, livestock grazing, noxious weed treatments, annual road maintenance, Divide Travel Plan, and private land timber harvest.
Measurement Indicators	Measurements include effects to thermal and hiding cover, forage, and open road densities.
Thresholds	There are no specific thresholds for mule deer.
Methods	Past, ongoing, and reasonably foreseeable activities are described quantitatively based on acres of mule deer habitat affected. Impacts of past activities are based on the FACTS database and summarized according to the types of treatments recorded in the database.
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized.

Past Activities

Past Forest Service timber harvest has resulted in the treatment of 9,137 acres of forested stands. Several hundred acres on private land have also been harvested since the 1980s. Today, these treatments are reflected in the existing condition. Table 138 summarizes the effects of timber harvest during three time periods on mule deer habitat currently existing within the mid-scale boundary. Many of the roads that have been built to facilitate timber harvest remain on the landscape today and are reflected in open road densities in the existing condition.

Fuels activities that occurred in the past in mule deer habitat mainly focused on reducing surface fuels. Many of these areas that were treated prior to the 1980s have returned to their ‘pre-treatment’ conditions especially in favorable growing conditions that accelerate understory development. Hiding cover has most likely developed in these areas. Fuels activities that have occurred since the 1980s have also reduced surface fuels and created more open conditions that favor shrub and grassland development.

Forest Service timber harvest and fuels treatments have been active over several decades in the project area and beyond, creating a widespread pattern of early-seral and mid-seral habitats amidst mature forest.

Table 138. Past forest service timber harvest activities in the combination boundary and their impacts on existing mule deer habitat

Decade	Treatment Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Regeneration Harvest Intermediate Harvest	3,079 264	Past regeneration harvest treatments currently provide hiding cover but it is unlikely that these areas provide thermal cover today. In areas of intermediate harvest, some hiding cover characteristics may be present as well as some thermal cover except in areas where trees have died as a result of mountain pine beetles.
Forest Service Timber Harvest 1980s through 1990s	Regeneration Harvest Intermediate Harvest	2,684 316	Past regeneration harvest does not provide hiding or thermal cover today. Areas that were harvested with intermediate treatments may provide hiding cover characteristics in those stands that are generally more productive (i.e., cool, moist types). Thermal cover has not yet developed in these areas.
Forest Service Timber Harvest 2000 to 2014	Regeneration Harvest Intermediate Harvest	236 2,558	Past regeneration harvest does not provide hiding or thermal cover.

The most influential natural event reducing forest cover in recent years is the mountain pine beetle outbreak (beginning around 2006). The pine beetle outbreak has not yet noticeably diluted hiding cover in most areas because tree trunks that provide much of the cover in mature stands are still upright. But this is about to change over the next decade, although its impact on elk security is unpredictable at this point.

Ongoing Activities

Ongoing activities that have effects to mule deer habitat are summarized table 139.

Table 139. Ongoing activities that may impact mule deer habitat

Activity	Effect
Red Mountain Flume/Chessman Reservoir Project	The Red Mountain Flume/Chessman Reservoir project affects 4 acres of hiding cover are being. Effects to mule deer are minimal.
Timber Harvest on Private/Non-NFS land	Timber harvest reduces hiding and thermal cover and creates early seral conditions.
Livestock Grazing	Ongoing grazing has the potential to reduce the amount of forage available for mule deer but not to the point that summer or winter range conditions are limiting for mule deer.

Reasonably Foreseeable Activities

Two reasonably foreseeable actions with implications for mule deer are planned in the cumulative effects area: (1) the Divide Travel Plan, which proposes a variety of changes to current vehicle routes

and is likely to improve habitat effectiveness for mule deer summer range and security during the hunting season and (2) the Tenmile/South Helena Vegetation Project, which would remove dead trees and thin young conifer stands on greater than 20,000 acres just west of the Continental Divide, eliminating hiding and thermal cover and opening up new foraging areas sooner rather than later.

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next several years. Private lands within the combination boundary but outside of the project area are a mix of lodgepole pine-dominated stands with a similar history and lower elevation stands dominated by Douglas-fir. Much of the lower elevation component has also been subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain. Mule deer habitat may be impacted if timber harvest occurs in hiding or thermal cover.

Cumulative Effects Conclusions

Alternative 1 would contribute to the effects of past timber harvest because forested stands that are killed by mountain pine beetles would revert to early seral stages similar to those early seral stands that were created as a result of regeneration harvest from the 1980s through today. These areas would no longer provide thermal cover for several decades. Early seral stands, after several years, will, however, provide hiding cover. These stand conditions would add to those areas that were regenerated through timber harvest from the 1980s through today. Currently, many of these areas provide forage habitat for mule deer. As the landscape continues to change due to mountain pine beetle mortality under alternative 1, the resultant early seral stages would add to those created during implementation of the Roadside Hazard Tree Project and the Red Mountain Flume/Chessman Reservoir project.

Implementation of alternative 2 or 3 would contribute to the effects associated with past timber and fuels activities that have in part created the existing condition. Specifically, the project area would become more open in the short term while stands regenerate and understories develop. Implementation of either alternative 2 or 3 would contribute to the effects associated with the ongoing Red Mountain Flume/Chessman Reservoir project, private land timber harvest, and grazing and the proposed Tenmile/South Helena project. As stands are thinned, conditions will favor production of herbaceous and shrub habitats that are attractive to livestock for grazing. Alternatives 2 and 3 would also add to the impacts associated with annual road maintenance due to temporary road construction associated with those alternatives. Cumulatively, these activities may temporarily disrupt animal movement. Travel plan implementation, however, should offset impacts associated with alternatives 2 and 3, because it will result in the creation of large unroaded areas that should provide some additional secure habitat for mule deer.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

The number of mule deer has increased since the early 20th century with the 1950s and 1960s considered the ‘hey days’ of mule deer populations after which mule deer numbers began to decline. Today, several factors have come together to lessen the ability of a region to produce and maintain mule deer. Of particular concern in the project area are those habitat changes that have been brought

about by fire suppression. Fire is a critical factor in creating and maintaining mule deer habitat because it sets back succession and can create a mosaic of cover and forage that can benefit mule deer depending on severity and intensity of the fire. Prior to the mountain pine beetle outbreak, most of the project area consisted of mid-successional closed-canopied forests that offered little in terms of forage habitat. Recently, the mountain pine beetle-related tree mortality has created conditions that allow more sunlight to reach the forest floor which in turn should eventually lead to increases in forage habitat.

Selection of alternative 1 precludes any immediate loss of hiding or thermal cover. As trees die due to the mountain pine beetle, understory shrubs and forbs should increase, providing forage for mule deer until dead trees fall. Once these trees fall, access to forage may be difficult. Other portions of the project area that are not impacted by the mountain pine beetle will continue to provide cover. However, while these forested stands will continue to offer places for mule deer to retreat from hunting pressure or severe weather, they will provide very little in terms of forage habitat.

Implementation of alternative 2 or 3 would result in the removal of hiding and thermal cover more so in alternative 2. Alternative 2 may in the long run be more beneficial for mule deer because more acres are proposed for regeneration and intermediate harvest which in turn will result in a mosaic of early successional forage habitat and cover. Implementation of alternative 3 would result in retaining more hiding and thermal cover in the short term which could be important in light of the recent tree mortality associated with the mountain pine beetle outbreak. However, in the long term local barriers to movement may be created as dead trees fall. This could provide some security for mule deer but it could also impede their movement and lengthen the time it takes for those stands to regenerate to hiding and thermal cover. The temporary road construction associated with the action alternatives could result in temporary displacement of mule deer.

Mitigation measures that are in place to minimize impacts to elk also benefit mule deer. These include:

- Minimizing impacts to security during logging operations by limiting logging activities to one drainage at a time
- Closing temporary roads to public use.

The increase in local habitat diversity and forage productivity generated by the new open habitats in juxtaposition with adjacent dead tree habitat is expected to prove more attractive to mule deer than the current environment. Use of the area from May through September is likely to increase. The immediate loss of forest cover would increase the vulnerability of deer to hunting in the treatment units; but, given the abundance of cover in surrounding habitats (and no changes in motorized hunter access), the change would not be meaningful. Eventually, the area-wide loss of cover throughout both treated and untreated habitats will prove problematic for mule deer during the hunting season, but this scenario will come about under any alternative.

Regulatory Framework and Forest Plan Consistency

Mule deer are a management indicator for commonly hunted species; as such they are intended to be a bellwether of the effects of management activities on representative wildlife habitats with the objective of ensuring that viable populations of existing native and desirable non-native animal species are maintained. Federal laws and direction applicable to management indicator species include the National Forest Management Act (NFMA), the Forest Service Manual, and the Helena National Forest Plan. The NFMA requires the Forest Service to “provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives” [16 U.S.C. 1604(g)(3)(B)]. All alternatives are consistent with this

requirement. Mule deer habitat would continue to be abundant and well-distributed and species' viability would be maintained across the Forest. See also the Viability Analysis Section.

Compliance with Forest Plan Standard 8

Forest Plan Standard 8 (Forest Plan II/19) requires that any proposed sagebrush reduction programs will be analyzed on a case-by-case basis for possible impacts on big game winter range. There is very little sagebrush in the project area. The action alternatives have been analyzed to determine the impacts of prescribed fire in shrublands and to the extent that its present, in sagebrush as well. The analysis has indicated that although shrubs will be removed through burning in the short term, in the long term the forage quality of shrubs, including any sagebrush should be improved, and, as such, beneficial to mule deer.

There are six management areas within the project area; of those, only Management Area W-1 has direction relevant to elk habitat (direction is in *italics*):

(1) *Wildlife habitat improvement practices, including road management, prescribed fire, and other techniques, will be used to maintain and/or enhance the quality of big game and nongame habitat* - Several miles of roads will be closed and/or decommissioned under all action alternatives. Prescribed fire goals include improving grass and shrublands which would be beneficial to mule deer.

(2) *Maintain adequate thermal and hiding cover adjacent to forage areas; this generally means providing at least 25 percent [thermal] cover, where available, on identified winter range*. Currently, there is no overlap with W-1 and identified mule deer winter range within the project area so this portion of the standard is not applicable. Elsewhere in W-1, alternatives 2 and 3 would result in the removal of approximately 62 and 19 acres of thermal cover respectively. The removal of thermal cover could actually create openings in areas that are otherwise contiguous which in turn should create forage opportunities for mule deer. As such, all action alternatives are consistent with this standard.

Monitoring

One of the goals of the Forest Plan is to "maintain and improve the habitat over time to support big game and other wildlife species." In order to accomplish this goal, the above standards are in place as well as a monitoring plan to ensure that management activities accomplish Forest Plan goals. Monitoring element C4 (Forest Plan p. IV/8) is the element that is applicable to the Telegraph project with regards to mule deer and focuses on those management areas that include a wildlife emphasis as part of the overall goals and objectives. The management area identified in element C4 that occurs within the project area is W-1. An analysis of cover/forage ratios, open road densities, and livestock impacts on mule deer habitat potential has indicated that the effects of implementing the Forest Plan are generally occurring as predicted in the case of mule deer (Forest Plan Monitoring and Evaluation Report, Fiscal Years 2008-2010). Outyear monitoring will occur in the project as part of Forest Plan monitoring specific to element C4.

Canada Lynx

Affected Environment

Population Parameters and Habitat Relationships

Lynx Habitat Use Patterns

Canada Lynx (*Lynx canadensis*) are confined to regions of North America with cold, snowy winters. Core populations are centered in Canada with persistent peripheral populations across the northern

tier of the lower 48 states and a patchy southward extension along the Rockies. Lynx inhabit coniferous forests capable of supporting snowshoe hares as a prey base: In North America, the distribution of lynx is nearly coincident with that of snowshoe hares (Ruediger *et al.* 2000). In the northern Rockies, most lynx occurrence is associated with forests dominated by lodgepole pine, subalpine fir, and Engelmann spruce in the 4,900- to 6,550-foot elevation zone. Secondary interspersed vegetation in the Divide landscape includes mid-high elevation Douglas-fir, whitebark pine, and aspen. Dry forest types, such as ponderosa pine and dry Douglas-fir seldom provide suitable lynx habitat (Aubry et al. 1999).

Females establish maternal ***denning sites*** in a variety of forest formations ranging from mature and old-growth coniferous forest to young regenerating stands (USDA 2007b, p. 16). In all cases, the key component of lynx den sites appears to be an abundance of coarse woody debris, rather than the age of the forest (Mowat *et al.* 1999). Middle-aged conifer stands (40 to 120 years old) with open understories and sparse deadfall do *not* provide good denning or foraging environments but often serve as travel habitat (Koehler and Aubry 1994).

Lynx usually avoid large unforested areas and prefer to move between primary habitat sites under cover of mature forest, dense early-seral forest, or tall shrubs—typically following ridges or riparian zones and moving through saddles. Based on fieldwork in north-central Washington, Koehler (1990) concluded that openings created by regeneration harvest, where the distance to cover is more than about 325 feet [total opening width of no more than about 650 feet], had potential to divert local lynx movement and preclude other habitat use until forest cover had regrown. On the other hand, research has documented many instances of lynx crossing unforested openings (Roe et al. 2000, cited in USDA 2007b, p. 10). Lynx will move across extensive non-forested areas as needed during dispersal or other long-range excursions (Koehler and Aubry 1994, p. 88; Ruediger et al. 2000, p. 1-12; Aubry et al. 1999, p. 379), although they prefer to travel through forested habitats or along forest edges (Squires et al. 2013; Ruediger et al. 2000, ch.1 p.4; Mowat et al. 1999). Lynx seldom forage in open habitats, most likely because preferred prey species are uncommon there (Maletzke et al. 2007).

Predator – Prey Relationships

Snowshoe hares are the primary prey, making up anywhere from 35 percent to 97 percent of lynx diet. Preferred lynx foraging habitat consists of dense young conifer growth—either in early seral stands or in mature forest understories—that provides cover and browse for hares (Koehler 1990). Koehler and Brittell (1990) recommend that seedling/sapling stands in the lodgepole/subalpine fir zone be well dispersed to provide optimal lynx foraging. Squires (2010) found that in the Seeley Lake region of western Montana, lynx hunted for hares primarily in mature, multi-storied spruce-fir forest in winter and in dense early-seral stands in summer. He cautioned, however, that in southern lynx populations, regional and local habitat differences were likely to generate variations in lynx foraging patterns: a number of southern populations depend primarily on early successional forests year-round, and some inhabit primarily lodgepole pine rather than spruce-fir forests (McKelvey et al. 1999; Aubry et al. 1999, p. 8). These differences are a function of the local availability of key forest types and the distribution of snowshoe hares among them (Maletzke et al. 2007, p. 1473; Squires et al. 2010, p. 1656).

In the mountains of Montana and further south, lynx prey on a wider diversity of species than northern populations because of lower hare densities and the presence of different small mammal communities. Potential alternate prey includes red squirrels, jackrabbits, cottontails, woodrats, marten, marmots, ground squirrels, chipmunks, mice, voles, and grouse (Buskirk et al. 1999b, p. 408-409; Aubry et al. 1999, p. 375-378). Of these, red squirrels are, in most locales, the most important (Ruediger et al. 2000, ch.1 p.8-10; Buskirk et al. 1999b, p. 408-409). Field research indicates that while lynx will opportunistically take advantage of the full array of potential prey

species in summer, they focus almost entirely on snowshoe hares in winter whenever they are abundant (Aubry et al. 1999, p. 378).

Lynx Populations

Lynx are highly susceptible to declines in the prey numbers. When hare populations are low, many lynx are unable to raise litters successfully, and in some cases, adults are unable to sustain themselves. As a result, local populations decline (Koehler and Aubry 1994). The other principal natural cause of mortality is conflict with larger carnivores, most notably, mountain lions [Squires (unpublished data, 2010); Buskirk et al. 1999a, p. 89-95]. Among human caused mortality factors, trapping has historically been primary. Heavy trapping throughout the 19th and 20th centuries extirpated lynx from many areas of the Rocky Mountains where they had once been consistently present. Montana set restricted trapping seasons for lynx from 1991-1998 and then suspended trapping after the 1998-1999 season (Ruediger et al. 2000). Lynx are still taken incidentally in traps set for wolves, coyotes, and other large/mid-sized carnivores. Lesser mortality factors in recent decades have included disease, shooting, and roadkill (USDA 2007b, p. 2; Squires and Laurion 1999, p. 10). Human disturbance around den sites, causing females to move kittens, does not appear to be a source of mortality (Olsen et al. 2011).

Despite this plethora of mortality factors, lynx population numbers in western Montana do not appear to have declined appreciably in recent years: they have increased slightly in some areas, decreased in others. Based on monitoring of 129 lynx over a 10-year period (1998 to 2007), Squires (unpublished data, 2010) concluded that the lynx population in the Seeley Lake region of west-central Montana has been inching downward while the population in the Purcell Mountains in the northwest corner of the state has been increasing slightly. These are preliminary conclusions, and population data on lynx in the Rocky Mountain region of the U.S. and southern Canada remain sparse and inconclusive. It can be said, however, that these southern lynx populations are substantially smaller than those of the boreal forests of northern Canada and Alaska (because snowshoe hare populations are smaller and more fragmented). On the other hand, southern lynx populations appear to be more stable (Aubry et al. 1999, p. 15-18).

As solitary, wide-ranging predators, lynx in both northern and southern ranges maintain low population densities relative to most other North American carnivores. Home range size varies primarily with the dispersion pattern of suitable habitat, the abundance of prey, lynx population density, and the intensity of trapping (Koehler and Aubry 1994, p. 89-91). In Montana, Brainerd (1985, cited in Koehler and Aubry 1994) has reported home range sizes of about 17 mi^2 for females and 122 mi^2 for males. Nellis (1989) concludes that most home ranges fall between 5 to 20 mi^2. In northern populations where hares are more abundant, home ranges are typically smaller (Squires and Laurion 1999, p. 347).

Lynx Distribution

Lynx have been documented throughout the mountains of western Montana from the Canadian border into the Yellowstone area. Current distribution of resident animals is disjunct, and a number of areas that support what seem to be extensive blocks of suitable habitat are unoccupied. On the other hand, some localities that appear to have little classic lynx habitat may be supporting small local populations or serving as linkage zones through which lynx move. In 2004–2006, the Colorado Division of Wildlife tracked three of its 218 radio-collared lynx (transplanted into Colorado in the early 2000s) northward into west-central Montana, across the Big Belt Mountain Range on the HNF (through very patchy “suitable” habitat), and eventually into Idaho and Wyoming [Ivan 2011; Devineau et al. 2010].

On the HNF, the most robust lynx habitat and resident population is in the Blackfoot landscape of the Lincoln Ranger District. Much of the lynx habitat there is a hybrid of the moister conditions in the Seeley Lake region to the northwest and the drier conditions of the Divide landscape to the southeast. The Divide landscape supports a sparse but apparently persistent "population." While some of these animals are probably transients, winter tracking surveys backed by DNA analysis of scat and hair over a 7-year period (2005 to 2012) indicates that others are long-term residents (Gehman 2006; Gehman and Jakes 2007, Gehman et al. 2008-2012; Pilgrim 2007-2010; Pilgrim and Schwartz 2007, 2008, 2011).

Lynx Management

Management Direction

The Canada lynx was listed as a ***threatened species*** under the Endangered Species Act in 2000. The primary reason for listing was the absence of focused management plans by resource agencies in the northern Rockies. Lynx are now managed via the *Northern Rockies Lynx Management Direction* (*NRLMD)* (USDA 2007a, 2007b, 2007c, 2007d), which has been amended into Forest Plans in the northern Rockies. This management direction is based on the science and recommendations in *Ecology and Conservation of Lynx in the United States* (Ruggiero *et al.* 1999), the *Lynx Conservation Assessment and Strategy* (Ruediger et al. 2000), and numerous publications cited in the *NRLMD* (USDA 2007b, 2007c). Attachment 1 in the *Record of Decision* for the *NRLMD* (USDA 2007b) displays 13 objectives, 7 standards, and 24 guidelines designed to conserve the lynx. These are divided among 5 categories: *all management practices and activities* (ALL), *vegetation management* (VEG), *livestock management* (GRAZ), *human use projects* (HU), and *linkage areas* (LINK).

All four of the standards that address vegetation management are relevant to the current project. Standards VEG S1 and VEG S2 limit the amount of lynx habitat that can be subjected to vegetation management in an LAU within a given time period; standard VEG S5 limits thinning in young conifer stands that provide winter (and summer) snowshoe hare habitat; and standard VEG S6 limits vegetation projects in mature multi-layered stands that provide hare habitat. For the latter two standards, an exception allows for a certain amount of cover loss to fuels management projects in wildland-urban interface (WUI) areas. [VEG S3 and S4, which dealt with denning habitat, were eliminated in the final version of the *NRLMD*]. Guideline VEG G10 indicates that such fuels projects should be designed with standards VEG S1 and VEG S4 in mind. Also applicable is standard ALL S1, which requires that vegetation management projects maintain habitat connectivity for lynx. The project area is in a linkage area (USDA 2007a), but the 3 LINK standards/guidelines focus on land ownership, highways, and livestock grazing, and none are directly applicable to the project. Finally, HU G9 directs that roads be gated to public vehicle use during project operations and that they be decommissioned or obliterated at project's end.

Lynx Analysis Units (LAUs)

The basic units for analyzing the effects of management actions on lynx are ***lynx analysis units*** (LAUs)—areas about the size of individual female lynx home ranges. The rationale for defining units on this scale is discussed in the *Canada Lynx Conservation Assessment and Strategy* (Ruediger *et al.* 2000, p.7-2). Biologists on the HNF delineated 29 LAUs in 2000, six of which fall within the Divide landscape [see figure 54 in the previous section on *"Analysis Areas"*]. Divide LAUs are designated di-01 through di-06 and average 34,920 acres in size.

The Telegraph project area is nearly coincident with a single lynx analysis unit—LAU di-04, which covers the Telegraph Creek drainage and parts of the Ontario Creek, Monarch Creek, and Little Blackfoot River drainages [See figure 54. The northwest corner of the project area edges into LAU

di-03, which covers the main stem of the upper Little Blackfoot River to the west, and the project area's eastern border is shared with that of LAU di-05 in the Tenmile drainage to the east. So, this analysis will look at all 3 of these LAU's—although over 90 percent of the project area is covered by LAU di-04.

Delineating Lynx Habitat

Most objectives, standards, and guidelines in the *Lynx Management Direction* apply only to designated lynx habitat within LAUs on National Forest System lands (*NRLMD*, Attachment 1, p. 1-6). The HNF delineates lynx habitat based on habitat types and satellite imagery (the Region 1 VMAP database). Basically, "potential lynx habitat" (generally referred to simply as "lynx habitat") consists of cool, moist coniferous forest habitat types—in any stage of development—in the Divide Landscape above 5,500 ft. These are environments in the Divide landscape that are likely to support habitat components that can retain lynx or that can be expected to develop such characteristics over time. Table 140 displays the acreage of lynx habitat on and off National Forest lands within the three LAUs; figure 59 shows its distribution.

Table 140. Lynx analysis units (LAUs) that overlap or lie adjacent to the Telegraph project area

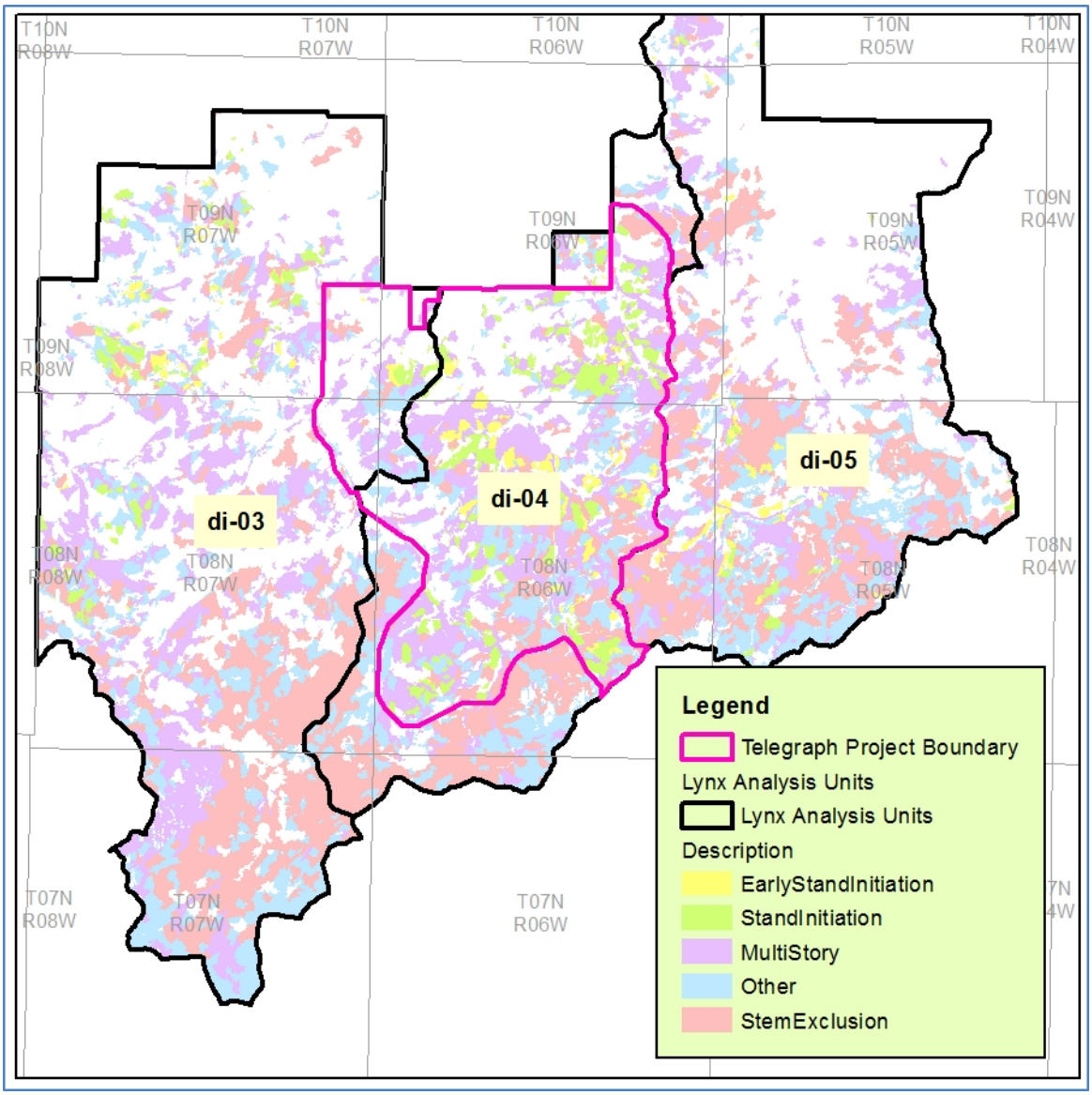
LAU	LAU Location	LAU Total Acres	Total Acres Lynx Habitat	Acres of Lynx Habitat on HNF Land	% of the LAU in Lynx Habitat
di-03	Upper Little Blackfoot River	46,126	24,192	22,794	52 %
di-04	Telegraph – Ontario Creeks	28,293	20,415	19,315	72 %
di-05	Upper Tenmile Creek	36,548	16,531	13,405	45 %
All LAUs		110,967	61,138	55,514	55 %

LAU di-03 includes a considerable amount of open grassland and dry forest (mostly in their northern, lower elevation reaches), and thus support less potential lynx habitat than LAU di-04, which is dominated by moist forest habitat types. LAU di-05 also includes substantial areas of talus and other lightly forested rocky slopes that will not develop as lynx habitat.

Within potential lynx habitat, the HNF [drawing on the *NRLMD* (USDA 2007b, p. 11-14)] delineates functional snowshoe hare habitat as the key component. Year-round snowshoe hare habitat consists of thickets of young conifers that can provide abundant browse, hiding cover, and enough overhead structure to create under-snow shelter and feeding enclaves. These conditions occur either in (1) early seral stands that are regenerating after timber harvest, fire, or other stand-replacing phenomena (*stand initiation structural stages*) or (2) in the understories of mature multi-layered forests (*multistoried structural stages*) with dense undergrowth. In both cases, the young conifers need to be tall enough to protrude above the snow and have boughs low enough to touch the snow surface. The rationale for focusing on these aspects of the habitat is discussed In the *NRLMD ROD* (USDA 2007b, p. 8-14).

There have been no fires of any size in these LAUs since the late 19th and early 20th centuries, and, as a result, vegetation structure is dominated by mature conifer forest. LAU di-04, on which the project area is centered, has seen a considerable amount of regeneration timber harvest from the late 1960s through the early 1990s and thus supports a robust matrix of mature forest and early seral forest (consisting mostly of conifer saplings). There has been little timber harvest in LAU di-05, which

covers the Helena municipal watershed in upper Tenmile Creek, and its forest habitat types remain mostly as mature forest. In LAU di-03, timber harvest has gone forward on a few sites in the northern half of the unit (mostly in the 1970s and 1980s), but there has been virtually no harvest in the southern half of the unit around the headwaters of the Little Blackfoot River. A majority of the mature forest in these LAUs is dominated by lodgepole pine, now dead from mountain pine beetle infestation.



Note: As can be seen here, the Telegraph Project area occupies most of di-04.

Figure 59. Lynx analysis units (LAUs) di-03, di-04, and di-05 in the southern Divide landscape, showing the distribution of potential lynx habitat and functional snowshoe hare habitat

Delineating Occupied Habitat

The *Lynx Management Direction* applies to National Forest lands "occupied" by lynx [*NRLMD ROD* (USDA 2007a; 2007b, Attachment 1, p. 1)]. On the HNF, the Blackfoot and Divide landscapes—both of which support resident lynx—are considered "occupied." In the Divide landscape, areas north of U.S. Highway 12 are categorized as "core" occupied habitat and those south of the highway

as “secondary” occupied habitat [Northern Rockies Lynx Planning Area Map (USDA 2007a)]. Preliminary objectives for “secondary” habitat areas are a bit different from those for “core” areas (USDA 2007c, p. 3-4), but we apply *NRLMD* standards and guidelines to both areas in the same way. The Telegraph project area lies within the secondary occupied habitat region.

Critical Lynx Habitat

The USFWS *Final Rule* (50 CFR Part 17) designating “critical” habitat for lynx in the contiguous U.S. (*Federal Register*, Vol. 74, No. 36, Feb. 25, 2009) has been in effect since March 2009. The critical habitat designation is based on field research and professional opinion, and in the northern Rockies it includes 26,200 acres. On the HNF it takes in the entire Blackfoot landscape (Lincoln Ranger District) and the northern half of the Divide landscape (north of U.S. Highway 12)—essentially the same area shown as “core lynx habitat” on the 2007 Lynx Planning Area Map (USDA 2007a). Critical habitat includes all National Forest land: the previously designated areas of “occupied core lynx habitat” plus all of the surrounding and intervening non-lynx habitat—“matrix habitat” that may provide linkage. It is not limited to “potential lynx habitat.”

In addition to designating critical habitat, the *Final Rule* identifies “physical and biological features that are essential to the conservation” of lynx: that is, “primary constituent elements” (PCEs). The overarching PCE for lynx critical habitat consists of “boreal forest landscapes supporting a mosaic of differing successional forest stages.” These landscapes contain (a) 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 multi-storied stands with conifer boughs touching the snow surface”; (b) “winter snow conditions that are generally deep and fluffy for extended periods of time”; (c) “sites for denning that have abundant coarse woody debris, such as downed trees and root wads”; and (d) matrix habitat (not supporting hares) “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 though such habitat while accessing patches of boreal forest within a home range” (*Fed. Register*, Vol. 74, No. 36, p. 8638).

The *Rule* indicates that “lands within critical habitat will require some level of management to address the current and future threats to the lynx and to maintain and protect the physical and biological features essential to the conservation of the species” (*Fed. Register*, Vol. 74, No. 36, p. 8638). That is, management actions need to maintain the PCEs. The USFWS is to decide whether a proposed Federal action amounts to “adverse modification” of lynx habitat based on whether it allows “the affected critical habitat to remain functional…to serve the intended conservation role for the species” (*Fed. Register*, Vol.74, No. 36, p. 8644).

At this point, the HNF, knowing that lynx are in fact resident in the “non-critical” habitat zone south of Highway 12, applies the standards and guidelines of the *NRLMD* to all areas of the Divide landscape. The PCE guidance, however, does not currently apply to the region south of Highway 12. The project area, while in “occupied” lynx habitat, is not in “critical” lynx habitat. PCE guidance does apply to the northern end of LAU di-05, however, which extends north of Highway 12 to take in the Sweeney Creek and Little Porcupine Creek drainages [See figure 59].

Lynx Habitat and Population Status

Habitat in Local LAUs

Table 141 and table 142, below, display the acreage and percentage of stand initiation and mature multistory snowshoe hare habitat in the three LAUs that include or lie adjacent to the project area. While most *NRLMD* guidance applies to management of lynx habitat on Federal land, Table 141 and table 142 provide an estimate of hare habitat on all public and private lands within the respective

LAU. The data for non-forest land is relevant to *NRLMD* Standard VEG S1, discussed in the *"Environmental Consequences"* section.

Table 141. Current acres of snowshoe hare habitat and the percent of habitat in the 3 local lynx analysis units.

Lynx Habitat		LAU di-03	LAU di-04	LAU di-05	Area Total
Multistory Hare Habitat	HNF acres	7,762	5,970	3,576	17,308
(winter & summer forage)	non-Forest acres	379	412	676	1,467
	total acres	8,141	6,382	4,252	18,775
	% of lynx habitat	*34.1%*	*32.0%*	*25.9%*	*31.2%*
Stand-Initiation Hare Habitat	HNF acres	818	1,983	198	2,999
(winter & summer forage)	non-Forest acres	77	64	63	204
	total acres	895	2,047	261	3,203
	% of lynx habitat	*3.7%*	*10.3%*	*1.6%*	*5.3%*
Early Stand-Initiation Habitat	HNF acres	104	594	204	902
(summer forage only)	non-Forest acres	209	80	215	504
	total acres	313	674	419	1,406
	% of lynx habitat	*1.3%*	*3.4%*	*2.6%*	*2.3%*
Stem Exclusion (	HNF acres	8,201	5,865	5,663	19,729
not currently hare habitat)	non-Forest acres	63	242	1,112	1,417
	total acres	8,264	6,107	6,775	21,146
	% of lynx habitat	*34.6%*	*30.6%*	*41.2%*	*35.1%*
Other Forest Habitat *	HNF acres	5,654	4,432	3,709	13,795
(not currently hare habitat)	non-Forest acres	632	289	1,010	1,931
	total acres	6,286	4,721	4,719	15,726
	% of lynx habitat	*26.3%*	*23.7%*	*28.7%*	*26.1%*
Total Potential Lynx Habitat		23,899	19,931	16,426	60,256

Note: "Multistory hare habitat," "stand-initiation hare habitat" and 'early stand initiation' are the 3 habitat categories used to determine compliance with NRLMD standards VEG S5 and VEG S6 ["Environmental Consequences" section

*"Other forest habitat" is generally considered to be in a mid-seral structure stage or mature stands with poorly developed understory structure

Potential lynx habitat on HNF land accounts for approximately 94 percent of LAU di-03, 94 percent of LAU di-04, and 81 percent of LAU di-05. These are habitat types capable of producing the kind of environments in which lynx can den, find cover, and, above all, successfully forage for snowshoe hares. When private and State lands are added in (table 128), the percentages are 52 percent for LAU di-03, 71 percent for LAU di-04, and 45 percent for LAU di-06. This amounts to a total of 60,256 acres of potential habitat in the 3 LAUs (54,733 acres on National Forest land). But as table 140 and figure 59 show, only a limited share of the potential habitat in these LAUs (approximately 2 to 10 percent) has achieved the stand initiation winter hare habitat that the *NRLMD* indicates will sustain hares and lynx year-round. Also, note that in all of the LAUs, a large proportion of the functioning hare habitat is in a multistory stage.

The distribution of snowshoe hare habitat is shown on the map in figure 59. While hare habitat is well-distributed throughout potential lynx habitat across all 3 LAUs, it is highly fragmented. Most of the larger blocks of contiguous habitat are formed by stem exclusion habitat in all LAUs, which was created by timber harvest in the 1970s and 1980s. A few consolidated areas of multi-storied mature forest can be seen in the southern portions of the LAUs, but elsewhere, these habitat formations generally occur only as small isolated patches—although most are surrounded by a matrix of mature (but single-storied) forest ('other'). This provides lynx with canopied travel habitat as they move between foraging sites with hares.

Table 142 combines the key winter (year-round) hare habitat categories—multistory and stand-initiation hare habitat—from table 141 and provides some additional perspective as to the relative abundance of viable winter snowshoe hare habitat in the 3 LAUs.

Table 142. Acres of winter snowshoe hare habitat (year-round hare habitat) in the three local LAUs (sum of the first 2 rows in Table 141) and percent of winter hare habitat in the LAUs

LAU	Acres of All Lands	Acres of Potential Lynx Habitat	Acres of Year-Round Hare Habitat	% Year-Round Hare Habitat of All Lands	Year-Round Hare Habitat: % of Lynx Habitat
di-03	46,126	23,899	9,036	19 %	38%
di-04	28,293	19,931	8,429	30%	42%
di-05	36,548	16,426	4,513	12 %	27%
Total area	110,967	60,256	21,978	20%	36%

Note: LAU acres are in Table 140; potential lynx habitat acres are shown in Table 140 and Table 141. Acres are for both National Forest and non-Forest (mostly private) lands.

Table 142 indicates that functional snowshoe hare habitat (the first 2 rows in table 141) is more abundant and represents a larger proportion of the landscape in LAU di-04 than in its 2 neighboring LAUs. The greater availability of winter hare habitat—particularly habitat in the form of multistory conifer configurations—is most likely what draws lynx into LAU di-04. As noted, LAU di-04 occupies essentially the same ground as the Telegraph project area. Lynx may frequent this LAU in summer as well, but we have little information as to the whereabouts of lynx outside of the winter season.

Lynx Occurrence in the Divide landscape

The HNF wildlife data base shows 12 observations (or groups of observations) of lynx or lynx tracks in the 6 Divide landscape LAUs since 1999 that have been verified or are considered highly credible (by MFWP and/or HNF biologists). These include an adult lynx photographed in a tree in Hahn

Creek in 2006 and a juvenile female killed on Highway 12 west of MacDonald Pass in 2003. Other reports have come from these areas, but their credibility is unclear (HNF wildlife observation files).

In addition to these fortuitous observations, data is available from systematic tracking surveys conducted by MFWP along the Continental Divide between Boulder River in the south and Bullion Parks/ Jericho Mountain in the north [B. Giddings, personal communication; HNF wildlife observation files]. Most lynx tracks encountered in these surveys over the past 15 years have been in the Boulder River drainage a few miles south and east of the HNF boundary. But some are from the Continental Divide trail (CDNST) where it runs along the Helena / Beaverhead-Deerlodge NF line.

From 2007 through 2010, Wild Things Unlimited of Bozeman, Montana ran winter track surveys over a wide area north and south of MacDonald Pass. The surveys identified several carnivores, but the primary targets were wolverines and lynx. Much of the fieldwork was done in the upper Little Blackfoot and Telegraph Creek drainages south of the pass, but areas along the Divide toward Greenhorn Mountain and in the upper Tenmile drainage were surveyed as well. Fieldworkers went wherever the tracks led. Surveys involved systematic back-tracking and collection of hair, scat, and urine samples, which were then sent to the USFS Rocky Mountain Research Station in Missoula for DNA analysis [see Gehman 2006; Gehman *et al.* 2007-2010; Pilgrim 2009-2010; Pilgrim and Schwartz 2007, 2008, 2011]. DNA analysis allows identification of species and individual animals. Since 2010, surveyors have continued to check in on the area each winter, but the bulk of the tracking effort has now shifted to the Lincoln RD to the north.

Habitat in the Project Area

The Telegraph project area occupies much the same ground as LAU di-04 [see figure 59]. At 23,669 acres, the project area is only slightly smaller than the LAU (28,293 acres): it shares the same eastern boundary along the Continental Divide but deviates from the LAU boundary on the north, south, and west in a few places (in particular, extending about 3,800 acres into northeast quadrant of LAU di-03 and not including the upper reaches of the greater Ontario Creek drainage to the south). As a result, the Project area includes roughly 10 percent less potential lynx habitat than LAU di-04, but about the same amount of functional snowshoe hare habitat [figure 59]. The upshot is that lynx habitat patterns in the Telegraph project area are essentially the same as those described for LAU di-04 [see previous section on *"Habitat in Local LAUs"*].

About 44 percent of the Project area qualifies as potential lynx habitat, and about 5,927 acres of the potential habitat is structurally capable of providing year-round snowshoe hare habitat. Of the functioning hare habitat, nearly 75 percent of it is multistory mature forest [*Photo 11*] and about 25 percent in a stand initiation stage. Early-seral forests—mostly sapling-dominated clearcuts from the 1970s and 1980s—currently account for roughly 9 percent of the lynx habitat in the project area (about 535 acres on National Forest land). Many project area forests—especially stands dominated by lodgepole pine—while exhibiting relatively high density of overstory trees and closed canopy conditions, support little understory regeneration and are unsuitable for winter hare occupancy [*Photo 9*]. A number of riparian and wetland sites—particularly those supporting tall riparian shrubs, Engelmann spruce, and subalpine fir—also provide some winter foraging opportunities for lynx [*Photo 12*].

Photo 9 Mature lodgepole pine stand in upper Telegraph Creek. This is typical of a majority of mature forests in the project area—a relatively dense overstory (prior to beetle-kill) with little regeneration emerging in the understory. This is "potential lynx habitat," but in its current configuration it does not provide winter habitat for snowshoe hares and thus is not considered viable lynx winter foraging habitat.

Lynx Occurrence in and around the Project Area

Wild Things Unlimited initiated a preliminary winter tracking effort in the MacDonald Pass area during the winter of 2006. In following winters, beginning in January 2007 and continuing on through 2010 they tracked lynx along established transects throughout the greater Telegraph Creek and upper Ontario Creek drainages [LAU di-04], parts of the Little Blackfoot River drainage [LAU di-03], and the western reaches of the upper Tenmile Creek drainage [LAU di-05]. All of these survey transects were either in or immediately adjacent to the Telegraph project area. Sites where lynx were commonly located within the project area included much of the Continental Divide National Scenic Trail (CDNST), Hahn Creek, Flume Gulch, Little Flume Gulch, Mike Renig Gulch, Jericho Creek, Jericho Mountain, Telegraph Creek, Bryan Creek, O'Keefe Creek, Sally Ann Creek, Clemmer Gulch, Booth Gulch, Ontario Ridge, and Sure-thing Swamps. Project area lynx, in addition to being followed across the Little Blackfoot River to the west and down into Tenmile Creek to the east, were also tracked northward across Highway 12 at MacDonald Pass and up toward Greenhorn Mountain.

Lynx commonly traveled along Forest System roads inaccessible to wheeled vehicles in winter but packed by snowmobiles. Fieldworkers navigated transects along these roads and trails, but then followed lynx tracks wherever they led, cataloging travel routes, resting sites, and kill/feeding sites (Gehman and Jakes 2007, Gehman et al. 2008-2010). In 4 years of survey work south of Highway 12 (mostly in the Telegraph Project area), trackers followed 56 lynx trails totaling more than 75 miles and documented 32 lynx beds and 13 feeding sites. At these sites, lynx were feeding on snowshoe hares (7 sites), red squirrels (4 sites), and the remains of elk and deer (2 sites). A total of 39 DNA samples sent to the Rocky Mountain Research Station led to the identification of one adult male lynx (present for at least 3 years) and an adult female lynx (present for at least 1 full year). In addition,

several samples could not be tagged to an individual, but their pattern suggested the presence of one or more additional lynx (Gehman and Jakes 2007, Gehman et al. 2008–2010).

Behavior patterns deciphered during these 4 seasons of intensive tracking (plus 4 subsequent seasons of less exhaustive survey work), coupled with the fact that at least one lynx has been present for 3 or more years, is a strong indication that some of these animals are local residents rather than transients lingering in the area as they make their way through a linkage zone. Gehman *et al.* (2006–2010) did conclude, however, that the Continental Divide, as well as the drainages on either side of it, are part of a much-used travel corridor for lynx and a variety of other carnivores (wolverines, red foxes, coyotes, bobcats, mountain lions, wolves) in winter—either moving within home ranges or dispersing over longer distances.

Photos 13 to 15 on the following pages illustrate the kinds of habitats where lynx have been located in the greater Telegraph Creek drainage in winter and in which they have been able to successfully forage for snowshoe hares. These habitats, while marginal by standards applied to moist westside and more northerly Forests, have been sufficient to support a modest population of snowshoe hares in winter. Lynx have been able to inhabit this area by taking advantage of these hares as well as red squirrels, and carrion remains of local ungulates (Gehman et al. 2010). Over the past several years, lynx have spent much of the winter in areas such as those depicted in these photos.

Photo 10 Lynx foraging area in Mike Renig Gulch. Sapling conifer dispersion is irregular, but there are enough dense patches throughout this old clearcut to support snowshoe hares in winter.

Photo 11 Multi-storied mature forest not far from Sure-Thing Swamps just west of the Continental Divide. These forests provide winter habitat for snowshoe hares, and lynx have been documented using this area during the winter.

Photo 12 Small subirrigated meadow with colonizing conifers and deciduous shrubs in Little Flume Gulch. Conifer and shrub density is irregular, and there are a considerable number of open patches as seen here. Lynx have been documented foraging for hares here in winter and probably do so in summer as well.

Environmental Consequences

The following measures are evaluated to analyze effects to lynx:

- Effects to early stand initiation habitat
- Effects to stand initiation hare habitat
- Effects to multistory hare habitat
- Effects to linkage areas
- Effects to denning habitat

Desirable Habitat Conditions
√ Early successional habitats that provide dense clumps of young conifers dominate
√ Multistory habitats that provide snowshoe hare habitat

Effects Common to All Alternatives

Landscape disturbances—fire, insects and disease—would continue and forested stands would progress through successional processes regardless of alternative. Large proportions of the project area would remain untreated in all alternatives. The MPB outbreak caused a large disturbance, potentially to a greater extent than would have been typical because of the landscape homogeneity comprised primarily of even aged lodgepole pine. This event has diversified species composition and densities in many areas and has created understories in an early stand initiation condition. Dead and dying trees would eventually fall to the ground and would provide denning habitat. Shade tolerant advance regeneration would likely persist and grow to dominate mixed sites where lodgepole has died ultimately resulting in the development of multistory hare habitat.

Effects Common to the Action Alternatives

Timber harvest and burning proposed in the action alternatives would reduce snowshoe hare habitat in the short term rendering some areas unsuitable for snowshoe hares until the understory regenerates. Several hundred acres of uneven-aged forests will remain in the project area, however. These uneven-aged stands provide a mosaic of multistory hare habitat and denning habitat.

Timber harvest and prescribed fire in the short term would remove conifers that may provide screening cover that facilitates travel. In the long term, harvest and burning treatments will result in patterns of habitat that are desirable to lynx – i.e., early successional habitats that provide year-round snowshoe hare habitat interspersed with older multistory stands.

Timber harvest treatments include regeneration harvest, intermediate harvest, and precommercial thinning. Prescribed fire treatments are all considered mixed severity. Treatment effects on lynx habitat depend on the type of treatments. For example, precommercial thinning in stem exclusion structural stage would maintain the stem exclusion structural stage, while the same treatment in stand initiation structural stage would convert the treated area to an early stand initiation structural stage. Regeneration harvest would result in all structural stages reverting to early stand initiation. Table 143 displays the expected lynx habitat structural stage post treatment based on the existing structural stage and the effects of the proposed treatment. Specifics of acres altered are discussed by alternative.

Table 143. Resultant lynx habitat structural stage post treatment

Proposed Treatment	Early stand initiation	Stand initiation	Stem exclusion	Other	Multistory
Mixed severity prescribed fire	Early stand initiation	Stand initiation and early stand initiation	Stem exclusion and early stand initiation	Other and early stand initiation	Multistory, stem exclusion, and early stand initiation
Intermediate harvest	Early stand initiation	Other	Other	Other	Other
Precommercial thinning	Early stand initiation	Other	Other	Other	Other
Regeneration harvest	Early stand initiation	Early stand initiation	Early stand initiation	Early stand initiation	Early stand initiation

Alternative 1

Direct and Indirect Effects

Alternative 1 would maintain the existing condition in the project area and allow current habitat trends to proceed. In the short term, the current distribution of functional snowshoe hare habitat (lynx foraging habitat), lynx denning sites, and lynx travel habitat would remain intact in the project area and in LAUs di-04, di-05, and di-06.

Under alternative 1, with no large-scale vegetation treatments going forward, human-induced habitat modification would be limited to such activities as normal firewood cutting (though accelerated in recent years because of the plethora of dead trees produced by the bark beetles). All habitat changes of any consequence would result from natural processes—most notably, in the next decade, from collapse of much of the mature forest overstory in the aftermath of the mountain pine beetle outbreak.

The mature single-storied lodgepole pine in the project area has little coniferous understory capable of sheltering hares or providing adequate winter browse for them [“stem exclusion”]. What multistoried structure there is typically comes from dense undergrowth of shade-tolerant conifers—Engelmann spruce, subalpine fir, Douglas-fir—often in draws, riparian sites, and sometimes in small within-forest openings.

Stand initiation in lodgepole pine stands killed by the mountain pine beetle should provide winter snowshoe hare habitat in 10 to 15 years due to the high productivity of these stands. In many areas, summer snowshoe hare habitat (early stand initiation) is already available. The mountain pine beetle outbreak is a prime example of how the development of mature multi-storied forest is truncated—leading to onset of early-seral conifer stands (stand initiation habitat), which will, over the next few decades, provide the primary foraging opportunity for lynx in the project area (and across the southern Divide landscape). Stand initiation habitat will become widespread over the next few decades as early seral conifer stands proliferate in the wake of the mountain pine beetle epidemic.

Given the normal return cycle of stand-replacing fire and insect/disease outbreaks in this landscape, the probability of effective multistory winter hare habitat ever becoming a prominent feature of area forests is very low.

Alternatives 2 and 3

Direct and Indirect Effects

Alternative 2 would result in approximately 212 acres of lynx habitat treated in LAU di-03 (less than 1 percent) and 150 acres of lynx habitat in alternative 3 (less than 1 percent) (table 144).

Table 144. Planned treatments within lynx habitat in LAU di-03 (acres)

Herd Unit	Regeneration Harvest	Intermediate Harvest	Precommercial Thinning	Prescribed Fire
Multistory Hare Habitat (winter & summer forage)				
Alternative 2	14	22	--	4
Alternative 3	14	22	--	4
Stand-Initiation Hare Habitat (winter & summer forage)				
Alternative 2	--	--	31	--
Alternative 3	--	--	31	--
Early Stand-Initiation Habitat (summer forage only)				
Alternative 2	--	--	34	--
Alternative 3	--	--	3	--
Stem Exclusion (not currently hare habitat)				
Alternative 2	--	--	--	--
Alternative 3	--	--	--	--
Other (not currently hare habitat)				
Alternative 2	103	--	1	3
Alternative 3	72	--	1	3
Total Acreage				
Alternative 2	117	22	66	7
Alternative 3	86	22	35	7

Alternative 2 would result in approximately 4,645 acres of treatment in LAU di-04 (23 percent) and 2,592 acres of treatment in alternative 3 (13 percent) (table 144).

Table 145. Planned treatments within lynx habitat in LAU di-04 (acres)

Herd Unit	Regeneration Harvest	Intermediate Harvest	Precommercial Thinning	Prescribed Fire
Multistory Hare Habitat (winter & summer forage)				
Alternative 2	1,184	16	10	384
Alternative 3	636	16	5	174
Stand-Initiation Hare Habitat (winter & summer forage)				
Alternative 2	22	--	857	37
Alternative 3	--	--	544	3
Early Stand-Initiation Habitat (summer forage only)				
Alternative 2	11	1	405	25
Alternative 3	6	1	316	17
Stem Exclusion (not currently hare habitat)				
Alternative 2	728	--	3	193
Alternative 3	304	--	3	143
Other (not currently hare habitat)				
Alternative 2	570	--	25	174
Alternative 3	306	--	3	98
Total Acreage				
Alternative 2	2,515	17	1,300	813
Alternative 3	1,269	17	871	435

Regeneration harvest constitutes the bulk of the proposed treatments in both action alternatives for both LAUs. These areas will be field validated to determine the nature of lynx habitat; if these units contain early stand initiation habitat or stand initiation habitat, they will be dropped from further consideration (See table 118 in *Assumptions, Information Used, and Methodologies* section). Regeneration harvest would remove or alter stand structure, eliminating snowshoe hare habitat until the site is regenerated. Regeneration harvest can also reduce potential denning habitat and red squirrel habitat by removing large trees and down logs on the site (Ruediger et al. 2000). Regeneration harvest can alter lynx movement through a stand, although this varies seasonally and temporally (Squires et al. 2010). Over time, snowshoe hare habitat would be created as treated units regenerate into dense understories (USDA FS 2007c, appendix P). Post-harvest, none of the treatment blocks approaches the larger size of regeneration areas avoided by lynx as shown by Squires et al. (2013) and are not expected to contribute to the type of habitat fragmentation that would disrupt future lynx movements through this landscape. If lynx were to avoid entering or crossing these regeneration harvest areas, sufficient habitat will remain to allow any lynx to easily pass around the harvest units in their travels. Regeneration harvest treatment effects are greater in alternative 2 and in LAU di-04.

Intermediate harvest comprises 22 acres of treatment in alternative 2 and alternative 3 in LAU di-03; 17 acres in both action alternatives in LAU di-04. This type of treatment is proposed mainly in Douglas-fir stands outside of lynx habitat. Intermediate harvest removes understory and overstory vegetation, reduces the availability of down wood and denning habitat, and reduces any existing forage opportunities for snowshoe hare. These treatments can also modify vegetation structure that contributes to red squirrel habitat (Ruediger et al. 2000) and the quality of red-squirrel habitat could be reduced. However, stands treated with intermediate harvest methods should retain their forested character following treatment. And, snowshoe hare habitat conditions are expected to improve for a while following harvest as understory trees and brush regenerate

Pre-commercial thinning involves thinning young trees, which reduces the density of sapling-sized conifer trees and understory shrubs and therefore reduces available snowshoe hare habitat (Ruediger *et al.* 2000). Pre-commercial thinning is proposed on 66 acres of lynx habitat in LAU di-03 in alternative 2 of which 34 acres are in early stand initiation habitat and 31 acres are in the stand initiation phase. The remaining acre is in ‘other’ habitat. In LAU di-04, 1,300 acres of lynx habitat are in pre-commercial thinning units. Of those, 405 acres are in early stand initiation habitat, 857 acres are in stand initiation habitat, 10 acres are in multistory habitat, and the remaining are in stem exclusion or ‘other’ habitat.

Alternative 3 includes 35 acres of precommercial thinning in LAU di-03 of which 3 acres are in early stand initiation habitat, 31 acres are in stand initiation habitat, and 1 acre is in ‘other’ habitat. In LAU di-04 under Alternative 3, precommercial thinning is proposed on 871 acres of which 316 is in early stand initiation habitat, 544 acres are in stand initiation habitat, 5 acres are in multistory habitat, and the remaining acres are in stem exclusion or ‘other’ habitat. For both LAUs and in both action alternatives, several acres, within which precommercial thinning is proposed, are outside of the WUI. These areas will be field validated to determine the nature of lynx habitat; if these units contain early stand initiation habitat or stand initiation habitat, they will be dropped from further consideration (see table 118 in *Assumptions, Information Used, and Methodologies* section).

Prescribed fire for both action alternatives consists of a mixed severity prescription. Seven acres would be treated with prescribed fire in alternative 2 or 3 in LAU di-03 of which 4 acres are in multistory habitat and 3 acres are in ‘other’ habitat. In LAU di-04 approximately 813 acres are proposed for prescribed fire in alternative 2 of which 25 acres are in early stand initiation habitat, 37 acres are in stand initiation habitat, 384 acres are in multistory habitat, and the remaining acres are either considered stem exclusion or ‘other’ habitat. In alternative 3 in LAU di-04, 435 acres of lynx habitat are proposed for prescribed fire of which 17 acres are in early stand initiation habitat, 3 acres are in stand initiation habitat, 174 acres are in multistory habitat, and the remaining acres are in stem exclusion or ‘other’ habitat. All treatments for both alternatives and both LAUs are within the WUI. Mixed severity prescribed fire would create openings in the overstory canopy and reduce understory vegetation. Depending on the extent of fire severity, lynx habitat would either reflect the existing condition or shift from one structural stage to another, generally less complex stage. Mature forest stands that have openings created through fire can provide snowshoe hare habitat and over time (over 15 years) as the understory develops, winter foraging habitat would be created within these openings. Also due to the recruitment of dead wood from fire-related mortality, potential denning habitat could be improved within these openings within 5 to 10 years of treatment. However, potential denning habitat is not limited in the project area due to the mountain pine beetle outbreak.

Approximately 8.5 miles of temporary road would be constructed under alternative 2 and 3.4 miles under alternative 3. While the actual road construction itself could remove small amounts of lynx habitat, lynx generally do not appear to be impacted by forest roads with low vehicular traffic (Squires et al. 2010) and may actually use the road for travel (Koehler and Brittell 1990). However,

because lynx appear to den father away from roads than would be randomly expected (Squires *et al.* 2008), the temporary roads may displace lynx from otherwise available denning habitat.

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on lynx habitat in the context of the myriad of other past, present, and future effects on lynx habitat from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. The following table summarizes the key items that are taken into consideration for the cumulative effects analysis for lynx habitat. See also Appendix E in the Wildlife Specialist Report, *Cumulative Effects*, for more information.

Table 146. Cumulative effects considertions for lynx habitat

Parameter	Discussion
Spatial Boundary	The spatial boundary needs to be expanded to the point at which lynx habitat is no longer measurably affected. The respective LAU satisfies this requirement because this is the scale at which the effects to lynx can be examined at the stand or treatment unit. The LAU boundary also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1960s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the project boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the vegetative and species composition of lynx habitat that comprise the project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, livestock grazing, the forestwide Roadside Hazard Tree Removal and Fuels Reduction Project and private land timber harvest.
	Ongoing and future activities include the Red Mountain Flume/Chessman Reservoir project, Tenmile/South Helena project, livestock grazing, routine use and maintenance of Forest trails and areas for over-snow winter use, and Divide Travel Planning.
Measurement Indicators	Measurements are qualitative
Thresholds	No threshold is applicable to this indicator
Methods	Past, ongoing, and reasonably foreseeable activities are described qualitatively based on information derived from the FACTS database.
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized.

Past Activities

Several past activities never had or no longer have present effects to which the project would contribute. Specifically, projects that involved vegetation manipulation (e.g., timber harvest, and fuels activities) may have impacted lynx habitat at the time of the activity. Some of these impacts may still be apparent in those areas not yet capable of meeting multistory habitat parameters. Table 147 summarizes the effects of timber harvest during three time periods on lynx habitat. Most of the stands that have been harvested in the past have yet to develop multistory characteristics.

Fuels activities that occurred in the past mainly focused on reducing surface fuels. Many of these areas that were treated prior to the 1980s have returned to their 'pre-treatment' conditions especially in favorable growing conditions that accelerate understory development. Fuels activities that have occurred since the 1980s have also reduced surface fuels and created more open conditions that favor shrub and grassland development. These activities have contributed to structural characteristics that may increase structural diversity and subsequent snowshoe hare habitat.

Table 147. Past forest service timber harvest activities and their impacts on the availability of lynx habitat by LAU

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	LAU di-03 Regeneration Intermediate LAU di-04 Regeneration Intermediate	 1,458 213 1,620 51	Potential habitat that was regenerated during this time currently comprises pole size trees (5-10" in size) that contribute to stem exclusion conditions today and/or have been impacted by the mountain pine beetle. Intermediate harvest treatments that occurred during this time are most likely trending towards multistory habitat in stands not impacted by the mountain pine beetle. In stands impacted by the mountain pine beetle, today the overstory is most likely dead and/or dying with sufficient regeneration in the understory to satisfy early stand initiation habitat conditions.
Forest Service Timber Harvest 1980s through 1990s	LAU di-03 Regeneration Intermediate LAU di-04 Regeneration Intermediate	 896 214 1,779 101	Potential habitat that was regenerated during this time currently comprises young sapling sized trees (up to 5" in size) that contributes to stand initiation habitat today. Intermediate harvests have resulted in stands that are open grown today with larger trees; however the understories aren't as developed as those areas treated at an earlier time. These stands may provide some snowshoe hare foraging habitat; or, if impacted by the mountain pine beetle, the understories may not comprise early stand initiation habitat.
Forest Service Timber Harvest 2000 to 2014	LAU di-03 Regeneration Intermediate LAU di-04 Regeneration Intermediate	 16 421 32 188	Potential lynx habitat that was regenerated at this time is currently in the early stand initiation phase. Intermediate treatments resulted in stands with larger trees and open understories that may have retained some multistory habitat characteristics; more likely these areas are in a mid-seral condition.

Ongoing Activities

Ongoing activities that have effects to lynx habitat are summarized in the table 148.

Table 148. Ongoing activities that may impact lynx habitat

Activity	Effects to Lynx Habitat
Red Mountain Flume/Chessman Reservoir Project	Approximately 22 acres of lynx multistory habitat in LAU di-05 are treated in this project. Twelve acres of early stand initiation habitat area treated in LAU di-05 and 366 acres of 'other' habitat (mid-seral and stem exclusion). Although di-05 is outside of the Telegraph project area, it is adjacent to the project.

Other ongoing activities that may impact lynx habitat or lynx include general road use and management which could disturb lynx depending on the level of use and activity and reductions in roadside vegetation which could provide snowshoe hare habitat.

Reasonably Foreseeable Activities

The Tenmile/South Helena Vegetation Project, which would remove dead trees and thin young conifer stands on more than 20,000 acres just west of the Continental Divide, would remove lynx habitat in LAUs di-04, di-05 and di-06. The effects associated with the Telegraph project would be cumulative to those anticipated from the Tenmile/South Helena project.

The Divide Travel Plan includes motorized routes that are open to over-the-snow motorized use during the winter. This could result in displacement to lynx; meanwhile, the impacts of winter logging associated with the Telegraph project on lynx would be cumulative to the Divide Travel Plan project.

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next several years. Private lands within the respective LAU but outside of the project area are a mix of lodgepole pine-dominated stands with a similar history and lower elevation stands dominated by Douglas-fir. Much of the lower elevation component has also been subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain and, hence, effects to goshawk habitat.

Cumulative Effects Conclusions

Implementation of alternative 1 would contribute to the effects of past timber harvest because forested stands that are killed by mountain pine beetles would revert to early seral stands similar to those early seral stands that were created as a result of regeneration harvest from the 1980s through today. Alternative 1 would also contribute to the effects associated with the Roadside Hazard Tree and Fuels Reduction Project. As the landscape continues to change due to mountain pine beetle mortality under alternative 1, the resultant early seral stages would add to those created during implementation of the Roadside Hazard Tree project.

Implementation of alternatives 2 or 3 would contribute to the effects associated with past timber and fuels activities that have in part shaped the existing condition. Early stand initiation habitat would increase in LAUs di-03 and di-04. This would increase the heterogeneity of lynx habitat overall, while decreasing the amount of snowshoe hare habitat in the short term. In the mid to long term, snowshoe hare habitat would increase as these areas develop into stand initiation habitat. Stand initiation habitat currently exists on few acres in LAUs di-04, di-05, and di-06 relative to the total

amount of lynx habitat in those LAUs. The increase in stand initiation habitat in the mid to long term would result in more robust hare populations in the analysis area.

Multistory lynx habitat would be removed in LAUs di-04 and di-05; again resulting in a decrease in snowshoe hare habitat is the short term. This reduction of multistory habitat would also reduce the potential denning habitat; although the increases in downed wood from MPB created snags falling has resulted in increased availability of den sites as well.

Cumulatively, either action alternative would contribute to habitat changes associated with past, ongoing, and reasonably foreseeable activities. The disturbance associated with implementation of either action alternative would also contribute to any displacement to lynx that may be occurring as a result of ongoing activities or that could occur upon implementation of the Divide Travel Plan.

Irreversible and Irretrievable Commitment of Resources

There is no irreversible or irretrievable commitment of resources.

Conclusions

Lynx in the northern Rockies are sensitive to changes in forest structure (Squires 2013, Koehler 1990, Squires 2010). Because proposed treatments would reduce overstory and understory vegetation and remove down wood, snowshoe hare habitat and the quality of lynx denning and foraging habitat would be reduced over the short and long term (over 10 years) (Squires 2013, Squires 2010). Thinning could also affect lynx movement across the landscape and can alter lynx distribution within their home range (Squires et al. 2006, Squires et al. 2010).

While there is no evidence that suggests that forest roads pose a threat to lynx (USDA 2007b, p. 3), road construction may reduce lynx habitat by removing forest cover and winter road use may provide access for lynx competitors. Conversely lynx have been documented using less traveled roads where the adjacent vegetation provides good hare habitat and Squires et al. (2010) concluded that forest roads with low vehicular or over-snow vehicle traffic had little effect on lynx seasonal resource-selection patterns in Montana. While preliminary information suggests lynx do not avoid roads (USDA 2007b, p. 26), potential impacts are reduced when access, traffic volume and road speed are reduced.

Implementation of either action alternative would result in a reduction of stand initiation hare habitat and multistory hare habitat. However, these effects will be short-term and are within the allowable exemptions outlined in the NRLMD. All proposed treatments comply with Northern Rocky Mountain Lynx Management Direction (USDA FS 2007b). Due to the magnitude of habitat changes, particularly in multistory snowshoe hare habitat in di-04, the determination for implementation of either action alternative is ***"may affect, likely to adversely affect"*** for Canada lynx. There is no critical habitat in the project area and therefore no effect to critical habitat.

Regulatory Framework and Forest Plan Consistency

The Helena National Forest Plan was amended in March 2007 with the Northern Rockies Lynx Management Direction, as published in the Northern Rockies Lynx Management Direction Record of Decision (USDA 2007b). Relevant standards and guidelines from that decision and indication of how the Telegraph Project meets them are listed in table 149. See Appendix C for project consistency with all NRLMD standards, guidelines, and objectives.

Standards VEG S1, VEG S2, VEG S5, and VEG S6 include an exemption provision for fuel treatment projects within the wildland urban interface (WUI) as defined by HFRA, subject to the following limitation: Fuel treatment projects within the WUI that do not meet Standards VEG S1,

VEG S2, VEG S5 and VEG S6 may occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest). Application of the exceptions to the standards is also discussed here.

Table 149. NRLMD standards and guidelines applicable to the Telegraph Project in LAUs di-03, di-04, and di-05

Standard	Description	Standard Met?
ALL S1	New or expanded permanent development and vegetation management projects must maintain habitat connectivity in an LAU and/or linkage area.	**Yes:** The Project Area is to the west of the continental divide which has been identified as a linkage area in the NRLMD. The project maintains the general forested nature of the action area as well as landscape connectivity permitting broader lynx movements. Planned treatments in alternative 2 affect 4,859 acres of lynx habitat (46% of habitat in the project area [10,524 acres]; alternative 3 affects 2,744 acres (26% of mapped lynx habitat). Connectivity across larger landscapes will not be affected by this project since more than half of the lynx habitat would remain untreated in either action alternatives although the lynx may have to temporarily adjust movement patterns during project implementation.
VEG S1	Unless a broad scale assessment has been completed that substantiates different historic levels of stand initiation structural stages limit disturbance in each LAU as follows: If more than 30 percent of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects. Fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit. In addition, fuel treatment projects may not result in more than three adjacent LAUs exceeding the Standard.	**Yes:** Approximately 1% (313 acres) of LAU di-03 is identified as ‘early stand initiation habitat’; 3% (674 acres) of LAU di-04, and 3% (419) of LAU di-05. Under alternative 2, an additional 117 acres of mapped lynx habitat would be regenerated in LAU di-03 thereby increasing the percentage of early stand initiation to 2 % (430 acres) in that LAU. An additional 2,504 acres of mapped lynx habitat would be regenerated in LAU di-04 thereby increasing the percentage of early stand initiation to 16 % (3,178 acres) in that LAU. There are no treatments in LAU di-05. The percent of early stand initiation habitat in all three LAUs does not exceed 30%. LAU di-02 which is adjacent to di-04 to the north is at approximately 5% early stand initiation habitat. Percentages in alternative 3 are 2% in LAU di-03 and 10% in LAU di-04. The total fuel treatment exception acres metered out to the HNF as part of the NRLMD Incidental Take Statement are 26,400 acres. To date, the Forest has treated 131 acres of lynx habitat subject to the WUI exception. Treatments in early stand initiation, stand initiation, and multistory habitat are well under the limit. (Note, some of the multistory, early stand initiation, and stand initiation habitat our outside of the WUI; these acres will be field validated and if habitat is confirmed in these types, these stands will be dropped from treatment and the above calculations reflected accordingly.)

Standard	Description	Standard Met?
VEG S2	Standard VEG S2 applies to all timber management projects that regenerate forests, except for fuel treatment projects within the wildland urban interface, subject to the following limitation: Fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit. Timber management projects shall not regenerate more than 15 percent of lynx habitat on NFS lands within an LAU in a ten-year period.	**Yes:** Currently, regeneration harvest in LAU di-03 has occurred on 0.03% of lynx habitat on NFS lands within the past ten years. The Telegraph project would result in the regeneration of up to 117 acres in this LAU (alternative 2 – the more aggressive alternative in terms of acres treated) which increases the percent regenerated in a ten year period to 0.54%. Currently, regeneration harvest in LAU di-04 has occurred on 0.07% of lynx habitat on NFS lands within the past ten years. The Telegraph project would result in the regeneration of up to 2,515 acres in this LAU (alternative 2) which increases the percent regenerated in a ten year period to 13.1%. There are no project treatments in LAU di-05.
VEG S5	Standard VEG S5 applies to all precommercial thinning projects, except for fuel treatment projects that use precommercial thinning as a tool within the wildland urban interface subject to the following limitation: Fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit. Precommercial thinning projects that reduce snowshoe hare habitat may occur from the stand initiation structural stage until the stands no longer provide winter snowshoe hare habitat only: Within 200 feet of administrative sites, dwellings, or outbuildings; or For research studies or genetic tree tests evaluating genetically improved reforestation stock; or Based on new information that is peer reviewed and accepted by the regional level of the Forest Service, and state level of FWS…; or For conifer removal in aspen or daylight thinning around individual aspen trees, where aspen is in decline; or For daylight thinning of planted rust-resistant white-bark pine where 80% of the winter snowshoe hare habitat is retained; or To restore whitebark pine.	**Yes:** Standard is met. There are 65 acres of pre-commercial thinning in early stand initiation habitat and stand initiation habitat in LAU di-03 (alternative 2). All acres are within the WUI. There are 1,262 acres of pre-commercial thinning in early stand initiation habitat and stand initiation habitat in LAU di-04 of which 917 are within the WUI and 345 are outside of the WUI. All acres of early stand initiation habitat and stand initiation habitat proposed for treatment outside of the WUI will be field validated and dropped from units if the field validation indicates that these acres are either early stand initiation or stand initiation.

Standard	Description	Standard Met?
VEG S6	Standard VEG S6 applies to all vegetation management except for fuel treatment projects within the wildland urban interface, subject to the following limitation: Fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit. Vegetation management projects that reduce snowshoe hare habitat in multistory mature or late seral forests may occur only: Within 200 feet of administrative sites, dwellings, or outbuildings, etc.; or For research studies or genetic tree tests evaluating genetically improved reforestation stock; or For incidental removal during salvage harvest (e.g., removal due to location of skid trails)	**Yes:** Standard is met. There are 14 acres of vegetation treatments in multistory habitat in LAU di-03 (alternative 2). All acres are within the WUI. There are 1,184 acres of vegetation treatments in multistory habitat in LAU di-04 of which 749 are within the WUI and 435 are outside of the WUI. All acres of multistory habitat proposed for treatment outside of the WUI will be field validated and dropped from units if the field validation indicates that these acres are multistory habitat.
Guideline VEG G10	Fuel treatment projects within the WUI should be designed considering Standards VEG S1, S2, S5, and S6 to promote lynx conservation.	Overall, the project is designed to be responsive to the mountain pine beetle outbreak in the area, promote desirable regeneration, improve conditions for fire suppression effectiveness as well as firefighter and public safety in the area in the event of a wildfire, and maintain diverse wildlife habitats. These goals are compatible with conservation of lynx habitat. Both action alternatives have been designed with VEG S1, S2, S5, and S6 in mind. Furthermore, alternative 3 has been designed to minimize effects to lynx habitat while still meeting the purpose and need of the project.
Guideline VEG G11	Denning habitat should be distributed in each LAU in the form of pockets of large amounts of large woody debris, either down logs or root wads or large piles of wind thrown trees (“jack-strawed” piles). If denning habitat appears to be lacking in the LAU, then projects should be designed to retain some coarse woody debris, piles or residual trees to provide denning habitat in the future.	Denning habitat is not lacking in the project area. Because of the mountain pine beetle outbreak there are currently about 50 snags per acre on average in the7-11.9” size class and 9 in the 12-19.9” size class in the project area. These snags will eventually fall to the forest floor creating abundant denning habitat. About 29% of the project area would be treated leaving 71% untreated.

Wetland Habitats and Riparian Zones

Affected Environment

The Nature of the Resource

Characteristics of Wetlands and Riparian Zones

A wetland is a land area that is saturated with water, either at the surface or in the root zone, and as a result, supports hydric soil and vegetation adapted to flooding (Mitsch and Gosselink 2007, p. 27-31). Wetlands in the Divide landscape vary widely in size and in the degree to which they support water through the season. They include marshes (with surface water), swamps (forested wetlands), bogs (with sphagnum moss mats), wet meadows (sub-irrigated grasslands), sedge meadows, and seeps (wet areas around springs). These sites vary in size, but most are localized and frequently isolated from other such habitats. Wetlands often lie within riparian zones adjacent to open water, but some, such as wet meadows and springs, occur as independent entities in upland landscapes and are referred to as *isolated wetlands* (Mitsch and Gosselink 2007, p.26). Wetlands are productive, ecologically diverse, and support characteristic vegetation that contrasts with that of surrounding areas. As a result, many wildlife species are drawn to these sites.

A riparian zone is an area with distinctive soil and vegetation between a stream, pond, or other body of open water and the adjacent upland. Most riparian zones include a certain amount of wetland habitat, and in some cases, the entire zone is wetland. Many riparian zones, however, are a mix of wetland vegetation (dominated by aquatic plants adapted to saturated soil) and vegetation adapted to more mesic conditions (including trees and shrubs). Regardless of the relative proportion of hydric and mesic substrate, riparian zones are typically more productive and diverse than the adjacent upland habitat (Thomas 1979, p. 40-47). Wetland and riparian habitats are essentially ecotones that occur at the interface of aquatic and truly terrestrial ecosystems (Mitsch and Gosselink 2000).

In this report, the term “wetland” is used when referring to the distinctive *habitat* associated with water-saturated soils; the term “riparian” is used when referring to the ecotonal *area* adjacent to an open body of water, regardless of whether or not wetland habitat is present (though it often is).

Riparian Associated Wildlife

The wildlife species served by wetland and riparian areas are diverse. Riparian zones provide more breeding habitat for birds than any other kind of habitat association in North America (Kauffman *et al*. 2001). Nesting substrates for birds include streamside trees (cottonwoods, aspen, spruce); tall deciduous shrubs (willows, red-stem dogwood, alders); and sedges, riparian forbs, and other productive ground vegetation. Amphibians require aquatic and wetland habitat for part, if not all, of their life cycle. Some mammalian species such as mink, beaver, muskrats, northern water shrews, and water voles are tightly tied to aquatic and wetland habitats. A number of small mammals, while not aquatic or wetland obligates, are attracted to the cool, humid microclimate of riparian environments (short-tailed shrews, meadow voles, long-tailed voles, northern jumping mice) and are then followed by opportunistic predators (short-tailed weasels, raccoons, red foxes). Several species of bats normally forage above wetland and riparian habitats because of the abundance of aerial insects present. Most wide-ranging mammals, such as elk, deer, moose, coyotes, bears, bobcats and mountain lions, though they spend much of their time in drier upland habitats, are sooner or later drawn to wetland habitats and riparian areas—for water, forage, prey, cover, or thermal relief. Linear riparian zones, such as those along streams and rivers serve as travel corridors for many species. Wetland habitats and riparian areas are thus focal habitats that concentrate wildlife use.

Human Influences

Since the 19th century, human enterprises have substantially reduced the effective size of wetland habitats and altered the character of riparian zones. A major contributing factor was the demise of most of the native beaver population—initially a consequence of 19th century fur trapping and then as a means of providing dry ground for livestock, agriculture, settlement, and roadways. Wetland and riparian areas of any size tend to attract a disproportionate amount of human activity: recreation, home building, water diversion and impoundment, and livestock grazing. Streamside riparian zones are often natural conduits for roads, and as well, roads are needed to bring people into the riparian/wetland zones for all the other human enterprises they attract.

Historically, logging operations targeted forested riparian areas because of the large trees that grow on these productive sites. Timber harvest—especially regeneration harvest—not only diminishes hiding cover, thermal cover, structural complexity, and plant diversity of forested riparian zones, it also changes the local microclimate, making it more like that of adjacent uplands. Solar radiation increases, water temperature increases, humidity decreases, vegetation composition is altered, and unique characteristics that attract and sustain a number of small mammals, birds, and amphibians are lost (Thomas 1979, p. 40-47). In recent decades, timber harvest has been substantially curtailed in riparian zones and around wetland sites in order to maintain the integrity of the vegetation communities, soils, hydrologic features, and wildlife habitats. Primary guidance for Montana National Forests comes from standards and guidelines in Forest Plans and the *Montana Streamside Management Zone (SMZ) Law and Rules* [see MDSL 1994].

Project Area Status

Wetlands and riparian habitats occupy only a small share of the Telegraph Project area and the Divide landscape—less than 3 percent of the overall landscape. The Project area supports a somewhat higher percentage because it encompasses the headwaters of numerous drainages—sites full of springs, seeps, high water tables, and, often, marginal drainage. As well, most streams in the area have not been tampered with and channelized in recent decades and thus retain their natural riparian habitat configurations. Though highly localized, these productive habitats are well distributed throughout the Project area, usually in association with perennial, ephemeral, and intermittent streams, but also with isolated ponds and springs and with perched water tables (as subirrigated wet meadows).

A majority of riparian zones in the Project area are densely forested, relatively narrow, and include considerable non wetland habitat—or habitat that is wet only part of the year. Even in drainages with rich meadowland, such as upper Ontario Creek, Bison Creek, or Flume Gulch, substantial segments of the stream bottoms are narrow and heavily forested. Within these timbered riparian zones, as well as in a number of upland forests, scattered seeps, springs, and other diminutive wetland sites, provide covered foraging and watering areas useful to many wildlife species.

The most common non-forested wetlands are subirrigated wet meadows, typically situated around the origins of streams or anywhere else along creeks where the riparian zone spreads out and drainage is poor. Less often, the meadows encircle ponds or occur as isolated wetland pockets in the uplands. A few of these sites include true bog habitat, dominated by sphagnum moss, but this is an uncommon wetland type here. A perusal of aerial photographs of the project area reveals wet meadowlands all across the landscape in virtually every drainage. They all concentrate wildlife activity, but some provide better habitat than others. The quality of forage for native grazers is highly variable, ranging from diverse associations of palatable grasses, sedges, and forbs to coarse sedges and reeds generally ignored as food sources.

Riparian shrub communities—typically, willows, redstem dogwood, alders—are less common in riparian and wetland areas than are wet meadows and forest, but they are often the rule along some of the larger streams, such as the Little Blackfoot River and lower Telegraph Creek. Some of these tall "riparian" shrubs also occur in upland habitats on well-watered slopes and benches. They are particularly useful to browsers such as moose and deer, and they also support robust bird populations.

Photo 13. One of many small forested wet sites in a stand of mature Engelmann spruce and subalpine fir on the north side of Jericho Mountain near the headwaters of Mike Renig Gulch. The combination of open water, good forage, and effective cover enhances the value of this stand to wildlife, and it is heavily used by elk in summer and fall.

Photo 14. Pothole pond in beetle-impacted lodgepole pine forest in upper Telegraph Creek. Riparian zone vegetation here is more attractive to elk than upland forage in the surrounding forest. Aquatic vegetation in the pond also makes this a focal habitat for moose.

Photo 15. Part of a complex of subirrigated wet meadows interspersed with conifer forest at Sure Thing Swamps near the headwaters of O'Keefe Creek on the Continental Divide. This is excellent summer habitat for elk, as it is for numerous other species.

Table 150 identifies riparian and wetland sites in the project area that are prominent enough to consistently draw in wide-ranging wildlife and support resident associations of birds, mammals, and amphibians. Those that are classified as "primary wetlands" include substantial wet meadow, marsh, bog, or riparian shrub often in a matrix with forested habitat. These are excellent wildlife habitats. Those labeled as "other effective wetland areas" feature long reaches of narrow forested riparian zone; small scattered meadows, springs, and ponds; or considerable non-wetland habitat in the riparian zone (dry/mesic fields or forest stands). Also included are some productive areas that have been heavily compromised by human activity—roads, mining sites, channel modification, and homesites. This list is incomplete, but it picks up the areas of most value to wildlife in the Project area.

Table 150. Areas of abundant wetland habitat in the Telegraph Project area

Area Identification / Location	Habitat Description
Primary Wetland Areas	
Little Blackfoot River—Main Stem	By far, the largest, most continuous riparian system in the Project area—with broad wet meadows, riparian shrub fields, and marshes, alternating with patches of forest and ecotone. Compromised in some areas by the presence of the busy Little Blackfoot River Road (#277). The Project area includes only about 3 miles of the 20-mile upper Little Blackfoot corridor south of Elliston.
Ontario Creek North Headwaters	Good-sized wet meadows, ponds, and extensive forest with many wet sites amidst mature Engelmann spruce & subalpine fir.
Ontario Creek South Headwaters	An extensive maze of wet meadows blending into forest, some in old cutting units; extensive wet slopes with tall riparian shrubs. Heavily used big game summer habitat.
Lower Bison Creek—Main Stem	Forested riparian area with small meadows in lower end toward Ontario Creek confluence; larger meadows father upstream, extending up both main forks. The headwaters area with extensive wetland habitat in the Roadless area is beyond Project area boundaries. Most of this drainage is unroaded and is key summer habitat for species averse to human presence.
Flume & Little Flume Gulch headwaters	A broad basin below the Continental Divide full of ponds, marshes, bogs, forested wetland. Numerous logged areas from the 1970s have now mostly regained hiding cover. The main road through the area is closed to wheeled vehicles with the exception of 3 landowners. This is heavily used summer habitat for numerous species, including elk, deer, moose, black bears, beavers, lynx, and wolverines, among others.
Mike Renig Headwaters	A broad area of mostly forested wet habitat on the gentle lower north slopes of Jericho Mountain. Very heavily used by elk in summer & fall—a key part of an elk security area.
Sure Thing Swamps (East Fork O'Keefe Creek headwaters)	An interconnected array of wet meadows at the head of 2 tributaries of O'Keefe Creek atop the Continental Divide. This is an extensive wetland area, including wet forested habitat. It is a focus of wildlife activity from late spring through mid-fall. A single open road runs within a few hundred feet of the east end of the meadows.

Area Identification / Location	Habitat Description
Upper O'Keefe Creek—Main Stem	A collection of wet meadows along the upper forks of O'Keefe Creek and across a broad basin at the head of the drainage. Small ponds are present; forested wet sites are widespread. This area comes close to connecting with Sure Thing Swamps just to the northeast. The wetland area is essentially unroaded.
Lower Sally Ann Creek	Big wet-mesic meadows at the confluence of the 2 main forks of Sally Ann Creek and extending up both forks. Many riparian shrubs. Good summer habitat for deer, elk, and, especially, moose. Lynx are present here in winter.
Upper Booth Gulch—Main Stem	Extensive complex of wet and mesic meadows, aspen, and mature forest wetland—in the upper half and around the headwaters of Booth Creek. Roaded, but lynx and wolverines found here in winter.
North Fork Mary Ann Creek	Numerous wet meadows down the length of the Creek, blending into forest in the upper half. Mostly unroaded except for a little-used road in the timber near the origin.
Little Blackfoot—North Negro Mountain tributaries	An array of big meadows, with groups of tall shrubs and aspen, along 2 broad tributaries of the Little Blackfoot River north of Negro Mountain. Half the area was opened up by the Treasure Mountain timber sale in the 1980s—now full of sapling conifers. Heavily used by elk. Nearby road system is closed year-round.
Middle Monarch Creek	Relatively narrow, but continuous wet meadows along the middle reach of Monarch Creek for more than a mile. Multi-sized conifers scattered through the open wetlands. A rough, little-used road runs adjacent to part of the riparian zone. More extensive wetlands in upper Monarch Creek are outside the Project area.
Other Effective Wetland Areas	
Mike Renig Gulch	A narrow riparian zone with scattered mini-meadows, tall shrubs. Forested slopes on the east side of the drainage support seeps and springs. A Forest road, 3 cabins, outbuildings, & access roads disrupt parts of the drainage and the stream bottom.
Hahn Creek	The drainage is narrow for most of its length but supports a string of meadows with adjacent aspen stands.
Bryan Creek	A short stream with a complex of wet meadows and ponds. Much of the drainage is on private land and is compromised by cutting units, roads, old mine diggings, and some cabins.
Upper Sally Ann Creek	The upper forks support strings of small wet meadows, patches of tall shrubs & forest. Heavily used by moose.
Upper Telegraph Creek	The riparian zone of the upper main fork is relatively narrow and forested, but receives considerable elk use in summer.
Middle Telegraph Creek	Middle reaches of the creek are narrow but support numerous streamside stringer meadows and abundant riparian shrubs. Wildlife activity is suppressed to an extent by a main Forest road that parallels the creek & by cabins along the bottom.
Lower Telegraph Creek	Lower Telegraph Creek is characterized by broad meadowland, wet and mesic, but runs mostly through developed private land.
Lower Moose Gulch	Wet meadows and forest between 2 open Forest System roads.

Area Identification / Location	Habitat Description
Booth Gulch—South Forks	The 3 forks have narrow riparian zones dominated by mature/old-growth riparian forest, broken by occasional small wet meadows. Mostly unroaded. Summer thermal cover for elk, deer, moose.
Clemmer Gulch	A continuously forested drainage, with the upper reaches encompassing small pothole ponds, sedge meadows, and seeps on gentle, rolling terrain. Summer thermal cover for elk, mule deer, moose, and other species averse to daytime heat.
Mary Ann Creek—Main Stem	A narrow riparian zone, densely forested, with forested wetland patches in its upper half. A Forest road crosses the upper end.
Ontario Creek—Central and Lower Reaches	A long forested riparian strip with a few small wet meadows dominates the middle section—but with much of it unroaded. Some of the side tributaries have wet meadows at their headwaters. Lower reaches of the main stream are also narrow but peppered with wet stringer meadows & riparian shrubs. Open roads are in or near the bottom, as are some cabins.
Lower Little Blackfoot River—Unnamed Tributaries	3 eastern tributaries of the Little Blackfoot River in the northern half of the Project area. Forested riparian zones with wet meadow in the headwaters of all drainages.
Bison Creek—West Fork	A mostly frosted riparian area with a variety of small meadows down its length, larger meadows toward the headwaters. No open roads.

Environmental Consequences

Effects to riparian habitat are described qualitatively.

Desirable Habitat Conditions

√ Diverse understory component
√ Healthy plant communities

Effects Common to All Alternatives

There are no effects with regards to riparian habitats that are common to all alternatives other than succession and natural disturbance processes that would continue through time.

Effects Common to All Action Alternatives

Timber harvest under all action alternatives would leave residual buffers of trees around drainages with flowing water and other wet sites. These are reflected in riparian buffers that include both the streamside management zones (SMZ) and additional buffers that may extend further, in some areas, than the SMZ requirements. These buffers would retain structural diversity characteristic of wetlands and riparian zones important to a variety of wildlife. In all units, no mechanical equipment would operate in SMZs, but incidental tree removal may occur within allowable SMZ retention regulations.

Buffers are also in place during prescribed fire on either side of the riparian zones and around additional wetlands. No ignition of prescribed fire would occur within SMZ's, although fire may back into them with low intensity (see description of prescribed fire activities). Where fire does burn into the wetlands and riparian zones, it would result in the removal of some dead and decadent shrubs and smaller conifers as well as some ground vegetation. The resulting regrowth should provide more robust vegetation important for species associated with riparian habitats (e.g., ruffed

grouse, among others). See also the Hydrology Specialist Report and the Soil Resource Background Report.

All treatments would comply with the Montana SMZ law.

Alternative 1

Direct and Indirect Effects

There would be no direct effects to wetlands or riparian zones under the alternative 1. The relationship between forest cover and local wetlands and riparian zones would remain more or less as is now for another couple years, with an abundance of standing dead lodgepole pine close at hand, a good representation of green Engelmann spruce and subalpine fir, and some woody debris scattered about. But soon, the environment in and around forested wetland and riparian zones would shift noticeably as the lodgepole pine trees, which provide the bulk of the associated forest structure, proceeded to fall and accumulate as woody debris.

The absence of standing cover would undoubtedly change the way in which some of the more wide-ranging wildlife species approach and make use of these areas—elk, deer, moose, and black bears among them. In addition, without most of the surrounding tree cover and shade, the microclimate of the wet sites would shift, affecting resident small mammals, birds, and amphibians. Changes would include loss of perch and nest sites, changes in ground vegetation, accelerated water evaporation in summer, increased water temperature, and so on (Thomas 1979, p. 46). The downed trees would provide a certain degree of structural complexity useful to small mammals, amphibians, and some birds, and if substantial enough, larger mammals (concealment for bedded animals, for example). An abundance of coarse woody debris would also serve as barriers discouraging cattle—while not numerous in this area—from getting into the wet sites.

Alternatives 2 and 3

Direct and Indirect Effects

Design elements are in place in the form of buffers that will minimize impacts to wetlands and riparian zones. Specifically SMZ requirements prevent use of wheeled or track vehicles in these zones. Mechanical treatments are allowed in the SMZs to the extent that the Montana Guide to Streamside Management Zone Law and Rules are applied.

Both action alternatives include removal of dead trees in riparian buffers and some prescribed fire. Treatments in the some of these buffers are designed to create sustainable riparian habitat by reducing risks of uncharacteristic disturbance agents in these stands and promoting wetland and riparian vegetation through the removal of conifers, mainly dead and dying lodgepole pine. The action alternatives would involve two effects different than what would occur by leaving dead trees to fall on their own: (1) the loss of the cover provided by standing dead trees that are associated with riparian sites would occur quickly through harvest rather than gradually over 5-10 years and (2) the bulk of the deadfall in surrounding areas would be removed.

The sudden loss of cover is likely to be more disruptive to small wildlife species dependent on riparian areas than if it were allowed to pass away by natural means. But, the end result after a year or two would be essentially the same. The removal of all deadfall would be a more substantial problem for a wider variety of species: therefore, it would be mitigated by retaining a margin of undisturbed snags and deadfall in and around the margins of riparian sites (see Mitigation Measures/Design Elements). Most green trees of all sizes associated with riparian sites would also be retained (mostly subalpine fir, Engelmann spruce, and aspen). Exceptions would be (1) where

leaving conifers would suppress the development of aspen and (2) where retention of particular trees or logs subverted the basic intent of the project to minimize fire intensity and promote forest resiliency. As per requirements of the Soils and Hydrology sections, mechanized equipment would not be allowed to operate in riparian areas—with a few potential exceptions involving passage over frozen ground in winter. This would minimize physical disturbance to the sites.

Most wetlands and riparian zones will remain untreated, more so in alternative 3 than alternative 2. These untreated areas will benefit species like the willow flycatcher that tend to be restricted to riparian zones (Hutto and Young 1999).

As a result of proposed mitigation and design elements, disruption of project area wetlands and riparian zones as wildlife habitat would be minimal. Anticipated changes in terms of habitat

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on wetlands or riparian zones in the context of the myriad of other past, present, and future effects on riparian habitats from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. The following table summarizes the key items that are taken into consideration for the cumulative effects analysis for wetlands and riparian zones. See also Appendix E in the Wildlife Specialist Report, Cumulative Effects, for more information.

Table 151. Cumulative effects considerations for wetlands and riparian habitats

Parameter	Discussion
Spatial Boundary	The spatial boundary needs to be expanded to the point at which riparian habitats are no longer measurably affected. The project boundary satisfies this requirement because this is the scale at which the effects to wetlands and riparian zones can be examined at the stand or treatment unit. The project boundary also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1960s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the project boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the vegetative and species composition of wetlands and riparian zones that comprise the project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, livestock grazing, the forestwide Roadside Hazard Tree Removal and Fuels Reduction Project and private land timber harvest.
	Ongoing and future activities include personal fire wood cutting, the Red Mountain Flume/Chessman Reservoir project, Tenmile/South Helena project, livestock grazing, and private land timber harvest.
Measurement Indicators	Measurements are qualitative
Thresholds	No threshold is applicable to this indicator
Methods	Past, ongoing, and reasonably foreseeable activities are described qualitatively based on information derived from the FACTS database.

Parameter	Discussion
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized.

Past Activities

Past timber harvest has resulted in the treatment of 4,963 acres in the project boundary from the 1960s through today. Few regulations were in existence in the 1950s and 1960s that governed management in wetlands and riparian zones; it's likely that timber harvest and fuels activities extended into these areas thereby impacting the vegetative composition and structure. Because wetlands and riparian zones are desirable to a variety of animals, including domestic livestock, impacts associated with domestic grazing were extensive in the past, prior to the development and implementation of utilization standards on public land.

Ongoing Activities

Ongoing activities that may negatively affect wetlands and riparian zones include private land timber harvest, livestock grazing, and the Red Mountain Flume/Chessman Reservoir project. The impacts of these projects are expected to be minimal however. Allotment Management Plans (AMPs) have been updated for many of the allotments in the project boundary. These AMPs contain provisions for adaptive management in order to be responsive to negative impacts associated with grazing. Best Management Practices that are in place for the Red Mountain Flume/Chessman Reservoir Project ensure that impacts to wetlands and riparian zones are avoided to the extent possible given the need to remove some trees in wetlands and riparian zones.

Reasonably Foreseeable Activities

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next five decades. Much of the lower elevation component has also been subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain. All timber harvest on private land, however, is governed by the Streamside Management Zone Law which will minimize impacts to any riparian habitat that may be entered (see Montana Code Annotated 77-5-301).

Both the Tenmile/South Helena project and the Divide Travel Plan project could also have impacts to wetlands and riparian zones. These are expected to be minimal however due to SMZ laws and other best management practices.

Cumulative Effects Conclusions

The sum of past and ongoing cumulative effects has not been of a great enough magnitude to interfere with the ability of wildlife to seek out and make use of productive wetlands and riparian zones throughout the project area. Retention of current conditions and trends in the project area under alternative 1 would not add to these human generated effects on riparian sites or to reasonably foreseeable actions in a way that would imperil the viability of local wildlife populations or violate Forest Plan standards and guidelines.

Implementation of alternatives 2 and 3 would contribute to the effects associated with past timber and fuels activities where harvest and prescribed fire were permitted within wetlands and riparian

zones. There would be short-term reductions in shrub communities with these areas which, combined with grazing effects, would be cumulative.

Overall, however, as with alternative 1, the action alternatives would not add to the sum of the past, ongoing, and reasonably foreseeable cumulative effects in a way that would considerably alter the ability of wetlands and riparian zones to support current wildlife populations or those expected to evolve with changes resulting from the mountain pine beetle outbreak.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

Natural changes associated with the mountain pine beetle outbreak would generate substantial short- and mid-term shifts in the environment in and around local wetlands and riparian zones. But, these sites would remain viable as focal wildlife habitats. This will occur under alternative 1 and in those portions of the project area not subject to treatments in alternatives 2 or 3.

Under the action alternatives, the structure and functioning of local wetlands and riparian zones would differ little from what would occur under natural conditions. Dead and live trees within viable wet sites and around their margins would be left intact. Primary departure from natural conditions would be in the surrounding upland areas, from which most snags and woody debris would be removed. Wildlife species approaching the wetlands and riparian zones would thus be moving across open grass/forb/shrub habitat rather than through a maze of woody debris. In either case, the overhead cover would be gone. Differences generated by the action alternatives would not be noteworthy. Treatments that mimic disturbance processes (as is the case here) in wetlands and riparian zones are important in maintaining species ***richness*** and diversity, both plant and animal.

Regulatory Framework and Forest Plan Consistency

The overarching standard for wetlands and riparian zones as wildlife habitat is riparian standard #9 [HFP, p. II/35], which states that "[r]iparian areas will be managed to be compatible with dependent wildlife species." Other standards relevant to wildlife are big game standard 6 (which includes the Montana Cooperative Elk-Logging Study recommendation to maintain the integrity of moist summer range sites for elk), big game standard 10 (which requires maintaining adequate browse for moose—often riparian vegetation), and threatened/endangered species standard 2 (which requires maintaining the integrity of grizzly bear habitat components—often riparian). Management Area W-1 hase a requirement that "[w]ildlife habitat improvement practices, including road management, prescribed fire, and other techniques, will be used to maintain and/or enhance the quality of big game and nongame habitat" – which is relevant to wetlands and riparian zones.

Neither alternatives 2 nor 3 are inconsistent with of any of the Forest Plan wildlife standards that either directly or indirectly relates to wetlands or riparian zones.

Other Prominent Issues

This section addresses species and habitat elements that, while not pivotal to project design, are of some consequence and worthy of detailed discussion. Following is a list of these topics and a brief explanation as to why they were not considered "driving issues." Underlying themes in all cases are that (1) the primary agent of change in Project area forests has been the mountain pine beetle epidemic and that project actions will not meaningfully add to what the beetles have wrought and (2) although the project will be removing standing snags as well as logs, all of this standing material

will have fallen of its own accord within 5 to 10 years, and the project will simply mimic the results of an ongoing natural process (albeit 5 to 10 years earlier).

- *Habitat Fragmentation:* Current project area forests, while a mosaic of mature stands and early-seral habitats, do not represent a "fragmented" landscape. The recent mountain pine beetle outbreak, however, has set the forest up for major fragmentation over the next decade. Proposed harvest activity, while modifying existing and future deadfall, would not be a major factor driving fragmentation—which is inexorably underway by natural means.

- *Travel Corridors and Linkage Zones:* In addition to encompassing numerous local travel routes, the Project area as a whole is part of a regional linkage zone centered on the Continental Divide. As with forest fragmentation, the primary agent altering the structural attributes of the local corridors and the linkage zone is the mountain pine beetle outbreak, not proposed removal of snags and downed woody debris.

- *Snags and Coarse Woody Debris:* While snags and logs provide key habitat for a number of species, they are so abundant throughout the entire Project area, and would remain so after any tree removal, that their preservation was not an issue that helped shape any alternative.

- *Grizzly Bear:* The grizzly bear, while a threatened species that needs to be taken into account, is rare in the Project area. Habitat management that would benefit grizzlies is accounted for in project design for elk and mule deer. The primary problem for grizzly bears involves open roads, which are not a focus of this project.

- *Wolverine:* The wolverine—a species proposed for listing as "threatened"—has been present in the project area but would be little affected by project proposals for removal of dead trees and thinning of young conifers. The primary threat to wolverines involves loss of persistent spring snow cover in high elevation natal denning areas—a function of climate change.

- *Migratory Landbirds and Shorebirds:* The primary habitat shift affecting migratory landbirds has been generated by the mountain pine beetle outbreak—the proliferation of snags and their imminent transition to coarse woody debris. Project proposals to remove dead trees and logs would have little additional effect.

- *American Marten:* The marten, while drawn to mature forest stands with abundant coarse woody debris in the understory, appears to see uncanopied debris to be marginal habitat. Removal of woody debris from portions of the Project area is unlikely to have any meaningful effect on the ability of marten to make use of what is left of mature forest after the beetles.

- *Northern Goshawk:* Goshawk nesting habitat—the primary limiting factor in the Project area—has been decimated by the mountain pine beetles. Project proposals for removal of dead trees and logs would have no effect on this habitat component.

- *Pileated Woodpecker:* Pileated woodpeckers are now observed more often in the Project area with the proliferation of beetle-killed trees, but they remain uncommon mainly because of the scarcity of large nesting trees. Project alternatives are not targeting such large trees, dead or alive. The remaining acreage of dead-tree dominated feeding habitat following any Project action alternative would be extensive enough to accommodate foraging pileated woodpeckers.

- *Hairy Woodpecker:* Hairy woodpeckers have increased substantially since the onset of the pine beetle outbreak. Nesting and feeding habitat for these birds are essentially one and the same. As with pileated woodpeckers, untreated dead-tree dominated habitat would remain plentiful enough after either action alternative to provide for local hairy woodpecker populations.

Snags and Woody Debris

Affected Environment

The Nature of the Resource

The *Helena Forest Plan* defines a "snag" as the stem of a dead tree, at least 6 inches in diameter at breast height (dbh), and, if broken, at least 20 feet high (*HFP*, p. VI/15). The basic logistics of snags as silvicultural components are covered in detail in the *Forested Habitats of Special Concern Background Report* (p. 12-18); the distribution of snags across the project area in the wake of the mountain pine beetle epidemic is examined in the *Vegetation Introduction Report*. This report examines the role of snags and coarse woody debris as wildlife habitat components.

Tree decay is an ecological function that creates key habitat components—snags and logs—for wildlife (Rose et al. 2001). Snags are defined as standing dead trees of pole size and larger (≥ 7 inches diameter at breast height—dbh). They provide the primary substrate for the cavities that many birds and arboreal mammals require for an array of basic life functions (Thomas 1979, p. 60-77). As well as supporting cavities, snags serve as primary foraging areas, perching and resting sites, lookouts, and escape ladders for many species (Davis 1983).

Woodpeckers are the most prominent excavators of cavities in the Divide landscape. Some species, such as pileated and black-backed woodpeckers are able to excavate trees with hard exterior sapwood shells and decaying heartwood. Weaker excavators, such as hairy and downy woodpeckers—as well as diminutive non-woodpecker species such as chickadees and red-breasted nuthatches—select trees with softer exterior wood created by armillaria root rot and other saprophytic fungi (Rose et al. 2001). Most woodpeckers excavate a new ***cavity*** each year (Bull et al. 1997), thereby generating a continuous resource for secondary cavity users—species unable to produce their own cavities. Secondary cavity dwellers include several species of owls, myotis bats, kestrels, wrens, tree swallows, bluebirds, marten, red squirrels, and flying squirrels, among others.

Snags continue to be important to wildlife once they fall. Logs provide foraging sites, hiding and thermal cover, den sites, nest sites, and travel conduits for small animals, such as chipmunks, pack rats, deer mice, weasels, marten, toads, and salamanders (Rose et al. 2001). Larger animals, such as bears, forage for invertebrates in logs. Fishers use large logs as den sites; lynx typically select dense patches of downed trees for denning. As logs continue to decay and lose structure, they play an important role in nutrient cycling, soil fertility, and erosion control, among other functions (Maser et al. 1988).

Snag and log occurrence is variable and hard to predict under natural disturbance regimes. A majority of dead tree concentrations are produced by fire, and while it is possible to estimate the relative probability of fire occurrence and expected fire behavior in a particular vegetation/fuel environment, actual predictions as to when and how such events might play out not have proven useful for planning and management purposes. Mixed coniferous forests (most commonly Douglas-fir/ lodgepole pine in the Telegraph project area) often experience a mixed severity fire regime, which results in considerable variability in snag density. Cool lodgepole pine and spruce/fir forests

generally experience infrequent stand-replacing fires, which generate periodic snag pulses (Lyon 1977).

Insect and disease infestations are also capable of generating large numbers of dead trees, but the result may differ from that produced by fire. Many trees killed by insects—in particular, bark beetles—often break off at the base, rather than uprooting, and tend to weaken and fall 5 to 12 years after death [*Forested Habitats of Special Concern Background Report*, p. 15]. The shift from an environment dominated by standing snags to one full of logs and other woody debris is thus a relatively rapid phenomenon. This is in contrast to many fire-killed lodgepole pine forests, which (depending on the severity of the fire) may retain numerous standing dead trees for several decades.

Project Area Status

The Influence of Mountain Pine Beetles

The current proliferation of snags throughout the project area and the Divide landscape as a whole is a product of the mountain pine beetle epidemic that first became evident around 2005-2006 and now appears to have mostly run its course. In the Telegraph Project area, which includes few ponderosa pine stands (less than 1 percent of the area), most of the impact has fallen on lodgepole pine forests, which are a dominant community type across this part of the landscape. Whitebark pine (and a few similar limber pine) have also been afflicted, but their numbers are miniscule compared to those of lodgepole pine.

In 2009, at the height of the beetle outbreak, aerial detection surveys determined that 94 percent of the project area (22,152 acres) and 77 percent of the combination boundary (90,626 acres) were actively infested with mountain pine beetles [*Forest Vegetation Introduction* Report: *Insect and Disease Existing Condition*]. Although the affected acreage is extensive, the degree of damage within different stands is highly variable, depending on the proportion of lodgepole pine in the overstory: In pure pine stands, virtually all of the trees larger than 5 inches dbh have been killed [*Photos 16, 19*]; in some mixed stands only scattered trees have been hit [*Photo 17*].

Photo 16. Beetle-impacted lodgepole pine forest near Treasure Mountain with most canopy dead. Green trees here are scattered Engelmann spruce and subalpine fir and smaller lodgepole pine (less than 4 to 6 inches dbh). Potential for smaller cavity nesters such as hairy and downy woodpeckers, nuthatches, and chickadees will abound in these stands over the next decade. Few dead trees have fallen in this 2012 view but virtually all will be down in 5 to 10 years.

Standing snags are an ephemeral resource, providing specialized wildlife habitat for only a few years. In a normal "healthy" mature forest, snags are relatively uncommon. But because they come and go in a steady flow, there are always a few available. In the case of the mountain pine beetle outbreak, the dead trees have come nearly all at once and in vast numbers. This pulse of standing snags, which began around 2006, will have exhausted itself in another 10 years, and it will be followed by a period of several decades when there will be few snags on the landscape—fewer than when green mature forests were the norm. Likewise, the local populations of species dependent on standing dead trees for food, shelter, and general structure will wax and wane with the snag pulse. For the time being, however, and for the next few years, snags will continue to be the most copious "habitat of special concern" in the Project area—surpassing in influence of some of the habitats that we consider to be normal fixtures of the landscape. After that, it will become a severely limiting resource, regardless of how forests are managed. The variable that will change depending on management will be the abundance of downed woody debris.

Photo 17. Mixed conifer stand on Jericho Mountain impacted by mountain pine beetle but retaining substantial green overstory. Surviving overstory trees are mostly subalpine fir and Engelmann spruce. In lower elevation stands, Douglas-fir provides the residual green overstory. Dead lodgepole pine can be seen in the background here.

Wildlife Habitat Opportunity

Habitat opportunities for wildlife species able to take advantage of snags have proliferated since 2006. In particular, woodpecker populations have burgeoned: wildlife surveys indicate that hairy woodpeckers and northern flickers are the most prominent; but pileated, downy, and northern three-toed woodpeckers, as well as red-naped sapsuckers, have increased as well. Black-backed woodpeckers, which are drawn to fire-killed trees, have not been identified in the project area. Nesting potential for pileated woodpeckers is relatively low in the small diameter lodgepole pine forests but feeding opportunities abound. Because most woodpeckers feed and nest in dead trees regardless of overstory conditions, they are able to take full advantage of the new environment. However, some of the species that previously occupied these forests when the live canopy was overhead—white-breasted nuthatches, creepers, ruby-crowned kinglets, red squirrels—are now seldom observed. A few of the more versatile species, such as mountain chickadees, red-breasted nuthatches, robins, juncos, and Townsend's solitaires, continue to occupy the stands, taking advantage of the dead tree structure, residual seeds, and ground vegetation. Where green understory trees remain, these species are more common and open-forest species such as chipping sparrows and yelow-rumped warblers are moving in.

These conditions are in the process of evolving as more standing dead trees fall, opening up the already spare canopy to a greater degree, diminishing hiding and screening cover, and building up the stock of woody debris on the ground. Field surveys in 2013 indicated that dead trees were beginning to fall at an accelerated pace in many stands that previously had seen little accumulation of coarse woody debris. As this process goes forward, habitat opportunity will shift toward species adapted to coarse woody debris (a number of ground-nesting birds and small/mid-sized mammals, such as chipmunks, hares, woodrats, weasels, etc.). Large logs and stacked deadfall have been

relatively uncommon in Project area forests in the past—with most stands having originated after fire and logging operations in the late 19th and early 20th centuries and not yet achieved old-growth structure. In this environment species dependent on standing snags will find little suitable habitat.

Forest Plan Considerations

Helena Forest Plan standards and guidelines for snags were developed in the early 1980s and were based on the assumptions that (1) large dead trees would remain a relatively minor component of most mature forest stands and that (2) they needed to be maintained in modest numbers as timber harvest proceeded across the landscape. Standards specify the numbers of snags per acre (or potential replacement snags) that need to be maintained within *third-order drainages* in areas being managed for timber harvest (*HFP*, p. II/21).

Prior to the pine beetle irruption, snags were not a prominent component of project area forests. With the exception of some pockets of winter-killed trees (most notably, on the south side of Jericho Mountain), most stands supported a sufficient number of large dead trees to meet the *Forest Plan* standard for non-riparian areas of at least two snags per acre (*HFP*, p. II/21), but often little more. Table 152 summarizes snags per acre according to the HNF Plan.

Table 152. Snags per acre by Forest Plan size classes, Project Area and Combo Boundary, Summary Database

Forest Plan Snag Size Classes	Project Area	Combo Bdry
7-11.9”	49.64	69.42
12-19.9”	9.03	10.03
20”+	0.00	0.00
Live TPA 20”+	3.01	1.67

The Project area encompasses 3 third-order drainages [now referred to as 6th *field HUCs* (hydrologic unit codes)]: Mike Renig Gulch (watershed #1106B), Telegraph Creek (watershed #1107), and Ontario Creek (watershed #1108-1). An estimate of the number of beetle-killed trees and resulting snags per acre within each of these watersheds as of 2012 is shown in table 153.

Table 153. Snags created by mountain pine beetles, 2006-2012, in the 3 third-order drainages of the Telegraph Project area. Forest Plan standards require a minimum of 2 snags per acre in non-riparian areas

Detection Year ADS	Trees Killed in 1106B (Mike Renig Gulch)	Trees Killed in 1107 (Telegraph Creek)	Trees Killed in 1108-1 (Ontario Creek)
Total	102,851	295,130	407,616
Average Snags/acre	**33**	**37**	**32**

Although table 153 does not separate out upland habitats from riparian habitats (where the Forest Plan expects to retain more snags), the overall totals are excessive enough to illustrate that these watersheds are well beyond Forest Plan minima for snags. Distribution of snags across the Project area is uneven, of course, with some stands (pure mature lodgepole pine) in excess of 300 snags per acre and others with no snags at all (some mature Douglas-fir and regenerating sapling stands).

Environmental Consequences

Effects to snags and down wood habitat are evaluated according to the following measures:

- Acres treated (that potentially remove snags) in the project area

Desirable Habitat Conditions
√ A variety of size and decay classes √ Well-distributed

Effects Common to All Alternatives

Under all alternatives, natural processes and disturbances at all scales will continue to create snags. Public firewood cutting is permitted and could reduce the snag resource adjacent to roads. Large untreated areas would remain on the landscape where snag creation and attrition processes would be undisturbed. In the long term, snags are likely to become rare as the current “snag pulse” is lost to natural attrition. Additionally, while lodgepole pine snags are abundant, snags of other species and of large size are limited.

The timing of when dead trees shift from a vertical to horizontal position varies, and the rate that trees fall in different environments may be related to the speed of bole decay at the ground level (Mitchell and Preisler 1998). Attrition may also vary by tree species. According to Smith (2000), ponderosa pine snags that result from MPB infestation may fall within the decade where there is a lack of factors that make these snags durable. Another study found that beetle-killed ponderosa pine begin falling at a rapid rate after year 5, and most of the fall occurs between years 5 and 12 (USDA 2000a). However, in the Telegraph area, most of the newly created snags are lodgepole pine. In a study done on MPB-killed lodgepole pine, dead trees began falling 3 years after death in thinned (more open) stands and 5 years after death in un-thinned stands–90 percent had fallen by year 12 and 14 respectively–and no particular year had a higher rate of fall than average once trees had begun to fall (Mitchell and Preisler 1998). Trees may fall sooner in more open stands because more wind can penetrate, and/or because more sunlight speeds up bole decay (Mitchell and Preisler 1998). Similar results have been found in fire-killed lodgepole following the Sleeping Child burn, where an average of 13.4 percent of the snags studied fell yearly (Lyon 1977). Due to the current limited age class diversity, after the snags created by this MPB outbreak fall there will be few lodgepole snags until the forests regenerate, mature, and begin to die again. This "pulse" cycle is consistent with stand-replacing disturbance regimes. However because there is also living Douglas-fir, spruce, and subalpine fir, some snag creation should occur through time to partially ameliorate this loss.

Effects Common to All Action Alternatives

Snags would be reduced in proposed harvest units and maintained or increased in burning units. Snags outside of treatment units would be unaffected in the short term aside from ongoing public firewood gathering and natural creation/attrition. Creation of snags in some untreated areas may be lessened to some degree due to the alteration of fire behavior across the project area. Enhancing vigor and resilience of treated areas may provide for snag recruitment into the future after the current pulse of snags from fires and insects have been lost through natural attrition.

Under the action alternatives, snags would be managed through the design of un-treated areas, retention of live trees for recruitment in treated areas, and setting snag retention goals in treated areas. In harvest units, contractors are required to fall any tree they identify as a safety hazard (OSHA Instruction CPL 2-1.19). However, retention goals would be included in prescriptions; if a snag designated for retention must be removed for safety, it would remain onsite as coarse woody

debris and a substitute snag selected for retention. No retention of individual dead lodgepole pine is desired; these trees are generally small diameter and not windfirm. Some groups or clumps of lodgepole snags may be left in inoperable areas or when mixed with other retention trees. All whitebark pine snags would be retained unless the pose a specific safety or operability concern. In regeneration harvest units, roughly 20 snags per 10 acres from a mixture of diameter classes available, with seral species preferred, and all snags greater than 20 inches dbh would be retained. In intermediate harvest units, the goal would be to retain all snags greater than 20 inches dbh; and additional snags to average at least two per acre of the largest and most windfirm snags available, or as many are available less than that. There would also be abundant live trees in various size classes retained for snag replacement as well as inoperable areas and buffers in units where snags would be retained. Snags are more likely to be retained in units with group shelterwood treatments because they are less likely to pose a safety hazard . Snags remaining in units would no longer be surrounded by a closed forest. As such, wildlife use is expected to shift from one suite of species associated with closed canopy forests (brown creepers, squirrels) to species associated with open canopies (bluebirds, flickers). For some, use would not change (chickadees, hairy woodpeckers).

Snag recruitment is anticipated from proposed prescribed fire, based on prescribed mortality goals. The target overstory mortality in burn units varies (see Forested Vegetation Background Report). For example, mortality goals are generally low in regeneration harvest units because the remaining trees are desirable for seed, shelter, and/or structural diversity. Mortality goals are higher in broadcast burns in areas not harvested. In prescribed fire prescriptions, specifications would generally include limiting cutting of snags greater than 12 inches diameter during pre-fire preparation unless they are a specific safety or line containment hazard.

Alternative 1

Direct and Indirect Effects

The availability of dead wood habitat is expected to increase under the no-action alternative. Risks associated with disturbance agents – wildfire, root disease, and insects – would most likely increase as forested stands become denser and more susceptible to these agents (see Forested Habitats of Special Concern Background Report). Low level disturbances in most cases will provide a variety of snag and down wood habitat. However, widespread wildfire and epidemic insect and disease outbreaks would compromise the ability of the project area to provide dead wood in the long term. More dead and dying wood would accumulate in the short term, increasing habitat for cavity depending and dwelling species such as Williamson’s sapsuckers, three-toed woodpeckers, among others that occur in the Project area.

The natural distribution and abundance of snags has been altered over the past several decades due to fire suppression, timber harvest, and other human activities (Korol et al. 2002). Because of these alterations, the mountain pine beetle outbreak has caused widespread mortality resulting in a proliferation of medium-sized snags in the project area.

Due to the current limited age class diversity, after the snags created by this MPB outbreak fall there will be few lodgepole snags until the forests regenerate, mature, and begin to die again. This "pulse" cycle is consistent with stand-replacing disturbance regimes. However because there is also living Douglas-fir, spruce, and subalpine fir, some snag creation should occur through time to partially ameliorate this loss.

Alternatives 2 and 3

Direct and Indirect Effects

Alternatives 2 and 3 would treat approximately 6,754 acres (about 29 percent) and 4,185 acres (about 18 percent), respectively, of the project area. About 71 percent and 82 percent would be left untreated (alternatives 2 and 3, respectively) providing an abundance of snag habitat and live trees for snag recruitment (in Douglas-fir and subalpine fir stands). Untreated areas are well distributed and connected. Any snags in treatment units that pose a safety concern would be removed. Table 154 summarizes the effects to snag habitat according to the respective harvest treatment proposed for a given unit. Fewer snags would be lost in alternative 3 due to a reduction in the amount of acres treated.

Meanwhile the portion of the project area that would remain untreated in either action alternative would continue to support adequate snag densities and linkages between snag patches. The aerial detection survey (ADS) data indicate that on average 26 snags per acre would remain post implementation of either action alternative. Snags over 20 inches dbh would remain rare however (see the *Forested Habitats of Special Concern Background Report*).

Table 154. Effects to snag habitat by harvest treatment type (from the Forested Habitats of Special Concern Background Report)

Treatment Type	Description	Acres Treated Alternative 2	Acres Treated Alternative 3
Intermediate Harvest	A stand of live residual trees is retained which provides for snag recruitment. Snag recruitment would occur to a lesser amount and/or at a slower pace after treatment because treatments are designed to increase tree vigor and lower susceptibility to mortality.	434	434
Regeneration Harvest	This treatment results in removal of most of the existing overstory. Scattered individual or patches of live tree reserves would be identified to provide seed, structure, snag recruitment, and/or species diversity. Some existing snags would be retained within reserve patches, or as scattered individuals.	3,484	1,856
Prescribed Fire	Few snags would be felled in these areas, limited to those necessary for safety and fire containment purposes. Prescribed fire follows harvest (intermediate or regeneration) as well. Target overstory mortality in burning areas would vary depending on objectives, ranging from fuel reduction to site preparation for regeneration. In all cases, some snag creation is expected.	1,050 (prescribed fire only)	606 (prescribed fire only)
Precommercial Thinning	These areas were previously harvested and generally contain few to no snags. The treatment is focused on thinning young trees. There would be little to no impact on snags; if they occur, they would be retained.	1,786	1,289
TOTAL		6,754	4,185

Management activities can have substantial effects on snag density and longevity (Wisdom and Bate 2008; Russell et al. 2006). Exploring the density of snags in wilderness and roadless areas can

provide insight to natural snag abundance and distribution on the Forest which in turn can help to explain and understand the differences between areas that have been influenced by management and unmanaged areas. Table 155 (excerpted from the Estimates of Snag Densities for Eastside Forests in the Northern Region [Bollenbacher et al. 2008]) summarizes the distribution of snags by size class and habitat type that occur within and outside of wilderness areas. These data are presented in order to give the project a forestwide context prior to and after implementation of either of the action alternatives.

Table 155. Mean snag density per acre* inside and outside of wilderness/roadless areas by snag analysis groups for the Helena national forest (based on regional grid data)

Area	Dominance Group	Habitat Type Group	Snags per Acre 10”+	Snags per Acre 15”+	Snags per Acre 20”+
In Wilderness/ Roadless	All Other Groups	Warm	3.6	0.6	0.1
		Cool	17.3	2.1	0.7
		Cold	21.5	2.2	0.5
	PICO	All	9.2	0.4	0.0
Outside Wilderness/ Roadless	All Other Groups	Warm	2.1	0.7	0.3
		Cool	11.8	3.8	1.5
		Cold	No data		
	PICO	All	5.4	0.3	0.0

*Size class categories presented in this table do not directly compare to Forest Plan categories except in the 20”+ class.

Current conditions in the Project area include about 49 snags per acre that are between 7 and 12 inches in size class and about 9 snags per acre in the 12 to 19.9” category. There are no snags greater than 20+ inches in the project area. Although the Forest Plan snag categories are not directly comparable to those in the table above, it’s clear that the current snag levels in the project area are well above those present in unmanaged—wilderness—landscapes. So, despite snag losses associated with harvest treatments in the action alternatives, snag levels project-wide would continue to exceed those found both within and outside of wilderness areas. In other words, there are currently more snags present in the project area due to the mountain pine beetle than would be expected based on forestwide conditions and there would continue to be ample numbers of snags in the project area even in light of treatments associated with alternatives 2 and 3.

Treatments in the forested stands are designed to reduce potential of stand-replacing fire. As stands are opened and ladder fuels reduced, remaining live trees on site have the potential to reach large tree sizes which, dependent on disturbance agents, will produce desirable future snag habitat and eventually down woody habitat.

Furthermore, treatment versus non-treatment areas will result in a diverse spatial arrangement of snags in the long term. Untreated areas will continue to unravel in the lodgepole pine dominated stands as trees killed by the mountain pine beetle fall to the forest floor. These untreated areas will provide for both clumpy and dispersed snags in a variety of forest conditions. Treated areas will encompass a mosaic of untreated patches and harvested areas. There is a benefit to having both dispersed and patches of snags and down wood on the landscape.

Some data suggest that different harvest treatments yield different use by secondary and primary cavity users (Bunnell et al. 2002). Dispersed retention of snags and trees favors secondary nesters compared to mature and old forests. Large patches of snags favor primary cavity nesters. Secondary cavity nesters appear to be more common in areas of timber removal. This may be attributed to the fact that many secondary nesters are more effective at foraging in open areas. Treated versus non-treated stands in the project area, as well as different harvest treatment prescriptions, should create a variable pattern of snag distribution within the project area.

Primary excavators tend to occur more in aggregated patches perhaps due to the fact that this is the natural distribution associated with insect and disease patterns. Bunnell et al. (2002) found that partial harvest did not affect the abundance of primary nesters in most cases. In some cases, abundance increased perhaps due to small openings and creation of edges. Therefore, effects to primary excavators will not be as pronounced in intermediate harvest treatment units relative to those in regeneration harvest treatment units.

Slash piles left in units can provide down wood habitat for wildlife species like the marten. Dispersed retention of down wood habitat can be advantageous, but for organisms of limited mobility, down wood habitat in close proximity to other patches of down wood habitat is advantageous. Down wood habitat is not limited in the project area and won't be for several decades as a result of the mountain pine beetle.

Approximately 8.5 miles and 3.4 miles of road construction would occur as part of alternatives 2 and 3 respectively. All roads would be closed to the public and decommissioned post-activities. So there are no anticipated effects to snags associated with firewood retrieval on these roads.

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on snag and down woody debris habitats in the context of the myriad of other past, present, and future effects on these habitats from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. The following table summarizes the key items that are taken into consideration for the cumulative effects analysis for snag and down woody debris habitats. See also Appendix E in the Wildlife Specialist Report, *Cumulative Effects*, for more information.

Table 156. Cumulative effects considerations for snag and down woody debris habitat in the project area

Parameter	Discussion
Spatial Boundary	The spatial boundary is expanded to the point at which snags and down woody debris habitats are no longer measurably affected. The project area satisfies this requirement because this is the scale at which the effects to these habitats can be examined at the stand or treatment unit. The Project area also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1950s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the Project boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the age class, density, and species composition of the snag and down woody debris habitats that comprise the Project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.

Parameter	Discussion
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, and private land timber harvest.
	Ongoing and future activities include personal fire wood cutting, the Divide Travel Plan, and private land timber harvest.
Measurement Indicators	Measurements include effects to snag and down woody debris.
Thresholds	Forest Plan Standards of a minimum of 2 snags per acre by 3rd order drainage.
Methods	Past, ongoing, and reasonably foreseeable activities are described quantitatively based on acres of forested habitat affected. Impacts of past activities are based on the FACTS database and summarized according to the types of treatments recorded in the database. The effects on forest habitat are based on observed changes to stand structure.
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized.

Past Activities

Past timber harvest most likely removed many of the snags that were in the area at that time. In turn, this would have affected levels of down woody debris habitat. Today, these treatments are reflected in the existing condition which, because of the mountain pine beetle outbreak, is currently well above Forest Plan standards. Table 157 summarizes the effects of timber harvest during three time periods on snags and down woody debris currently existing in the project area.

Fuels activities that occurred in the past mainly focused on reducing surface fuels. These activities most likely have resulted in the creation of snags and subsequent down woody debris habitat.

Table 157. Past Forest Service timber harvest activities and their impacts on the availability of snags and down woody debris in the project area

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Regeneration Harvest	1,899	Although no pre-harvest data exist on snag levels, it's probable that most snags that were present at the time were removed during timber harvest. This is reflected in the existing condition. Down woody debris was also most likely removed during timber harvest. Alternative 1 would not remove any snags; alternatives 2 and 3 would remove snags adding to the effects of past harvest.
	Intermediate Harvest	230	
Forest Service Timber Harvest 1980s through 1990s	Regeneration Harvest	1,832	
	Intermediate Harvest	152	
Forest Service Timber Harvest 2000 to 2014	Regeneration Harvest	48	
	Intermediate Harvest	188	

Ongoing Activities

Ongoing activities that have effects to snag and down woody debris habitat are summarized in table 158.

Table 158. Ongoing activities that may impact snags and down woody debris habitat

Activity	Effects to Snags and Down Woody Debris Habitat
Firewood Cutting and Post & Pole Permits	Ongoing firewood cutting and post & pole permits result in removal of snags along roadsides and reduces snag availability in those locations (Bate et al. 2007).
Private land timber harvest	Private land logging will continue to remove snag and down woody debris habitat.

Reasonably Foreseeable Activities

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next five decades. Private lands within the combination boundary but outside of the project area are a mix of lodgepole pine-dominated stands with a similar history and lower elevation stands dominated by Douglas-fir. Much of the lower elevation component has also been subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain. Implementation of the Divide Travel Plan, pending a decision, would result in several miles of road closures that would preclude firewood retrieval in most cases (exceptions include opening some of these areas to firewood gathering on a limited basis as needed to address fuel loading concerns). Conversely, the roads that would remain open under the Divide Travel Plan would continue to be used for firewood gathering; however, since this is already ongoing the impacts to snags, and down wood habitat, would remain the same as the current situation along these open roads.

Cumulative Effects Conclusions

Implementation of alternative 1 would contribute to the effects of past timber harvest because forested stands that are killed by mountain pine beetles would revert to early seral stages similar to those early seral stands that were created as a result of regeneration harvest from the 1980s through today. Ongoing and reasonably foreseeable projects to which alternative 1 would contribute effects include firewood retrieval, the Divide Travel Plan, and private land timber harvest.

Implementation of alternative 2 or 3 would contribute to the effects associated with past timber and fuels activities that have partially defined the existing condition by both removing snags through timber harvest and adding them through prescribed fire. Alternatives 2 and 3 would also contribute to the effects associated with the following ongoing and reasonably foreseeable projects: private land timber harvest and development, firewood retrieval, and the Divide Travel Plan. However, due to the abundance of snags in the project area, overall cumulative effects to snag and down wood habitat are expected to be minimal.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

Snag and down wood habitat will continue to be abundant and well-distributed in the project area regardless of which alternative is chosen. Clearly, alternative 2 removes more snags than alternative 3; however, snags are not limited in the project area. A variety of size and decay classes would continue to occur across the project area.

Populations of all cavity-nesting species known to occupy the project area appear viable (See Affected Environment). It follows that, in general, snag levels are currently adequate to sustain those species known to occur in the project area – Williamson's sapsuckers, downy, hairy, and three-toed woodpeckers, among other cavity nesters. Furthermore, data collected elsewhere on the HNF in an area of similar mountain pine beetle-related tree mortality (albeit predominantly ponderosa pine) indicate that nest success of some woodpecker species nesting in that area has increased since the mountain pine beetle outbreak.

Regulatory Framework and Forest Plan Consistency

Forest Plan Standards (Forest Plan p. II/21-will be adhered to in all action alternatives (See *Forest Plan Consistency* section). These include:

- *To keep an adequate snag resource…snags should be managed at 70 percent of optimum (average of 2 snags per acre) within each 3rd order drainage.* There are three 3rd order drainages associated with the Project area (1106B, 1107, and 1108-1); based on aerial detection surveys there are at least 32 'new' snags per acre in all 3rd order drainages in the project are, more than 2 snags per acre required. The *Forest Plan* has identified this level of snag retention as needed to retain an adequate snag resource. It stands to reason, therefore, that this level of snag retention is needed to ensure viability of snag-dependent wildlife.

- *Management areas other than T-1 should be the primary source for snag management. However, if adequate snags cannot be found outside of T-1, then the following numbers and sizes of snags should be retained in cutting units, if available. (A) In units with snags, keep a minimum of 20 snags and 10 replacement trees per 10 acres, if available. If 20 snags are not available, then any combination totaling 30 should be left by the following dbh classes: 13 snags and 6 replacement trees from 7-11 inches; 5 snags and 3 replacement trees from 12-19 inches; and 2 snags and 1 replacement tree 20+ inches.* The bulk of the proposed treatments in all alternatives are in T-1. Therefore, it is appropriate to focus snag management on untreated areas in other management areas. In alternative 2, 71 percent of the project area will be left untreated; in alternative 3, 82 percent will be left untreated – in other words, an abundance of snags will remain in the project area post implementation of either alternative.

Monitoring

Snags are monitored as part of the Forest's FIA and intensified grid data collection. These data have been summarized above and indicate that there are approximately 49.64 snags per acre in the 7- to 11.9-inch tree size class, 9.03 snags per acre in the 12- to 19.9-inch size class, and 0 snags per acre 20 inches or larger in the project area. Outyear monitoring will occur in the project as part of *Forest Plan* monitoring.

Habitat Fragmentation

Affected Environment

The Nature of Fragmentation

Habitat fragmentation occurs when a given habitat—forest, grassland, shrubland—becomes partitioned into smaller disjunct patches either by natural means (such as conifer colonization in grasslands or fire in forests) or by human enterprises (such as logging, settlement, or road building). Classic fragmentation of mature forest habitat results from timber harvest, fire, insect irruptions, or other sources of deforestation creating swaths of unforested habitat so large as to leave only islands of functioning forest. The creation of new clearings in a mature forest stand does not necessarily represent forest "fragmentation." In fact, as long as the openings are surrounded by larger masses of forest, it is the openings that are the fragments. But if the process continues, the openings may become so all-encompassing that remnant forest patches become poorly connected or isolated from one another and the microclimate within them is altered (Saunders et al. 1991). In a fragmented forest landscape, interior forest species have difficulty moving between different parts of their habitat, and the patch size and suitability of the forest environment may be diminished to the point that local population viability of dependent species is threatened (Rosenberg et al. 1997).

This model of fragmentation derives from the theory of island biogeography (MacArthur and Wilson 1967): it focuses on the size of remnant forest patches and the distance between patches as the key factors that determine the fitness of the resident forest wildlife populations. More recent scrutiny, however, suggests that the character of the habitat "matrix" that surrounds the forest remnants can ameliorate the effects of fragmentation for many forest species (Kupfer et al. 2006; McIntyre and Hobbs 1999). Unlike true ocean islands, which are separated by a permanently hostile milieu, forest patches are set in a matrix of terrestrial habitat of varying congeniality for forest wildlife. Intervening environments are often "variegated" to an extent that they can be regularly crossed by many forest species. Suitability of the matrix can be enhanced by mature trees scattered about or in patches, groups of younger trees and shrubs, riparian/wetland habitat, robust ground cover, connectivity via forest stringers, and short distances between the forest remnants. In addition, a majority of forest patches are enveloped by open habitats that are in the process of regenerating to new forest: that is, the matrix is evolving and does not represent a permanent barrier. In this view, the landscape as a whole is the "continuum," and conditions in the matrix have as much to do with how suitable the landscape is for forest species as does the character of the forest itself (Debinski 2006).

The degree to which the juxtaposition of different habitat structures across the landscape is perceived as "fragmentation" or a useful habitat mosaic depends, as well, on the species involved. A landscape with a complex matrix of mature conifer forest, new clearcuts, sapling thickets, aspen clones, burns, and dry parks may limit habitat opportunity for certain mammals and birds (red-backed voles, red squirrels, fishers, brown creepers, goshawks, meadow voles, meadowlarks), but it may provide a good habitat mix for more wide ranging habitat generalists (elk, mule deer, moose, black bears, grizzly bears, bobcats, wolverines, robins, Townsends solitaires) (Debinski 2006; McIntyre and Hobbs 1999).

On the HNF, most roads and other human developments of similar scale tend not to physically fragment habitat so much as to create zones that repel wildlife species wary of human activity. The end result for some species is that animals confine much of their activity to smaller, less optimal blocks of habitat and, as with structural fragmentation, they move between blocks of undisturbed habitat under duress. One study of road and powerline corridors through forest habitat (Rich et al. 1994) concluded that interior forest birds did not perceive narrow forest-dividing corridors—road

corridors 25 to 50 feet wide—as sources of forest fragmentation. They did not avoid the edges but they were susceptible to cowbird nest predation in those areas.

Openings created by timber harvest, on the other hand, may be perceived as sources of fragmentation if they are wide enough and surround enough of the forested area. Clearcuts and seed-tree cuts, in particular, can eliminate whole blocks of interior forest habitat replacing them with open environments that can be problematic for some forest-dependent forest species for several decades. The new unforested clearings and the early-seral forest habitats that follow favor a different association of wildlife species—those adapted to "open" environments, edges, ecotones, or mosaics of early/late seral forest. These species may then compete with interior forest dwellers in zones

Historically, natural forces that broke up the continuity of the mature forest included fire, insect and disease outbreaks, winter-kill, flooding, landslides, wind-shear events, and so on. Wildfire and insect infestation—the most common agents of transformation—often razed mature forest over extensive areas (thousands of acres) rather than in the patchworks typically generated by timber harvest. This was not so much forest fragmentation as broadscale community replacement (temporary though it might be), and it presented local wildlife associations with a set of circumstances quite different from those that arise from a more fine-grained honeycomb of mature forest spotted with openings.

Habitat in the Divide Landscape and the Project Area

Timber harvest has partially fragmented mature forest in a number of local areas of the Divide landscape over the last few decades, but its primary effect in most places has been to break up parts of the forest continuum into a mosaic pattern rather than to create an assortment of isolated forest remnants. The effects (positive and negative) have been appreciable for some species, but the process has not produced the kind of true fragmentation that imperils species population viability.

The Telegraph Project area is a typical example of how timber harvest has modified forest habitat in the landscape. Between 1960 and 2014, approximately 16 percent of the Project area was logged via regeneration harvest methods, creating new openings totaling about 3,779 acres in the mature forest continuum. Nearly 95 percent of these cutting units are less than 40 acres in size and 50 percent of them are less than 15 acres. Because all but about 50 acres were harvested prior to 1990, they are now occupied by stands of sapling conifers (with the younger stands not far beyond seedling stage and the older stands moving into pole stage). These units are reasonably well dispersed across the entire Project area, producing a landscape dominated by mature forest but perforated by early-seral forest openings. The acreage of older forest has decreased and forest edge and ecotone have increased, but viable connections between blocks of mature forest have been retained.

Photo 18. View from Jericho Mountain of upper Mike Renig Gulch and the Continental Divide. Mature forest is the dominant vegetation formation, but its continuity is broken by an array of old clearcuts and, to a lesser extent, by natural grasslands. Clearcuts date from the 1960s through the 1990s: those visible here range in size from about 15 to 40 acres and are full of sapling conifers (averaging 12-18 feet tall). This mosaic of mature forest and regenerating openings is typical of the project area. While the mature forest continuum is interrupted, forest connectivity is maintained. As can be seen in this 2012 view, much of the mature forest canopy is dead in the wake of the pine beetle outbreak, and true forest fragmentation lies ahead.

Mature forest has remained the dominant habitat formation in the project area but now, because the diversity of habitat structure has increased, so have the habitat opportunities for a variety of wildlife species. The mature forest continuum has been made more porous, but it has not been fragmented in a way that has threatened the viability of resident interior forest wildlife or lowered diversity (as described by Kupfer et al. 2006). The presence throughout the area of species such as elk, mule deer, moose, wolverines, lynx, black bears, grizzly bears, mountain lions, wolves, bobcats, goshawks, great gray owls, blue grouse, snowshoe hares, and a full complement of the common songbirds, raptors, woodpeckers, and small mammals indicates that the area is functioning as a non-fragmented landscape. Local problems have arisen in a number of areas where a combination of newly cleared forest habitat and open roadways have elevated human disturbance in sites lacking cover. Some of these problems have been addressed by road closures; others have been ameliorated over time by regrowth of forest in the openings.

Currently, the primary agent of mature forest fragmentation in the project area and across the Divide landscape is the mountain pine beetle. Follow-up salvage operations may accentuate the effect in some areas, but, with or without the supplementary harvest of dead trees, the beetles have already done the work. Because of its scale, the beetle-kill will produce genuine fragmentation and

wholesale replacement of mature forest communities across large sections of the landscape. Stands of younger pine (regenerating clearcuts) and of mature non-pine species (Douglas-fir, Engelmann spruce, subalpine fir, aspen) will serve to break up the new continuum of dead pine trees. It needs to be emphasized, however, that in most cases, this fragmentation is temporary: beetle-impacted areas will begin the process of regenerating toward mature forest as soon as site conditions allow.

Environmental Consequences

There are no specific indicators used to analyze the effects of the alternatives to habitat fragmentation. Effects are qualitative. Fragmentation, for the purposes of this analysis, includes only human-caused fragmentation.

Desirable Habitat Conditions
√ Naturally fragmented landscapes and interior forests are maintained within the project area

Effects Common to All Alternatives

There are no effects with regards to fragmentation that are common to all alternatives other than succession and natural disturbance processes that would continue to shape landscape patterns. These successional changes will influence the juxtaposition of forested and non-forested patches, the result of which is a shift in the spatial arrangement of openings and forested stands over time. Most wildlife species should be able to handily adjust to these shifts in landscape patterns except in those situations where change is sudden (e.g., wildfire).

Effects Common to All Action Alternatives

Timber harvest and prescribed fire in the action alternatives would create openings in those stands that are either predominantly dead (i.e., lodgepole pine) or dense with thick understories (i.e., Douglas-fir). These activities would result in a reduction of habitat for species that prefer dense, interior, forested environments (e.g., brown creepers) or for species taking advantage of the structure afforded by the standing dead trees (e.g., hiding cover for elk). Conversely, these activities would result in an increase in habitat for species that prefer more open stands. Species that utilize a wide range of forest structure would remain unaffected. Species associated with edges and ecotones would find new habitat opportunities. Wildlife species composition would vary from one stand to another depending on the number of trees per acre that remain post-treatment. Canopy cover, vertical structure, and hiding cover would decrease while understory vegetation, visibility, and sub canopy flyways would increase.

Lack of fragmentation in the interior west is more of an issue than fragmentation. Forested landscapes are not a national priority for conservation or a priority at the ecosystem level in the Northern Region (Samson 2005, p. 17). In the past, fire and topographic diversity in the west together produced a temporally dynamic, naturally fragmented landscape. Because western populations of wildlife have a long association with naturally fragmented forested landscapes, as a group, they may be less impacted by forest fragmentation at some spatial scales (Dobkin 1994, Hutto 1995). In managed forests, timber harvest is the major method of regenerating forested stands to create multiple-aged forests on a landscape, because large-scale wildfires are mostly prevented. A timber harvesting practice that might cause a relatively great short-term change from pre-harvest conditions may be integral to long-term strategy for maintaining populations of all wildlife species, especially in areas that experience frequent and wide spread disturbance (Hutto et. al. 1993, Hejl et al. 1995).

The brown creeper warrants additional consideration since it is an animal species of concern according to the Montana Natural Heritage Program (accessed on June 6, 2015). Brown creepers are

strongly associated with late successional stages of coniferous forests and in Montana they are more common in spruce-fir and mixed-coniferous forests (Hutto and Young 1999). Studies in the Rocky Mountains indicate that creepers tend to be less abundant in logged (clearcut and partial logged) versus unlogged forests (Hejl *et al*. 1995). In an extensive survey throughout the northern Rocky Mountains, creepers were two times more abundant in old-growth than in mature forests, rare in young, partial cut, patch cut, and pole-sapling stands, and absent from seed-tree and recent clearcut openings (Hutto and Young 1999). No old growth would be treated under any action alternative. However, implementation of any of the action alternatives would create conditions that are unsuitable for brown creepers – i.e., logged forests.

Alternative 1

Direct and Indirect Effects

In the short term, ecosystem processes that shape the project area will continue to unfold; areas affected by the mountain pine beetle will continue to unravel creating openings crisscrossed with downed trees. In the long term, closed canopy forests would increase in portions of the project area unaffected by the mountain pine beetle as open forests fill in with understory trees and early seral stands proceed towards maturity. Over time, wildfires could create large blocks of open habitat with standing snags. The juxtaposition of forested and non-forested areas will continue to be in flux. Wildlife in the project area should be able to adjust habitat use and distribution patterns as long as the vegetative changes proceed relatively slowly.

Alternatives 2 and 3

Direct and Indirect Effects

Intermediate timber harvest and prescribed fire would result in the creation of open-canopied forests. Wildlife associations would shift from those species preferring closed, interior forests to those preferring open-canopied forests and ecotone habitats (e.g., mule deer). Species like the brown creeper that are associated with late-successional forests will experience a decrease in habitat where treatments are proposed in stands that are unaffected by the mountain pine beetle. Treatments proposed in stands that have been affected by the mountain pine beetle will result in openings some of which approach 100 acres. Some wildlife species will avoid openings of this size while other species may make use of the subsequent regeneration (e.g., snowshoe hare). After a decade or so, the same pattern of open forest and non-forested habitat will have formed in the surrounding untreated areas (albeit with abundant woody debris). This fragmented formation will develop whether or not the action alternatives are carried out. The action alternatives only serve to hasten the development of this landscape pattern. Eventually (over 50 years) mature forests should once again become the dominant habitat formation in the project area. Meanwhile, viable connections between blocks of mature forest would be retained thereby facilitating movement patterns and habitat use in the project area.

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on habitat fragmentation in the context of the myriad of other past, present, and future effects on these landscape features from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. The following table summarizes the key items that are taken into consideration for the cumulative effects analysis for habitat fragmentation. See also Appendix E in the Wildlife Specialist Report, *Cumulative Effects*, for more information.

Table 159. Cumulative effects considerations for habitat fragmentation

Parameter	Discussion
Spatial Boundary	The spatial boundary is expanded to the point at which habitat fragmentation is no longer measurably affected. The project area satisfies this requirement because this is the scale at which the effects to landscape patterns can be examined at the stand or treatment unit. The project area also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1950s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the Project boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the arrangement of edge and ecotones as well as the availability of contiguous blocks of habitat that comprise the Project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, and private land timber harvest.
	Ongoing and future activities include the Divide Travel Plan and private land timber harvest.
Measurement Indicators	Measurements include effects to fragmentation, edge, and ecotones
Thresholds	There are no specific thresholds; effects are qualitative.
Methods	Past, ongoing, and reasonably foreseeable activities are described quantitatively based on acres of forested habitat affected. Impacts of past activities are based on the FACTS database and summarized according to the types of treatments recorded in the database. The effects on forest habitat are based on observed changes to stand structure.
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized.

Past Activities

Several past activities never had or no longer have present effects to which the project would contribute. Specifically, projects that involved vegetation manipulation (e.g., timber harvest and fuels activities) created patterns still evident on the landscape today. Table 160 summarizes the effects of timber harvest during three time periods in the Project area. Areas that were treated in the 1960s are beginning to develop mature stand characteristics. Areas more recently harvest have yet to achieve this condition.

Fuels activities that occurred in the past mainly focused on reducing surface fuels. Many of these areas that were treated prior to the 1980s have returned to their ‘pre-treatment’ conditions especially in favorable growing conditions that accelerate understory development. Fuels activities that have occurred since the 1980s have also reduced surface fuels and created more open conditions that favor shrub and grassland development.

Table 160. Past Forest Service timber harvest activities and their influence on habitat fragmentation in the project area

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Regeneration Harvest Intermediate Harvest	1,899 230	Forested habitat that was regenerated during this time currently comprises pole size trees (5-10” dbh). Intermediate harvest treatments that occurred during this time are now open grown stands with developing understories. The effects of timber harvest on fragmentation are still present today in the project area.
Forest Service Timber Harvest 1980s through 1990s	Regeneration Harvest Intermediate Harvest	1,832 152	Forested habitat that was regenerated during this time currently comprises young sapling sized trees (up to 5” in dbh). Intermediate harvests have resulted in stands that are open grown today with larger trees; however the understories aren’t as developed as those areas treated at an earlier time. The effects of timber harvest on fragmentation are still present today in the project area.
Forest Service Timber Harvest 2000 to 2014	Regeneration Harvest Intermediate Harvest	48 188	Forested habitat that was regenerated at this time is currently in the stand initiation phase and in some instances large trees may remain (e.g., shelterwood or seed tree harvests). The effects of timber harvest on fragmentation are very pronounced today in the project area.

Ongoing Activities

Ongoing activities that have influenced habitat fragmentation include timber harvest on private land and some private land development.

Reasonably Foreseeable Activities

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next five decades. Much of the lower elevation component has also been subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain. Timber harvest, especially at lower elevations, could contribute to habitat fragmentation. Implementation of the Divide Travel Plan, pending a decision, would result in several miles of road closures that would eventually reduce habitat fragmentation. Conversely, the roads that would remain open under the Divide Travel Plan would continue to fragment some portions of the project area.

Cumulative Effects Conclusions

Implementation of alternative 1 would contribute to the forest conditions that are the result of past timber and/or fuels activities because forested stands that are killed by mountain pine beetles would revert to early seral stages similar to those early seral stands that were created as a result of regeneration harvest from the 1980s through today. This would add to the open understories that are still present in the project area as a result of those earlier activities. Ongoing and reasonably

foreseeable projects to which alternative 1 would contribute effects include private land timber harvest and development.

Implementation of alternative 2 or 3 would contribute cumulatively to the effects associated with past timber and fuels activities. Specifically, the project area would become more open in the short term and edge would increase while stands regenerate and develop understories. Alternatives 2 and 3 would add to the effects associated with the following ongoing and reasonably foreseeable projects: private land timber harvest and the Divide Travel Plan.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

The action alternatives—more so in alternative 2 than 3—will open up closed-canopied forests and produce temporary non-forested openings (in regeneration harvests in lodgepole pine stands). Stands that are thinned may fragment contiguous blocks of mature forest. The action alternatives are designed to maintain forest/non-forest ecotones and avoid treatments and patterns that are inconsistent with naturally-occurring patterns. This type of forest/non-forest juxtaposition would be beneficial for elk, for example, since it provides forage opportunities but not at the expense of cover, and vice-versa (Stubblefield et al. 2006). However, because a majority of the project area will remain untreated under any action alternative, habitat should remain available in forested stands not affected by the mountain pine beetle for a variety of species that rely on large tracts of interior forest habitat—i.e., brown creepers.

Regulatory Framework and Forest Plan Consistency

Forest Plan Standards applicable to fragmentation are primarily those included in the respective management areas that occur within the project area. forestwide Standards that may be applicable include standards for old growth. Since no old growth will be treated with this Project, Forest Plan standards relative to old growth are not applicable. See also Forest Plan Consistency Appendix for more details.

There are six Management Areas within the Project Area; of those, only two contain direction that may be applicable to fragmentation although fragmentation is not specifically identified:

- Management Area T-5 – Maintain adequate thermal and cover adjacent to forage areas, provided timber harvest volumes are not significantly reduced over the rotation period.
- Management Area W-1 – Wildlife habitat improvement practices, including road management, prescribed fire, and other techniques, will be used to maintain and/or enhance the quality of big game and nongame habitat.

These standards emphasize improvement of big game habitat of which fragmentation can be a factor. Mule deer, for example, often use edges created by fragmentation since those areas optimize the relationship between forage and cover. Fragmentation, or thinning of forested stands, can render an area unusable by big game if those areas are devoid of screening properties or other features upon which big game depend. The action alternatives include treatments that would increase fragmentation; however, these open forests should provide a mix of forage and shade during the summer for big game. All of the action alternatives are consistent with these standards in terms of maintaining and/or enhancing big game habitat.

Travel Corridors and Linkage Zones

Affected Environment

The Nature of the Resource

Corridors

A travel corridor is a pathway of hospitable habitat that allows species to move between larger, more suitable habitat blocks that are separated from one another by less congenial environments. The narrow, linear configuration of corridors results from (1) their conformity to narrow travel channels or bottlenecks presented by local topography (ridgetops, draws, passes), (2) the linear arrangement of suitable habitat components (stream bottoms, strings of drainage-head riparian sites), and (3) the general dominance of unfavorable environments on the landscape forcing certain species to pick their way through patches of suitable habitat. In addition, animals sometimes travel along relatively narrow pathways because of habitual behavior, even though there is ample opportunity to move across a broader area. This is particularly evident with herd animals such as elk (Irwin 2002, p. 498-499). Corridors may be local routes, facilitating movement of animals within their daily home ranges, or they may extend over greater distance, connecting more widely separated seasonal ranges (Rosenberg et al. 1997). But, whether serving as seasonal migration routes or as daily travelways, corridors represent predictable pathways between key habitats, usually along the most advantageous routes available.

Some corridors—particularly local connections between forest or riparian patches—can be readily recognized by their vegetation structure and composition, which contrasts with the dominant surrounding environment (Harris 1984, pp. 141-144). Many corridors, however, are not obvious, well-defined features of the landscape that can be precisely defined by topography or vegetation. Rather, they can be defined only by following the movements of animals that make use of them over time (Servheen et al. 2003).

The effectiveness of a given corridor varies with species: the combination of habitat parameters that makes a corridor suitable for an elk will be different for a lynx and different still for a mink or a red fox. Historically, the course of most travel corridors was dictated by topography, vegetation structure, the pattern of snowpack, and the availability of resources (particularly, forage, water, and cover). In the Divide landscape over the past 150 years, many routes have shifted in response to human development and to natural phenomenon, such as fire, vegetative succession, shifts in predator/prey patterns, and so on. Today, animals on the move follow the old resource/topography-driven routes where possible but divert as necessary to avoid roads and other centers of human activity [see Irwin 2002, p. 498-499]. Travel can be hemmed into well-defined corridors wherever a combination of topography, vegetation, and human development has limited the options.

Linkage Zones

While long-distance connections between regions of suitable habitat or population ***refugia*** are sometimes referred to as “corridors,” they are usually more aptly described as “linkage zones.” A linkage zone is an array of multiple habitats—often regional in scope—through which wide-ranging species gradually move as they make their way between larger and more hospitable ecosystems (Servheen et al. 2003).

Characteristics favorable for linkage zone/corridor function for most species (especially the large carnivores and ungulates) include low open road density, low concentrations of human occupancy (as represented by occupied buildings, developed recreation facilities, mining operations), an abundance of productive foraging habitat, a robust mix of forested and non-forested habitats

(abundant edge), and gentle-moderate terrain (Craighead et al. 2001; Walker and Craighead 1997; Servheen et al. 2003). In areas where these characteristics predominate, some transient species may linger for some time before moving on, taking a period of years to traverse a linkage zone and making their status as "resident" or "transient" somewhat problematic for biologists studying the role of a particular landscape.

Project Area Status

Local Connectivity

Movement routes through the Telegraph project area are numerous and diverse. Some are narrow and well-defined. These include (1) local routes that are part of a repeated daily movement regimen (such as trails leading to water or between bedding and feeding sites) and (2) routes delimited by topographic features such as drainage bottoms, narrow ridgelines, and saddles. Well-worn game trails follow the unroaded portions of productive stream bottoms throughout the project area: Bison Creek, Flume Gulch, Ontario Creek, O'Keefe Creek, Clemmer Gulch, Mary Ann Creek, and numerous unnamed side drainages. Major portions of most primary stream corridors, however, have been usurped by roads (much of the Little Blackfoot River, Telegraph Creek, Ontario Creek, lower Monarch Creek, Hahn Creek). Where roads are closed to vehicles at least part of the year (Mike Renig Gulch, Little Flume Gulch, lower Bison Creek) or vehicle use is light, they may serve as regular wildlife travel routes. Many ridgetop travelways have remained unroaded and retain historic wildlife use patterns. Travel across ridges is most often funneled through saddles, some of which are roaded but many of which are not. Key saddles continue to serve as conduits for wildlife even though they have roads running through them, such as some of those on the Continental Divide.

Movements of some species, such as seasonal migrations by elk and mule deer or the long-range circuits of wolverines and grizzly bears, may be reasonably predictable in terms of the general routes they follow but are subject to multiple local variations from one year to the next. Elk moving from winter to summer range in the northern part of the project area, for example, typically graze their way from wintering areas north of U.S. Highway 12 across open grasslands above Mike Renig Gulch, eventually moving into a maze of forest, small meadows, stream bottoms, and calving sites spread through the Project area. The movements of individuals and groups in any given year will depend on local foraging opportunity, the timing of green-up, the need to locate calving sites, and impromptu events such as the arrival of predators or a human-generated disturbance in the forest.

Many of the animals traveling throughout the project area prefer to move under forest cover—elk, mule deer, moose, black bears, mountain lions, marten, porcupines—although most can navigate a more open environment as long as human interference is minimal. Some forest animals such as fishers and marten are more tightly tied to forested movement corridors than are elk, grizzly bears, and moose—species that need open habitat as well. For those species that make use of forested travelways, the current status of most movement corridors will remain relatively intact for perhaps another 3 to 5 years. Because many travel routes pass through beetle-killed lodgepole pine, hiding cover and then screening cover will be disappearing through the next decade. At the same time, coarse woody debris will pile up, providing some cover for smaller animals—and in some cases for larger animals—but requiring more convoluted pathways to navigate the area. As post-fire environments in lodgepole pine stands elsewhere on the HNF have demonstrated (the Warm Springs burn in the Elkhorn Range, for example), stands of moderate-high density can often accumulate enough deadfall to block movement by larger animals and force them to seek out diversionary routes.

Regional Connectivity: the Divide Linkage Zone

The Linkage Zone in General

The Telegraph project area lies within what has been characterized as the "Continental Divide linkage zone" (Servheen et al. 2001), although it is also referred to as the Continental Divide "travel corridor," "migration corridor," or "habitat corridor" (Walker and Craighead 1997). On a regional level, it is seen as one of half a dozen connections between the Northern Continental Divide Ecosystem (NCDE) to the north and the Greater Yellowstone Ecosystem (GYE) to the south for a number of uncommon wildland species (grizzly bears, wolverines, lynx, and wolves, among them). In the Divide landscape, the linkage zone encompasses the entire breadth of National Forest lands centered on the Continental Divide (and for some species, adjacent non-Forest land). While the linkage zone is up to 25 miles wide across the Helena Ranger District, many dispersing species tend to concentrate in areas of productive habitat such as the string of drainage-head basins near the Divide or some of the primary drainage bottoms. The linkage zone does not lend itself to simple, straight-line travel: It is populated by an irregular dispersion of human development (roads, inholdings, campgrounds, ski areas, etc.) and exhibits irregular topography and fragmented groupings of favorable habitat. It thus functions as a network of smaller travelways—avenues of productive habitat, corridors of cover, zones away from human activity, paths of least resistance—along which different animals move, depending on their needs.

The Continental Divide Route through the Project Area

The Continental Divide ridge and the upper slopes on either side of it constitute probably the most prominent linkage zone pathway through the Divide landscape [other prominent pathways include the Little Blackfoot River corridor, the Ontario-Bison Creek corridor, Telegraph Creek, and the Negro-Treasure Mountain ridge system]. The Divide ridge defines the eastern boundary of the Telegraph Project area for a distance of 11 miles. While it provides a route for animals dispersing over long distances, it also functions as a conduit for daily and seasonal movement for locally based species. The probability of wildlife actually encountering humans varies from one segment of the route to another, but it is generally low. Table 161 shows road and trail presence along the Continental Divide where it borders the Project area [see also, the Project area map, figure 54].

Table 161. Forest condition and the level of human presence (as indicated by roads and trails) along the Continental Divide ridge on the eastern border of the Telegraph Project area

Divide Ridge Segment	Miles	Forest and Road/Trail Status on the Ridge
Northern Segment: North of Jericho Mountain	3.3	Continental Divide National Scenic Trail (CDNST): occasional non-motorized human presence—hikers, hunters, Forest workers [see *Photo 19*]. Much of the route passes through stands of beetle-killed lodgepole pine—still mostly standing. Douglas-fir is more prominent toward MacDonald Pass.
Central Segment: Jericho Mountain to Bullion Parks	2.4	A narrow jeep road (#1863) with several rough segments (part of CDNST): occasional human presence—afoot, 4wd vehicles, ATVs/motor bikes. Crossed by Forest Road #527 at its southern end; one residence at Bullion Parks. No hazard tree removal along this route, but it will soon be largely deforested as beetle-killed lodgepole pine falls.
Southern Segment: Bullion Parks to Beaverhead-Deerlodge NF Boundary	4.0	Forest Road #1863 (part of CDNST): Irregular vehicle traffic, typically light (estimate 1 vehicle/hr on summer weekdays; more on weekends and in hunting season). Sometimes used as haul route to the Luttrell mine waste repository. 3 residences at north end near where Road #527 crosses. Much of the road corridor has been opened up via the Hazard Tree Removal Project (2011-2012) prior to the trees falling of their own accord [*Photo 20*].
Far Southern End: Along the Beaverhead-Deerlodge NF Boundary	1.3	Crossed by an old 4wd road to pvt. property, but supports no ridgetop roads or trails: human presence is rare—occasional hunters, Forest workers. Forest is a mix of lodgepole pine (dead and alive) and subalpine fir.
Total Ridge	11.0	

As can be seen in table 161, 4.6 miles of the ridge bordering the project area (the northern and far southern segments) are essentially unroaded and support only occasional and low-key human activity. The northern segment carries the Continental Divide Trail and supports a consistent, but relatively low flow of foot traffic—mostly day hikers coming down from MacDonald Pass. Wildlife wary of humans (elk, black bears, mountain lions, bobcats) use the trail as a regular travel route, avoiding it to a certain extent during the hunting season. Further south where the Project area abuts the Beaverhead-Deerlodge NF, the ridge is crossed by a currently unused 4-wheel drive road but supports no ridgetop roads or trails. Wildlife traversing this segment of the Divide ridge would rarely encounter humans. *Photo 18* in the previous section on *"Habitat Fragmentation"* provides a view of the Divide ridge north of Jericho Mountain: the ridge in this area is broad and almost continuously forested (though now mostly with beetle-killed lodgepole pine, as can be seen in the photo). *Photo 19* provides an interior view of the forest along this part of the ridge.

Photo 19. The Continental Divide ridge between Mike Renig Gulch and Minnehaha Creek on the east edge of the project area. The non-motorized CDNST runs through here, and the ridge is unroaded for 4½ miles between Jericho Mountain and MacDonald Pass. The area is heavily forested, but much of it with lodgepole pine now dead from beetle attack. The ridge provides a wildlife travel route, an elk calving area, and a refuge from human activity for several species.

Between the 2 unroaded segments runs a single ridgetop road (Forest road #1863). The northern portion of the road (2.4 miles) is a narrow, irregular jeep road that receives only occasional vehicle use (the bulk of it during the hunting season). The southern portion is a more substantial Forest road that can be negotiated by most full-sized vehicles under normal conditions and that has on occasion served as a haul route for trucks bringing mine waste to the Luttrell Pit repository to the south. Be that as it may, vehicle traffic is generally light. In the past, species such as elk, deer, moose, black bears, bobcats, mountain lions, foxes, wolves, and coyotes, among others, have used the road as a regular travelway, switching to parallel routes a couple hundred feet into the forest when vehicle traffic on the road picks up. In 2011, beetle-killed lodgepole pines were cleared from a 25- to 120-foot swath on either side of the road as part of the *Forestwide Hazardous Tree Removal and Fuels Reduction Project.* Recent fieldwork in this area (2012) indicates that animals still use the road as a travelway (presumably mostly at night), but that they have increased use of parallel routes off in the unlogged timber. *Photo 20* illustrates the dramatic change in habitat character along this part of the Divide. Prior to this, road side forest was similar to that pictured in *Photo 4.* Without hazard tree removal, the road corridor would have remained lined with standing dead and fallen trees for another 5 to 10 years. After that, it would have been lined with stacked deadfall—as would most of the adjacent forest further back from the road.

Photo 20. Roadside corridor along the Continental Divide (Road #1863) from which dead lodgepole pine was removed as part of the *Forestwide Hazardous Tree Removal and Fuels Reduction Project* in 2011-2012. Animals such as elk, deer, bears, coyotes, and mountain lions still use the roadway as a travel route, but primarily at night. Otherwise they travel on previously-established parallel trails in the mostly dead timber on either side of the road corridor.

Because large blocks of forest cover are soon to be lost across the entire Divide linkage zone [note the dead tree pattern in *Photo 20*], changes in the way different species navigate the area along this part of the Divide apply to the entire Divide landscape. Adjustments already made by animals moving along the route shown in *Photo 23* give some indication as to the nature of these changes.

Environmental Consequences

There are no specific indicators used to analyze the effects of the alternatives on travel corridors and linkage zones. Effects are qualitative.

Desirable Habitat Conditions
√ Corridors and linkage zones through the Project area remain connected and effective.

Effects Common to All Alternatives

There are no effects with regards to travel corridors and linkage zones that are common to all alternatives other than succession and natural disturbance processes that would continue through time. These successional changes will render some areas unsuitable as corridors or linkage zones for those species associated with the existing vegetative patterns. Other species that are more general in their corridor requirements should be able to continue to move through the project area unimpeded.

Effects Common to All Action Alternatives

All action alternatives would harvest timber in areas used by wildlife for dispersal, for movement between winter and summer ranges, and for daily movement between primary habitats. As a result, the closed canopied component of some of these corridors would be diminished. Nonetheless, they would continue to function as effective travelways for most species. Exceptions would be local connections between forested sites used by interior forest obligates. New openings and open-forest sites would be less suitable as local movement pathways for closed-forest species such as red-backed voles, marten, northern flying squirrels, and brown creepers.

Timber harvest would affect primarily movement corridors between big game summer and winter ranges. The opening up of forest stands are likely to alter the way in which big game animals use these seasonal corridors at certain times during the hunting season by shifting movement to other parts of the corridors to take advantage of denser timber. Alternative 3 would have less effect on seasonal movement corridors and on movement pathways between local habitats such as foraging areas, resting sites, and patches of escape cover.

Regeneration treatments are proposed mainly in stands comprised of dead and dying lodgepole pine. These stands have already lost their suitability as a corridor for species associated with a certain level of canopy cover and tree density. For some species, the removal of standing dead trees results in a reduction of ‘hiding cover’ or screening that otherwise could allow for safe passage through the project area.

Prescribed fire should have little impact on the travel patterns of wildlife in the project area. There may be some short term displacement during prescribed fire activities and shortly thereafter while the understory is re-established. However, these impacts should be minimal.

None of these changes is expected to significantly lower the effectiveness of dispersal or seasonal movement corridors, which under natural conditions support a variety of vegetation types and structures. The more open corridors are not expected to emerge as new killing zones during the hunting season because hunter access would be considerably more difficult (due to the accumulation of down woody debris associated with the mountain pine beetle). The proposed reduction of forest cover in and of itself should not lower the effectiveness of the corridors. In some cases where forage is currently limiting, effectiveness of local habitats may improve as new forage appears.

Timber harvest would have no effect on the integrity of the Continental Divide linkage zone—which relies for its effectiveness on a mosaic of forested cover and productive openings (Walker and Craighead 1997, p.7).

Alternative 1

Direct and Indirect Effects

There are no direct effects to travel corridors and linkage zones under alternative 1. The ongoing mountain pine beetle outbreak most likely has already resulted in altered travel patterns for some species. As the dead pine forests eventually fall, wildlife in the project area will need to re-adjust movement patterns to account for open stands, lack of screening, and potential barriers created by large levels of down woody debris. The availability of travel corridors will depend on the species of interest and their requirements for movement. Over time, the availability of wildlife corridors will fluctuate with forest succession and, potentially, wildfire as these processes change the nature of these corridors temporally and spatially.

Alternatives 2 and 3

Direct and Indirect Effects

Timber harvest and prescribed fire will open up patches of forest habitat, and occasionally disrupt movement patterns across the landscape for certain forest obligates (northern flying squirrels, marten, red squirrels, red-backed voles). Treatments would not preclude travel through these sites, but would affect movement to a certain degree. Areas of untreated forest would remain interspersed with more treated stands, providing a variety of alternate local travel routes.

Treatments would increase sight distances and allow animals moving through the area to be seen from further away. The open stands, created by the treatments, would continue to screen large animals such as elk, deer, moose, and black bears, but only at distances of greater than 200 feet. On the other hand, the forage value of the treated areas would be higher than at present, allowing animals more opportunity to feed as they moved through. Tree removal is unlikely to deter straight-line movement by forest birds that quickly wing their way across local bits of less favorable habitat.

Approximately 8.5 miles of road construction would occur as part of alternative 2 and 3.4 miles as part of alternative 3. All roads would be closed to the public and would be decommissioned post-activities. Roads can present barriers, bottlenecks, and otherwise impede movement especially for smaller animals or animals with limited mobility. The extent to which a road acts as a barrier depends on an animal's behavior, dispersal ability, and population density. Some animals in the project area would most likely alter their movement patterns to avoid these temporary roads. Alternative 3, with fewer miles of temporary road, would cause less disruption to animal movement than alternative 2.

While project operations are on-going, species wary of human presence (bears, elk, mountain lions) will find the activity a local barrier to movement; and for a time they will need to select alternate travel routes or move through the area when workers are not present (at night, on off-days).

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on dispersal, migration, and travel corridors in the context of the myriad of other past, present, and future effects on these corridors from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. The following table summarizes the key items that are taken into consideration for the cumulative effects analysis for travel corridors and linkage zones. See also Appendix E in the Wildlife Specialist Report, *Cumulative Effects*, for more information.

Table 162. Cumulative effects considerations for travel corridors and linkage zones

Parameter	Discussion
Spatial Boundary	The spatial boundary needs to be expanded to the point at which corridors are no longer measurably affected. The Divide Landscape - South satisfies this requirement because this is the scale at which the effects to corridors can be examined at the stand or treatment unit. The Divide Landscape - South also provides a sufficient landscape to assess pattern and structure in the context of larger processes and movement in and out of the Project area.
Temporal Boundary	The temporal boundary ranges from the 1950s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the combination boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the age class, density, and vegetative species composition of the dry corridors that comprise the Project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, private land timber harvest, grazing allotment management, the Statewide OHV Rule, and road construction and management.
	Ongoing and future activities include the Tenmile/South Helena Vegetation Project, Divide Travel Plan, annual road maintenance, and private land timber harvest and development among others.
Measurement Indicators	Measurements include effects to corridors.
Thresholds	No threshold is applicable to this indicator
Methods	Past, ongoing, and reasonably foreseeable activities are described quantitatively based on acres of forest habitat affected. Impacts of past activities are based on the FACTS database and summarized according to the types of treatments recorded in the database. The effects on corridors are based on observed changes to stand structure. Impacts are also described qualitatively.
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized. Past, ongoing and future vegetation treatments and road management are expected to change the nature of corridors depending on extent of these activities and the wildlife species in question.

Past Activities

Several past activities on the Forest may have affected habitat connectivity and the way animals move through the landscape. Actions that have improved connectivity and habitat quality in the Divide Landscape – South linkage zone include: implementation of the Statewide OHV Plan (USDA and USDI 2001), which prohibits riding off established motor routes; a variety of trail relocation projects that have removed trails from sensitive wildlife areas likely to serve as local movement corridors to upslope locations; mine reclamation projects that have improved the functioning of riparian habitats likely to attract animals moving through a linkage zone; grazing allotment revisions that have generally reduced cattle numbers and improved habitat condition; and road and motor trail closures associated with timber harvest projects (Clancy-Unionville, Sound Wood, Mullan Pass, Lava Mountain, Treasure Mountain).

Activities that have reduced effectiveness of connectivity or had a mixed impact (negative for some species, positive for others) include: timber harvest that has created large clearcuts (Bison Creek, Mike Renig-Hahn Creek, Deadman Creek, Slate Creek, Ophir Creek-Cave Gulch, Lump Gulch, Lava Mountain, Mullan Pass); road permits allowing access across HNF land to private holdings; retention of recreational residences on HNF land (as at MacDonald Pass); small mining operations (under the 1872 Mining Act); construction and maintenance of power lines and communications sites; Forest road improvement projects that have widened road corridors; and fencing associated with grazing allotments that can impede movement by some animals.

Recently, harvest of snags from the mountain pine beetle outbreak have created "clean" openings in the forest, whereas natural processes eventually would have produced openings full of large woody debris. Most of these projects have been along roads and at developed recreation and administrative sites, and so have had little impact on unroaded habitat. Most recently, the Red Mountain Flume-Chessman Reservoir project—on both National Forest and private land—has been removing dead trees from a broad corridor along the flume and around the Reservoir in the upper Tenmile drainage. The project has been mostly completed on private lands, but is ongoing on the HNF. Table 163 summarizes effects of past Forest Service timber harvest on travel corridors and linkage zones.

Table 163. Past Forest Service timber harvest activities and their influence on habitat fragmentation in the Divide Landscape - South

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Regeneration Harvest Intermediate Harvest	4,080 264	Forested habitat that was regenerated during this time currently comprises pole size trees (5-10" in size). Intermediate harvest treatments that occurred during this time are now open grown stands with developing understories. Past harvest treatments have resulted in forested conditions that are open which in turn has resulted in increased sight distances. This allows animals moving through the area to be seen from further away. Initially, this may have complicated movement for some species by causing them to alter travel to avoid human activity. In some places, vegetation has grown back to the point that these areas can once again be used as corridors for species that need thick cover.
Forest Service Timber Harvest 1980s through 1990s	Regeneration Harvest Intermediate Harvest	3,220 465	Forested habitat that was regenerated during this time currently comprises young sapling-sized trees (up to 5" dbh). Intermediate harvests have resulted in stands that are open grown today with larger trees; however, the understories aren't as developed as those areas treated at an earlier time. Impacts of timber harvest during this time period to corridors are similar to those described for the pre-1960s through the 1970s.
Forest Service Timber Harvest 2000 to 2014	Regeneration Harvest Intermediate Harvest	1,089 1,977	Forested habitat that was regenerated at this time is currently in the stand initiation phase and in some instances large trees may remain (e.g., shelterwood or seed tree harvests). These areas provide corridors only for those species associated with young, open forests.

Ongoing Activities

Ongoing activities that have effects to travel corridors include private land development, especially rural home building which is making it more difficult for animals to move through the landscape. Problems also come from new and upgraded roads, mining operations, ATV-trail bike riding areas, private timber harvest, clearing of vegetative cover from riparian sites, and paving of the Rimini road.

Reasonably Foreseeable Activities

Activity on private land within the cumulative effects area that is expected to continue in the future and that may affect connectivity includes: settlement and associated development of private lands (including road building); timber harvest and removal of beetle-killed dead trees; continued mining operations that usurp habitat and create disturbance zones (most notably, the Montana Tunnels mine expansion); continued ATV and other motorized activity.

Reasonably foreseeable activities on the HNF that may affect connectivity include the Divide Travel Plan and the Tenmile/South Helena Vegetation Project. The Divide Travel Plan would result in the closure, at least seasonally, of several miles of roads that are currently open. This would be beneficial to a variety of wildlife species. Where roads remain open, wildlife movement patterns have most likely already been adjusted. The Tenmile/South Helena Project could result in large openings that could cause animals to shift their movement patterns.

Cumulative Effects Conclusions

Implementation of alternative 1 would contribute to the effects associated with past timber and/or fuels activities. As the mountain pine beetle runs its course in the project area and combination boundary, forested stands will revert to early seral stages as mature trees die creating conditions similar to those created by past timber harvest and fire. These open areas will continue to be avoided by interior forest obligates. Road use that is the result of past management decisions will continue to impact animals that avoid roads.

Implementation of alternative 2 or 3 would contribute to the effects associated with past timber and fuels activities. Specifically, the project area would become more open in the short term while stands regenerate and understories develop. All of these activities have or will create open stand conditions that complicate movement for some species by causing them to alter travel patterns. However, a large portion of the Divide Landscape - South will remain untreated; this should provide alternate routes for travel. Alternatives 2 and 3 would also contribute to the effects associated with the following ongoing and reasonably foreseeable projects: paving of the Rimini road, private land timber harvest, travel plan implementation, the Tenmile/South Helena Project, and annual road maintenance. These ongoing and reasonably foreseeable projects along with implementation of either alternative 2 or 3 may cause short-term, temporary disruptions to animal movement but should not impede passage due to the availability of adjacent untreated areas. Alternatives 2 and 3 would also contribute to the impacts associated with annual road maintenance. Cumulatively, these activities may temporarily disrupt animal movement. Travel plan implementation, however, should offset impacts associated with alternatives 2 and 3 because it will result in the creation of large, unroaded areas that should reduce the amount of travel animals need to meet their requirements.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

Connectivity is important because it allows animals to move between different habitats to meet their daily and lifetime needs as well as mitigate problems associated with fragmentation (Noss 1987). It also allows for repopulation of unoccupied areas. Reduced movement results in empty habitats or habitats that have smaller populations than they can actually support. This increases the risk of local extinction in that area and subsequently results in a lower regional population and lower long-term population persistence (Gilpin and Soule 1986). This also could increase isolation and result in decreased gene flow.

Deleterious effects associated with lack of connectivity are not well understood. The scientific debate over the need for corridors demonstrates the extent of the problem (Walker and Craighead 1997). However, there is agreement that habitat connectivity can contribute to long-term species survival (Noss 1983, Noss 1992, Noss et al. 1996).

In the short term under the action alternatives, wildlife species may have to adjust their movement patterns to take advantage of untreated areas. Given that harvest and prescribed fire patterns would match historical patterns; these anticipated shifts would be no greater than what animals would typically do after small to moderate-sized natural disturbances. However, alternative 3 probably has the least effect to existing movement corridors at least in the short term because fewer acres are treated, hence less disturbance.

The temporary road construction associated with the action alternatives could create barriers to some animal movement for the duration of the project and until those roads are reclaimed which further exacerbates the effects of the existing road network. However, unroaded portions of the project area should provide additional areas for animal movement. Implementation of alternative 3, with the fewest miles of temporary road construction, would have the least impact.

The biggest threats to animal movement in the vicinity of the project area are associated with non-federal activities such as subdivisions, highway use, and other activities that create inhospitable areas for movement within the Divide Landscape - South.

Regulatory Framework and Forest Plan Consistency

There are no specific Forest Plan Standards – other than the Northern Rockies Lynx Management Direction (see the *Canada Lynx* section) applicable to management of travel corridors and linkage zones.

Threatened, Endangered, and Sensitive Species

The Endangered Species Act (ESA) of 1973 (along with its subsequent amendments) and the National Forest Management Act (NFMA) of 1976 provide the authority for managing threatened and endangered species on the National Forests. Species are listed as *threatened* or *endangered* by the U.S. Fish and Wildlife Service (USFWS) in accordance with the ESA. An “endangered species” is one that is in danger of extinction throughout all or a significant portion of its range. A “threatened species” is one that is likely to become endangered in the foreseeable future. The ESA requires that the Forest Service (and all Federal agencies) evaluate the effects of proposed management actions on these *listed* species, as well as those *proposed* for listing, via *biological assessments*— the conclusions of which require concurrence from the USFWS before projects can go forward.

This report, deals with threatened, endangered, and proposed species as directed by NFMA, which requires Forests to evaluate the effects of proposed actions and their alternatives on local wildlife populations whose viability may be at risk. In addition to the threatened/endangered species (listed under ESA), NFMA also requires consideration of sensitive species (specified by Forest Service

policy). Threatened/endangered/sensitive (TES) species that may be present in the project area are addressed in some detail in different sub-sections of the *"Affected Environment"* and *"Environmental Consequences"* sections. This information is then presented in condensed form in the "***Biological Evaluation***" summary toward the end of the report. Taken together, these segments constitute the *biological evaluation* required by NFMA.

The *Forest Plan* deals with threatened and endangered (T&E) species, both as management indicator species [discussed in later sections] and as species of special concern to be evaluated according to specific management and recovery plans. In 1986 when the *Plan* was assembled, four species fell into this category: the bald eagle, peregrine falcon, and gray wolf (all listed as endangered) and the grizzly bear (listed as threatened). Since then, the bald eagle, peregrine falcon, and wolf have been de-listed and are now classified as *sensitive species* in USFS Region 1 [discussed in later sections]. The wolf is also now classified as a *game* species by the State of Montana. The Canada lynx, formerly a Forest Service sensitive species, was listed as a threatened species under ESA in 2000. The upshot is that the list of *Forest Plan* T&E species is different from the current ESA list.

Of the two species now listed as threatened that are known or suspected to range through the Telegraph project area, the Canada lynx has been addressed previously as one of the *"Driving Issues"* and the grizzly bear is addressed below under *"Prominent Issues."* The only sensitive species discussed in this section (*"Prominent Issues"*) is the wolverine. Other sensitive species are discussed later on as *"Topics not Analyzed in Detail."*

Grizzly Bear

Affected Environment

Grizzly Bear Biology

Habitat Use, Behavior, Movements

The grizzly bear (*Ursus arctos horribilis*) is the largest carnivore in North America and one of the only animals that consistently alters the way in which humans function in wildland settings. Grizzlies are imposing, intelligent animals with both genetic and learned abilities to take advantage of the resources in their local environments, to adapt to new ranges, and to deal with environmental change, including human intrusion and habitat alteration (Jonkel 1978, p. 227).

Grizzly bears are individualistic in their habitat use and behavior. Adult males are normally solitary wanderers within extensive home ranges, which they come to know in detail (McLellan 1985). Adult females, while often tending to cubs, are also relentlessly on the move scouting out the resources needed for survival. The home ranges of adult male grizzlies are generally two to five times larger than those of adult females: average range estimated from 4 Montana populations was 71 mi^2 for females and 319 mi^2 for males (Schwartz et al. 2003, p. 566). Home ranges of adult bears overlap to a certain extent, and they vary in size and location depending on food availability, weather conditions, and interactions with other bears (USDI 1993). Grizzlies may be periodically social when they congregate at food sources (whitebark pine stands, insect larvae irruptions, berry crops, fish runs), and at these times and during other encounters between individuals, a social hierarchy dictates behavior within the local population (Craighead et al. 1995, p. 109-154; Jonkel 1978, p. 234-236). The densities of established populations vary considerably, but they are inevitably low—an average of 102 bears/1000 mi^2 for 5 Montana populations (with a range of 18 – 207 bears/1000 mi^2) (Schwartz et al. 2003, p. 573-574). These estimates are for core populations: densities are substantially lower in more marginal habitats and linkage zones [such as the Divide landscape].

Grizzlies, while formidably equipped as carnivores, behave basically as omnivores. The majority of their food intake consists of vegetation (green plant matter, roots, seeds), which they consume in huge quantities (Foresman 2012, p. 347). Items with high crude protein content are particularly important. As opportunistic feeders, grizzlies prey on or scavenge any animal food source that becomes available, including insect larvae, rodents, elk and moose calves, incapacitated or unwary adult ungulates, domestic livestock, and carrion of any sort. Winter-killed ungulates and other carrion are a key source of energy in spring when green vegetation is less available (Craighead et al. 1995, p. 235-237).

The search for food is a primary influence on grizzly bear movements. Upon emergence from hibernation dens in spring, grizzlies typically move to lower elevations, focusing on drainage bottoms, ungulate winter ranges, and other sites where food requirements can be met. Throughout spring and early summer most bears follow greening vegetation back to higher elevation, although some may continue to focus much of their activity in the valleys and foothills (Mace and Roberts 2012b). In late summer and fall, there is a transition to more fruit and nut sources in addition to herbaceous vegetation. Seeds from whitebark pine are an important food source wherever they occur, but if they become unavailable for a time, the bears switch to other foods. Grizzlies will deviate from this general pattern, adapt to local conditions, and go wherever they need to in order to meet their food requirements (USDI 1993).

While grizzly bears make extensive use of forest cover, they generally prefer to operate in a landscape with a variety of habitat formations ranging from dense interior forest to open meadowlands (Dood et al. 2006, p. 18). The bears use forested habitats for resting, general concealment, thermal relief in summer, and foraging and hunting (USDI 1993, p. 7-8). They spend considerable time feeding on vegetation in more open habitats or in brushy areas along streams. They are drawn to areas with an abundance of deciduous shrubs in both forested and unforested habitats. In mountainous terrain, avalanche chutes often serve as foraging areas (USDI 1993, p. 7).

Research in Alberta (Nielsen et al. 2004) and northwest Montana (Zager et al. 1983) has found that bears avoid new openings produced by forest management (typically, clearcuts) although they regularly use the edges and the forested areas adjacent to them. Once suitable forage develops in the openings—particularly if berry-producing shrubs are involved—grizzlies spend considerable time in them. Clearings that are not near open roads and are irregularly shaped so that bears are usually within approximately 165 feet of cover receive the most use. Cover does not need to be in the form of mature closed-canopy timber: tall shrubs, clumps of regenerating conifers, and leave-trees either within cutting units or around the edges allow bears to regularly travel through and forage in these areas (Nielsen et al. 2004; Zager et al. 1983).

Human Influences

Historically, grizzly bears occupied a variety of suitable habitats across much of central and western North America from northern Canada down into Mexico (USDI 1993, p. 8-9). They made use of alpine environments, mountain forests, meadows, open prairies, and river bottoms stretching well out into the Great Plains. By the mid-20th century, human domination of the landscape had reduced their range in the lower 48 states to pockets of well-forested montane habitat in the northern Rockies (Foresman 2012, p. 346). Five areas in this region, representing less than 2 percent of the grizzly's historic range, now support grizzly bear populations (USDI 1993). Of the 5 areas, two of them straddle the Continental Divide in Montana: the Greater Yellowstone Ecosystem (GYE) and the Northern Continental Divide Ecosystem (NCDE). The Divide landscape is located partway between these large wildland ecosystems and thus is in a position to intercept any exchange between the two. Virtually all movement through the landscape is from the NCDE toward the GYE, north to south.

Field studies in the northern Rockies—Montana, British Columbia, Alberta—have lent support to the presumption that grizzly bear persistence in any given area is determined by (1) habitat quality, (2) the number of humans within that habitat, and (3) the behavior of those humans (Apps et al. 2004). Areas within historic grizzly range across the region have thus been identified in terms of the availability of large tracts of relatively undisturbed land that provide some level of security from competitive use by humans (USDI 1993, pp. 1-14). To that end, 'effective' habitat is described in terms of core areas—blocks of suitable habitat free of motorized access during the non-denning period (IGBC 1998).

Research has indicated that grizzly bears, in order to avoid negative interactions with humans, underutilize habitat near roads (Apps et al. 2004; Mace and Waller 1998; McLellan and Shackleton 1989). In areas of higher open road density, this translates to considerably less suitable habitat available to the bears, which, in turn, stifles the potential for grizzly populations to increase or even persist (IGBC 1998). One of the reasons that grizzlies often avoid logged areas has more to do with the presence of new roads and the consequent increase in human activity than with the change in habitat structure (Nielsen et al. 2007; Apps et al. 2004; Zager et al. 1983). Timber harvest can improve local habitat quality for grizzlies by creating more edge and more productive foraging opportunities, but bears will seldom use these sites if they are accompanied by roads open to vehicles (Nielsen et al. 2007; Zager et al. 1983).

Ongoing research in the Northern Continental Divide Ecosystem suggests that, in spite of the grizzly's aversion to contact with humans, a substantial number of bears are now spending time outside of mountainous wilderness areas, focusing instead on the agricultural lands of the intermountain valleys and the prairies east of the Rocky Mountain Front (Mace 2014; Mace and Roberts 2012b). This research, based on tens of thousands of telemetry points, emphasizes the importance of areas with diverse and abundant food sources—be they roaded or unroaded—and the propensity of grizzlies to opportunistically move from one place to another in search of different foods, regardless of the season. Blocks of roadless habitat remain important, however, as areas where bears can avoid human activity.

With or without roads, regular human presence in occupied grizzly range increases the potential for negative confrontations. While many encounters between grizzlies and backcountry recreationists are a matter of chance, others are created by poor sanitation and food storage that lures bears into camps. Gut-piles left by hunters are an additional attractant that may bring bears and humans into close contact. Poor sanitation may also serve to attract grizzlies to rural cabins and other residences that they would normally avoid. In some areas, the presence of free-ranging livestock on public and private lands provides another prey source for grizzlies, leading to ranchers calling for predator control.

Considering the gamut of human activity in grizzly country, the USFWS identifies 3 primary management elements that adversely affect grizzly bears in and around the Northern Continental Divide Ecosystem (NCDE): (1) human access management (roads and trails), (2) sanitation, and (3) livestock grazing. While other land management activities influence grizzlies, these are the 3 human generated components that produce most of the adverse effects (USDA 2013).

Population Dynamics

General Parameters

Grizzly bears are long-lived, with many individuals surviving more than 20 years in the wild. But, they have one of the lowest reproductive rates among terrestrial mammals, which precludes rapid population increase. During a female's lifetime, if she has litters of two cubs with a 50:50 sex ratio

and a 50 percent survivorship of young to age 5.5 years, at best, she can replace herself with one breeding age female in the first decade of her life (USDI 1993). Age of first reproduction and litter size varies and appears often to be related to nutritional state. In areas where suitable resources are less plentiful or compromised by human development and activity, the ability of local populations to multiply is limited.

The sources of natural mortality have proven difficult to quantify, but old-age, conflicts with other bears, starvation, and accidents (avalanches, den collapse) are known to be factors. Disease and parasites appear not to be major sources of mortality (Dood et al. 2006, p. 21; Schwartz et al. 2003, p. 571). Most mortality in dependent young (cubs and yearlings) is natural, but the exact causes are often unknown because so few are radio collared. The bulk of adult mortality is human-caused: Bears are shot by hunters (accidentally, maliciously, in self-defense), killed by residents protecting themselves or their property, hit on railways and highways, or removed for management purposes (usually for killing livestock or threatening humans). Death rates in northern Rocky Mountain grizzly populations have varied dramatically over the past several decades, but in recent years, rates of mortality in the 2 large Recovery Zones [Northern Continental Divide (NCDE) and Greater Yellowstone (GYE)] have been regularly exceeded by those of surviving young—thus resulting in slow but consistent population increase (USDI 2014, p. 12-23). Rates of increase/decrease in the smaller Cabinet-Yaak (CYE) population have been uneven. Population parameters in “Distribution Zones” and other more marginal areas outside of the Recovery Zones are unknown.

Population Status in the NCDE

Analysis by Mace and others (2011), based on 6 years of demographic data derived from a variety of field research, indicates that by 2009 the NCDE and adjacent areas were supporting a growing population of more than 1,000 grizzly bears. The analysis estimated annual population growth rate at about 3 percent. Annual monitoring since 2009 (Mace and Roberts 2012a, 2012b) shows that the rates of reproduction and mortality that have been producing the 3 percent growth rate are continuing. Current population numbers (≈1,100 grizzlies) are significantly greater than the estimate of 440 to 680 bears believed to have inhabited the ecosystem in 1975 when the grizzly was listed as a threatened species.

Also, work by Kendall and others (2009) has shown that this population is characterized by high genetic diversity and is expanding its distribution beyond the NCDE in all cardinal directions. This expansion, documented by targeted survey work and many fortuitous observations in the field, led USFWS, USFS, MFWP, and IGBC biologists in 2002 to designate the northern half of the Divide landscape on the Helena Ranger District as part of a “Grizzly Bear Distribution Zone”—an area outside the Recovery Zone that was beginning to be occupied by grizzlies. Given the number of credible grizzly reports in the southern portion of the Divide landscape since 2002, the HNF has now extended this Distribution Zone southward to encompass the entire landscape down to the Helena/Beaverhead-Deerlodge NF boundary [USDA 2013]. In sum: research and monitoring over the last decade clearly point to a continuing “positive trajectory in population trend” in the NCDE grizzly bear population (Mace *et al*. 2011).

Management Direction

Regional Management Guidance

The grizzly bear has been listed as a threatened species in the lower 48 states since 1975. The governing management document is the *Grizzly Bear Recovery Plan*, initially approved in 1982 and revised in 1993 (USDI 1993). The 1993 version remains in effect today, although as bear distribution and management needs have shifted, the *Recovery Plan* has been clarified by more recent documents such as the *Interagency Grizzly Bear Committee Guidelines* (IGBC 1986), the Grizzly Bear

Management Plan for Western Montana (Dood *et al*. 2006), and the *Biological Assessment for Grizzly Bears on the Westside of the Helena National Forest* (USDA 2013). The 1993 *Recovery Plan* identified seven grizzly bear ecosystems (5 currently occupied, 2 unoccupied) around which the primary recovery zones were to be centered. The intent of the *Recovery Plan* has been to generate viable grizzly populations sufficient to remove the bear from the Endangered Species List in each of the 7 ecosystems. The U.S. Fish and Wildlife Service (USFWS) felt that this goal had been achieved in the Greater Yellowstone Ecosystem in 2007, and delisted the species at that time. This action was reversed by a court ruling in 2009 (due primarily to concerns over the decline of whitebark pine as a food source) and, as a result, grizzlies remain listed as threatened in all 7 ecosystems.

More recently (2013), MFWP, Montana Department of Natural Resources and Conservation (DNRC), the Confederated Salish and Kootenai Tribes, Glacier National Park, the Forest Service, and USFWS developed a draft conservation strategy for grizzly bears in the NCDE.

Interagency Grizzly Bear Committee Guidelines

The 1986 *Interagency Grizzly Bear Committee Guidelines (*IGBC 1986, p. 3-5*)* outline five "Management Situations" (MS's), three of which (MS 1, 2, and 3) apply to areas in and around recovery zones and two of which (MS 4 and 5) apply to areas further afield. The *Helena Forest Plan* has mapped the areas where Management Situations 1 and 2 apply (namely, inside the NCDE Recovery Zone) but it has not done so for Management Situations 3, 4, and 5 (since their introduction post-dated the release of the *HFP*). The status of these latter three management situations in any given area is often in a state of flux, due to shifts in human settlement, roading, recreational activities, vegetation conditions, bear distribution, and so on. As a result, their site-specific delineation has been left to biologists at project level as needed.

Given the small number and low density of grizzlies in the Divide landscape, the management situation that most often applies (irrespective of the area's status as a 'Distribution Zone'), is *MS 5*. Although the description of MS 5 in the *Guidelines* is an imperfect fit for much of the landscape, it comes the closest of the 5 management situations. Population and habitat conditions for MS 5 are described as follows: "Grizzlies do not occur, or occur only rarely in the area. Habitat may be unsuitable, unavailable, or suitable and available but unoccupied. The area lacks survival and recovery values for the species or said values are unknown….." (IGBC 1986). A primary element that reduces suitability of grizzly bear habitat in the Divide landscape is the density of roads and motor trails. Management direction for MS 5 is that grizzlies are to be given deference up to a point but are subject to "control" in cases of conflicts with humans. Maintenance of habitat for grizzlies is an "option" but "is not directed." Note, though, that the Divide Landscape has never officially been designated MS-5.

Helena Forest Plan

The *Helena Forest Plan (HFP)* (1986) addresses grizzly bear management via the following forestwide standards and guidelines:

- *HFP Appendix D—Guidelines for Management of Grizzly Bear Habitat:* These guidelines provide direction based on the 1982 version of the *Grizzly Bear Recovery Plan.* "Grizzly bear habitat" (as of 1986) is identified and population/habitat conditions and management direction are specified for 2 "management situations" that occur in areas occupied by grizzlies. All grizzly bear habitat identified in the *Forest Plan* is on the Lincoln Ranger District: management situation 1 lands are inside the NCDE Recovery Area; management situation 2 lands are south of the NCDE boundary.

- *HFP Appendix E—Grizzly Bear Management Outside of Recovery Areas:* These guidelines specify steps to be taken in identifying and inventorying potential grizzly habitat, documenting grizzly "biological activity centers" (BACs), protecting areas used by grizzlies, and determining if management direction for the areas should be changed to emphasize grizzly bear needs. The guidelines apply to the Divide, Big Belts, and Elkhorns landscapes on the Helena and Townsend Ranger Districts, as well as the Lincoln District south of Highway 200.

- *Indicator Species* (*HFP*, p. II/17): The grizzly bear is to be monitored as a management indicator for the threatened and endangered species group—the objective being to determine whether or not viable populations are being maintained.

- *Biological Evaluations* (*HFP*, p. II/19): A biological evaluation must be written for all projects that have potential to impact grizzly bears, and appropriate mitigations developed (in consultation with the USFWS, if necessary) if adverse impacts are likely.

- *Field Studies* (*HFP*, p. II/19): Field studies should be conducted in areas not yet designated as occupied grizzly habitat but where grizzlies are known to be present. The areas should be managed according to guidelines in *Appendix E.*

- *Open Road Density* (*HFP*, p. II/19): In occupied grizzly habitat, so as to minimize human-caused mortality, open road density should not exceed 0.55 mi/mi². Note that occupied grizzly habitat refers to the map in the Forest Plan (*HFP*, p. D/3)

Habitat and Population in the Divide Landscape and the Project Area

The Divide Landscape

Core Areas and Road Densities

Effective grizzly bear range requires a reasonable distribution of "core areas" that can provide the bears with basic habitat components (food and cover) in an environment free from motorized disturbance and other forms of "high-intensity" human use (as along popular hiking trails) during the period when bears are active (April to November) (IGBC Motorized Access Management guidelines 1998). The HNF delineates grizzly bear core areas as blocks of suitable habitat larger than 2,500 acres with all boundaries 0.3 miles from motorized routes open during the non-denning period (see IGBC 1998; USDA 2005, p. 7, 32; USDI 2006, p. 22). While these parameters were originally designed to be applied only to occupied grizzly bear habitat in and around Recovery Zones (Management Situations 1 and 2), they are applied here to the Distribution Zone as a way of comparing infrastructure for motorized use.

The Divide landscape currently supports 8 "core" areas with potential to provide grizzly bears with refuge from human interference [table 164]. These non-motorized areas represent 30 percent of the landscape [all lands, public and private, within HNF administrative boundaries] south of Highway 12 but only 11 percent north of the highway (23 percent overall). This compares to core area percentages of 67 percent - 75 percent in Bear Management Subunits within the NCDE Recovery Zone on the Lincoln District (USDI 2006, p. 21-22).

The effectiveness of these unroaded areas as grizzly bear habitat—in terms of their size, abundance and distribution of key habitat components, and their proximity to other such core areas—is variable. The Electric Peak Roadless Area, for example, provides productive foraging habitat and excellent cover in an extensive unroaded environment—and it is adjacent to similar habitat on the Beaverhead/Deerlodge NF to the south. The Sweeney Creek–Austin Creek Area, on the other hand,

is only slightly larger than the minimum 2,500 acres, surrounded on 3 sides by high-use roads and human settlement, and provides productive habitat primarily in an array of highly fragmented drainage-head sites. Grizzly bears have been reported in both areas, but observations have been considerably more consistent in the upper Little Blackfoot. It should be noted that grizzly bears have also been reported, both north and south of Highway 12, in a number of non-motorized habitat blocks in the 1,000 to 2,500 acre range. The Divide landscape, while not a region with enough secure habitat to provide for a core grizzly bear population, does provide habitat enclaves for bears moving through and, apparently, for a small resident population.

Table 164. Potential grizzly bear core areas within the Expanded Distribution Zone

Potential "Core" Areas	Acres
South of Highway 12	
Lazyman Gulch Roadless Area	10,260
Jericho Mountain Roadless Area	6,993
Treasure Mountain	2,970
Electric Peak Roadless Area	22,383
Baldy Ridge	2,538
North of Highway 12	
Black Mountain (north)	3,780
Meyers Hill – Deadman Creek	2,808
Sweeney Creek – Austin Creek	2,673
Expanded Grizzly Bear Distribution Zone	54,405

In addition to the presence of core areas, the overall density and distribution of roads and motor trails in a given area is a key to determining habitat suitability for grizzly bears. Mace and Manley (1993) found that in Montana adult bears use habitat with *open* road densities that exceed 1.0 mi/mi^2 less than expected (if habitat use were random). All sex and age classes used habitat with *total* road densities above 2.0 mi/mi^2 less than expected. Grizzlies generally adjust to disturbance along roads by avoiding the areas around regularly-traveled routes. This lowers the likelihood of grizzly-human conflict in areas where roads and multiple use management are more common, but it diminishes the amount of habitat available to the bears (Mace and Waller 1998).

The IGBC Motorized Access guidelines (IGBC 1998) thus recommend calculating the overall density of open roads and total roads (open + restricted) in addition to delineating core areas. Although "closed" or "restricted" roads exclude motor vehicles, they still provide travelways for hikers, equestrians, bicycle riders, and hunters afoot. If these uses occur at high levels, the ability of an area to hold grizzly bears may be compromised much as it would be by open roads and motor trails (Mace and Manly 1993). Route densities for the Divide landscape are shown in table 165.

Table 165. Densities of all open roads on public and private lands within HNF Forest Administrative boundaries north and south of U.S Highway 12

Divide Landscape	Area (mi²)	Open Road miles	Open Road Density (mi/mi²)
North of Highway 12	127	264	2.1
South of Highway 12	238	299	1.3
Total	365	563	1.5

Table 165 shows that open road densities in the Divide landscape are substantially higher north of U.S. Highway 12 than they are south of the highway. The overall open road density of 1.5 mi/mi² is generally higher than densities in Bear Management Subunits of the NCDE Recovery Zone on the Lincoln Ranger District. The fact that grizzlies continue to move through and occupy parts of the Divide landscape in spite of road densities that approach or exceed levels recommended by Mace and Manley (1993) may reflect the rough, primitive condition of many Forest and private roads and the low levels of vehicle use they receive in summer—to the point that bears may often not perceive them as functioning roads. The presence of a few unroaded enclaves—the size of core areas in the Recovery Zone—also ameliorates the impact of dense road networks in other areas.

Grizzly Bear Occurrence in the Landscape

Grizzly bears have been observed throughout the Divide landscape numerous times over the past 25 years [HNF wildlife observation data base; MFWP records (Helena Area Resource Office)]. A majority of observations have come from the northern half of the landscape toward the NCDE Recovery Zone and have probably been of bears that den and center much of their activity in the Blackfoot landscape of the Lincoln Ranger District but that range southward during part of the year.

South of U.S. Highway 12, most observations have come from the upper reaches of the Little Blackfoot watershed and along the border between the HNF and the Beaverhead-Deerlodge NF (including the upper Cataract and Basin Creek drainages just to the south). The number of credible grizzly bear reports in these areas has been increasing in recent years as the population in the NCDE expands to the point that more bears are exploring new territory further to the south (J. Jonkel, personal communication, 2007). Be that as it may, recent monitoring efforts designed to identify individual grizzlies through DNA analysis of hair samples collected from rub trees (2009 to 2010) have yet to turn up any sign of the bears south of Highway 12—a further indication of their scarcity in this area.

The tally in table 166 is incomplete, but it includes most credible observations made by or reported to HNF and Helena-area MFWP biologists from 1991 to 2012. Most of the reports are from the HNF, but 7 observations are from south of the Forest boundary on the Beaverhead-Deerlodge NF: One of these consists of a series of close-up photos from a camera station on the Continental Divide south of Electric Peak in 2012; another is a MFWP report of a grizzly shot in the Boulder River Drainage further to the south [both, obviously, verified occurrences]. Reports that were vague or otherwise dubious (of which there are many) have been eliminated, and those deemed credible by professional wildlife specialists or that seemed reliable for other reasons have been retained. The actual number of grizzlies that have ranged into the Divide landscape since 1991 is considerably less than these totals might suggest since some of the bears have been observed and tallied multiple times over 20 years.

Table 166. Credible observations of grizzly bears in the Divide landscape reported 1991-2012

Area	Observations from HNF Records	Additional Observations from MFWP Records	Total Observations 1991-2011
North of U.S. Highway 12	22	22	44
South of U.S. Highway 12	12	23	35
Divide Landscape Total	34	45	89

North Divide

The northern half of the Divide landscape is an area still very much in transition with regard to its role in grizzly bear recovery. Although it lies adjacent to the Blackfoot landscape where a resident grizzly population has been established for several decades, only its northernmost reaches—the Little Prickly Pear watershed—may accommodate resident bears (animals that either den in the upper drainages or spend a substantial portion of their active spring-summer-fall season there). Bear activity in the rest of the landscape appears fluid, associated with long-distance dispersal or with wide-ranging seasonal forays beyond core home ranges to the north. The number of bears likely to be present in the northern Divide landscape at any given time is unknown. But, two decades of fortuitous observations and occasional targeted field checks suggest the following:

- In spite of the fact that the grizzly bears have been reported in this area north of Highway 12 Pass for over two decades, there is currently no bonafide "resident" population in the area south of the Little Prickly Pear watershed (at the northern end of the Divide landscape).
- Bears observed south of the Little Prickly Pear watershed appear to be either transient animals moving southward through a linkage zone or those with ranges centered further north (on the Lincoln Ranger District or the Little Prickly Pear watershed) that sometimes foray southward.
- Neither denning nor reproduction has been documented in the Divide landscape between the Dog Creek/Little Prickly Pear divide in the north and the upper reaches of the Little Blackfoot watershed to the south.

The north Divide landscape is therefore not currently part of a Biological Activity Center for grizzlies [which requires that female bears with cubs be observed 5 out of 10 years (*HFP*, Appendix E].

South Divide

Grizzly bears that occupy or move through the Expanded Distribution Zone in the southern half of the Divide landscape where the Telegraph Project Area is located also range into the drainages flowing southward into Boulder River on the Beaverhead-Deerlodge NF. Although rural residences, open roads, motorized trails, developed recreational facilities (campgrounds, etc.), livestock grazing, mining operations, and other human activities are spread throughout this block of territory, substantial portions of it are unroaded or lightly roaded. While the area is not sufficiently untrammeled to serve as a Recovery Zone, the fact that grizzlies seem to have persisted here for at least two decades (albeit in very low numbers) suggests that it has a role to play in the recovery process—potentially providing local habituation opportunities and linkage between bonafide Recovery Zones.

As with the area north of Highway 12, the southern half of the Divide landscape is still very much in transition with regard to its role in grizzly bear recovery. At this time, the size of the local grizzly

population is unknown and its status uncertain. All that can be said, based on field observations to this point, is the following:

- Population density is very low (only 5 verified occurrences in the general area 2004-2012—although several additional observations are highly credible).
- Reproduction is uncommon (4 reports of a sow with cubs since 1991).
- The stability and persistence of the current population may be tenuous (since the presence of grizzlies may be indicative of a linkage zone with transient individuals rather than an incipient Biological Activity Center) (*HFP,* Appendix E).

The Telegraph Project Area

The Telegraph project area encompasses only one potential grizzly bear 'core area' in its entirety—the compact Treasure Mountain core area (roughly 2,970 acres); but it also takes in the northern fringes of the Electric Peak Roadless Area (22,383 acres) as well as the western edge of the Jericho Mountain Roadless Area (6,993 acres). In addition to these larger non-motorized areas, the project area includes a number of productive riparian and wetland habitats—often around the heads of drainages—that provide excellent cover and forage within unroaded blocks ranging from a few hundred to more than 2,000 acres. Many of the roads that approach these sites are little used most of the year and allow bears to range through the area with little chance of directly encountering a human.

As discussed earlier, the Telegraph project area is situated near the center of a potential linkage zone that covers much of the National Forest on both sides of the Continental Divide. While the Divide represents the central feature of this zone, grizzly bears moving through the area are not confined to a narrow corridor astride the Divide Ridge. While there is a considerable amount of good habitat near the Divide—provided by the headwaters of numerous local steams that originate just below the ridge—the bears would be able to find numerous suitable routes through this part of the landscape, including some through the project area. Movement through the area will be complicated in the next few years by the downfall of forest overstory in the ubiquitous beetle-killed lodgepole pine forests. This will cause bears to alter current travel routes and it will also provide them with a different kind of cover than that currently provided by standing tree trunks.

Reports of grizzly bears have not been widespread throughout the Telegraph project area over the past 20 years. However, since 2007, several observations have come from a local area in the upper reaches of Telegraph Creek. Some of the reports have come from cabin owners, who have described a large grizzly probing the areas around the cabins; others have come from hunters, hikers, and forest workers who have glimpsed bears that they believed to be grizzlies or have come upon and measured large bear tracks and scat. At present, we do not know whether these observations are of multiple bears or one individual, if the bear/bears are on a local range or moving through the linkage zone, or, if they are resident animals, what their ranges and movement patterns might be.

Environmental Consequences

The following measures are used to evaluate effects to grizzly bears:

- Effects to forested cover – i.e., acres treated/remaining forested acres in the project area
- Acres of potential forage created in the project area
- Human activities that could lead to disturbance, displacement, or direct mortality

Effects Common to All Alternatives

Untreated portions of the Project area will continue to progress through succession regardless of alternative. Disturbance processes including climate change, insect infestations, disease, and fire will continue to influence the project area. At any given time, the project area will comprise a variety of successional stages. Dead and dying trees associated with the mountain pine beetle outbreak would continue to fall to the ground. However, because of the productivity of the project area in general, the MPB impacts would not likely result in long term 'deforestation' unless a severe wildfire were to occur after news forests have regenerated.

Effects Common to All Action Alternatives

Timber harvest and prescribed fire in the action alternatives would remove conifers from stands that are currently providing forested cover. This would potentially increase forage but would reduce tree density that currently provides cover. Post-disturbance conditions following harvest differ from those following most natural disturbances in terms of the types, levels, and patterns of structural legacies (Franklin et al. 2002). Remnant trees have important influences on stand development (ibid). While traditional clearcutting left few to no remnant trees, all proposed treatments with the Telegraph project would leave some remnants where living trees are available. Treatments would generally promote seral species composition (lodgepole pine) over shade-tolerant competitors (spruce and fir), and promote more open structures.

The action alternatives would create patches and patterns that to some extent emulate natural fire which has been excluded from this ecosystem for a century. The restoration of fire adapted ecosystems does not involve simply the maintenance of open, late seral stands, but also promoting a mosaic of conditions on the landscape on all forest types. Proposed treatments would promote resilience to disturbances by creating a mosaic of conditions in densities, species composition, and age class that differ from untreated areas that would help ensure that not all forests are equally susceptible to the same disturbances at the same time.

While grizzly bears make extensive use of forest cover, they generally prefer to operate in a landscape with a variety of habitat formations ranging from dense interior forest to open meadowlands (Dood et al. 2006, p. 18).

Alternative 1

Direct and Indirect Effects

There are no treatments proposed under this alternative, so there would be no direct effects to bears or their habitat in the project area. Risk of wildfire would remain high;, therefore the likelihood of long-term loss of grizzly bear habitat from stand replacing wildfire is greatest under this alternative. Also, due to continued fire suppression and insects and disease, whitebark pine is anticipated to continue to decline under this alternative. Fallen trees, the result of the mountain pine beetle outbreak, could present local barriers to movement.

Alternatives 2 and 3

Direct and Indirect Effects

Most of the habitat management guidelines in the MFWP Grizzly Bear Management Plan for Western Montana (Dood et al. 2006, p. 48-49), as well as those in previous management guidance dating back to the Grizzly Bear Recovery Plan (1982), are focused on roads (as agents of fragmentation and as conduits for bringing humans into bear habitat). A few guidelines, however, deal with habitat manipulation and human presence in general (including livestock grazing) and

apply to the Telegraph project. Table 167 shows the differences in alternatives for grizzly bear habitat components of cover and forage. When trees are removed from a site, tree cover and shade are reduced while ground cover plants may become more abundant. In much of the project area, this effect would last up to about 30 years (depending upon the site) until trees become dense enough to shade out the early successional understory plants. On drier sites containing ponderosa pine trees, however, more open understory conditions would be maintained over the long term (see the *Forested Vegetation Background Report*).

Some, but not all, forested sites have the potential to produce vegetation that provides food for bears following logging. Most harvest units overlap habitat types that have the potential to increase production of bear foods such as huckleberries and serviceberries (Pfister et al. 1977). [See *Assumptions, Information Used, and Methodologies* section.]

Table 167. Changes in grizzly bear cover and forage habitat by treatment type and alternative (acres)

Treatment Type	Habitat Effects	Alternative 2	Alternative 3
Regeneration Harvest	Reduction in cover	3,484	1,856
	Potential increase in forage	1,378	727
Intermediate Harvest	Reduction in cover	434	434
	Potential increase in forage	36	36
Precommercial Thinning	Reduction in cover	1,786	1,289
	Potential increase in forage	877	537
Prescribed Fire	Reduction in cover	1,050	606
	Potential increase in forage	110	82

All harvest will result in a reduction in cover, with regeneration harvest resulting in a long-term loss of overhead forested cover and alternative 2 resulting in the greatest reduction of both action alternatives. As a result bear use of regenerated sites could be reduced and most use within the next 10 years would be expected to occur largely near edges of treatment areas or riparian buffers (i.e., areas that provide cover). Cover will also be reduced on partial or intermediate harvest units, although residual overstory cover will be maintained on sites treated. Also riparian buffers would be maintained and interspersed throughout many units, further limiting sight distances. It is expected that that overall intermediate harvest prescriptions would provide adequate cover to provide for bear security. The amount of human activity and access also determines the likelihood a harvest site would be used by bears. There will be no change in public access within the project area; however 8.5 and 3.4 miles of temporary road would be built in alternatives 2 and 3 respectively. Most of the timber harvest occurs adjacent to or in the vicinity of an existing road where bear use is already expected to be low (figure 60).

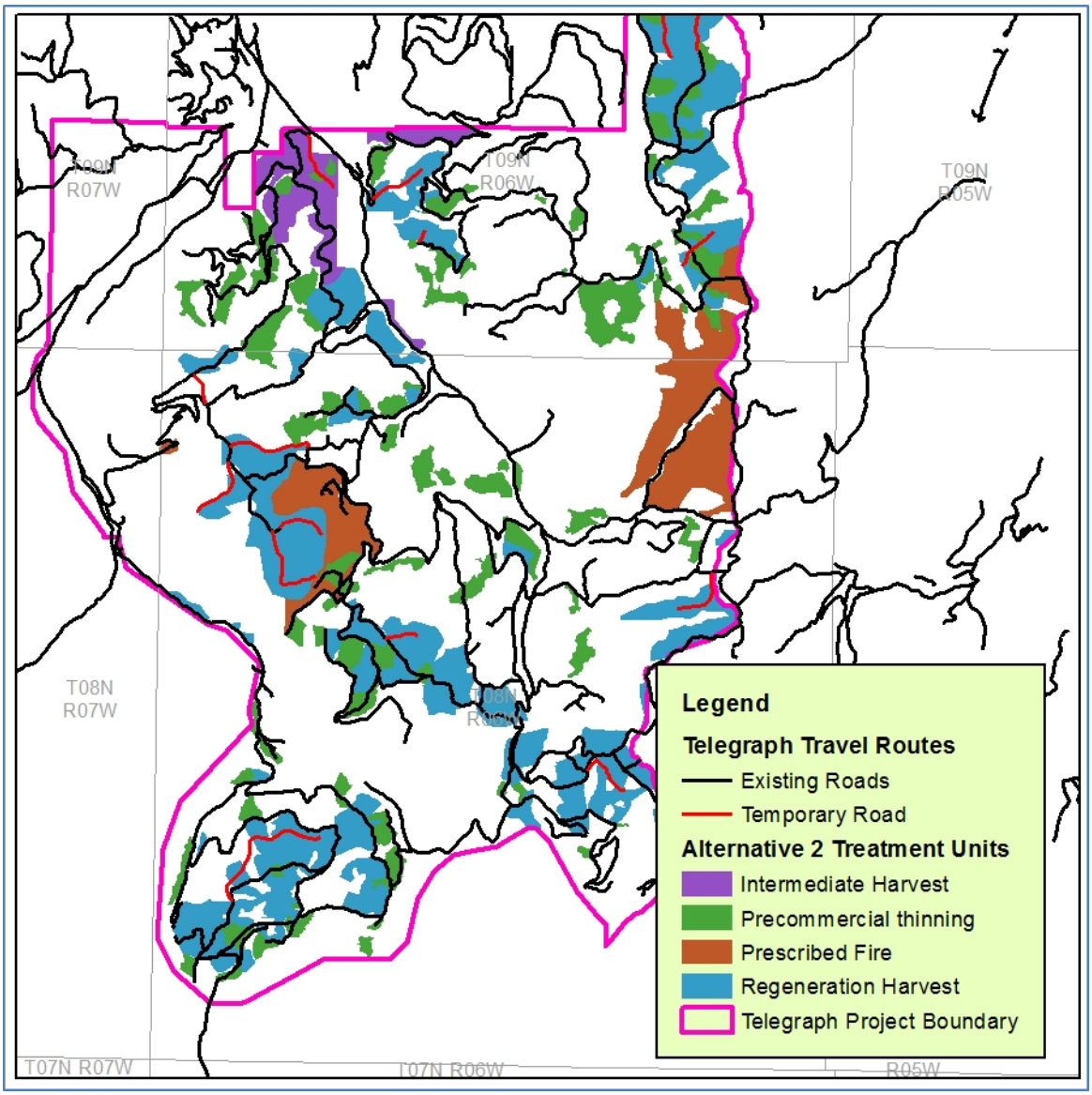


Figure 60. Proximity of treatment units to roads

While timber harvest would result in a long-term reduction in forested cover, available forage would increase in the openings associated with harvest. For example Nielson et al. (2004) found that the occurrence of critical grizzly bear foods, including roots and tubers, herbaceous vegetation and ants were more common in clearcuts than the surrounding forest. Also shrubs including huckleberry and buffalo berry were found to increase, although this varied by site (Martin 1983, Zager et al. 1983). Alternative 2 would result in the increase in forage on up to approximately 2,291 acres associated with timber harvest; alternative 3 up to 1,300 acres (see table 167).

Bear use of harvest units varies over time. Some research indicates that grizzly don't utilize harvest units until 10 years after treatment (MDNRC 2010), whereas other research found that grizzlies utilized recent clearcuts (Nielson et al. 2004, Wielgus and Vernier 2003). Other studies indicate that intermediate aged clearcuts (approximately 30 years of age) were selected throughout the year, whereas recent and old clearcuts were utilized largely early in the year and again between early August and denning (Nielson et al. 2004). While grasses and forbs would be expected to increase on

all sites, increases in shrubs (e.g., huckleberries) were found to be greatest on moist sites with northern and easterly aspects (Martin 1980). Consequently cover and forage availability as well as bear use will vary over time and by site.

Prescribed fire is proposed on 1,050 acres in alternative 2 and 606 acres in alternative 3. The mixed severity prescription should create openings that favor forage development. Prescribed fire would result in a flush of herbaceous vegetation and shrubs on up to 110 acres in alternative 2 and 82 acres in alternative 3 (Martin 1980).

All timber harvest would be implemented via ground-based logging systems. Helicopter logging is not included in either action alternative. As mentioned, 8.5 miles of temporary road would be constructed in alternative 2 and 3.4 in alternative 3. An additional 29 miles of roads that are currently closed yearlong to the public would be used for logging activities in alternative 2; 26 miles in alternative 3. Motorized use on roads closed yearlong or on temporary roads during project activities could result in short-term disturbance and displacement of grizzly bears. Once harvest related activities have been completed, the temporary roads would be obliterated and the closed roads used for the logging activities would return to the existing status – closed. Most of the timber harvest would occur outside of the denning period with the exception of units 17, 18, 52, 143, 145, and 155.

Both action alternatives would also improve whitebark pine; alternative 2 includes 781 acres of treatments that will benefit whitebark pine; alternative 3 includes 366 acres. In terms of whitebark pine restoration, alternative 2 would be more favorable for grizzly bears. See the *Forested Habitats of Special Concern Background Report*.

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on grizzly bear habitat in the context of the myriad of other past, present, and future effects on grizzly bear habitat from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. The following table summarizes the key items that are taken into consideration for the cumulative effects analysis for grizzly bear habitat. See also Appendix E in the Wildlife Specialist Report, *Cumulative Effects*, for more information.

Table 168. Cumulative effects considerations for grizzly bear habitat

Parameter	Discussion
Spatial Boundary	The spatial boundary needs to be expanded to the point at which riparian habitats are no longer measurably affected. The Divide Landscape - South satisfies this requirement because this is the scale at which the effects to grizzly bears can be examined at the stand or treatment unit. The boundary also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1960s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the project boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the vegetative and species composition of grizzly bear habitat that comprise the project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, livestock grazing, mining, road construction, the forestwide Roadside Hazard Tree Removal and Fuels Reduction Project and private land timber harvest.
	Ongoing and future activities include the Red Mountain Flume/Chessman Reservoir project, Tenmile/South Helena project, livestock grazing, routine use and maintenance of Forest trails and roads, Divide Travel Planning, and the Forest Plan Amendment to incorporate relevant direction from the Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy.
Measurement Indicators	Measurements are qualitative
Thresholds	No threshold is applicable to this indicator
Methods	Past, ongoing, and reasonably foreseeable activities are described qualitatively based on information derived from the FACTS database.
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized.

Past Activities

Past forest management actions such as timber harvest/salvage, precommercial thinning, and prescribed fire have generally been favorable for grizzly bears because these activities created a mosaic of forest age classes and increased vegetation diversity, and bear forage opportunities. However, roads built for these activities and left open for use have reduced grizzly habitat quality. Table 169 summarizes past harvest activities in the Divide Landscape – South.

Table 169. Past Forest Service timber harvest activities and their impacts on grizzly bear habitat in the Divide Landscape - South

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Regeneration	4,080	These past harvest treatments have resulted in landscape patterns today that favor grizzly bear habitat – i.e., a mosaic of forested age classes.
	Intermediate	264	
Forest Service Timber Harvest 1980s through 1990s	Regeneration	3,220	
	Intermediate	465	
Forest Service Timber Harvest 2000 to Present	Regeneration	1,089	
	Intermediate	1,977	

Ongoing Activities

Ongoing activities that have improved prospects for grizzly bears include trail relocation projects that have removed trails from riparian areas to upslope locations (Blackfoot Meadows, CDNST); mine reclamation projects, some of which have improved riparian habitat function favorable to bears; establishment of the Statewide OHV Plan (2001) which prohibits riding off established motorized routes; grazing allotment revisions that have often reduced cattle numbers and improved habitat; and road and motorized trail closures associated with timber sales (Clancy-Unionville, Sound Wood, Treasure Mountain) that have enlarged non-motorized blocks of habitat.

Ongoing activities that may have reduced the quality of grizzly bear habitat in the Divide Landscape – South include road permits across the HNF to access private holdings; retention of private recreational residences on the HNF (especially near the Divide at MacDonald Pass); small mining operations; construction and maintenance of communication sites and power lines; and widespread fencing associated with grazing allotments that complicate movement. The ongoing Red Mountain Flume/Chessman Reservoir Project is removing dead lodgepole pine from 490 acres in the upper Tenmile drainage. The resulting habitat opportunity for grizzly bears would be mixed. Private land development continues to create sites that generate problems for animals striving to move through or occupy the landscape (barriers to movement, habitat loss, bear attractants, dogs). Recent purchase of 27,600 acres of private ranchland in the Spotted Dog drainage by MFWP will forestall subdivision and development of those lands immediately west of the HNF boundary and allow them to remain in a condition more amenable to grizzly bear habitation and passage. The improvement of the Rimini Road could also affect grizzly bears.

Reasonably Foreseeable Activities

Reasonably foreseeable activities that may affect grizzly bears include the Tenmile/South Helena Project which would alter dead tree environments over a wide area from the Continental Divide eastward to the outskirts of Helena. Private land timber harvest could also affect grizzly bears and their habitat. The effects on grizzly bear habitat would be mixed – some beneficial, some problematic. The Divide Travel Plan should prove beneficial for grizzly bears compared to the existing condition. Several miles of roads will be closed in the Divide Landscape creating non-motorized blocks that could provide secure habitat for grizzly bears.

The Forest Plan amendment to incorporate relevant direction from the NCDE grizzly bear draft conservation strategy is designed to integrate relevant habitat-related direction from the Northern Continental Divide Ecosystem (NCDE) Grizzly Bear Conservation Strategy (GBCS) into the forest plans for the Helena, Kootenai, Lewis and Clark and Lolo National Forests (also referred to as “amendment forests”) to have an integrated set of plan direction (referred to as plan components from this point forward) consistent across the national forests that are a part of the NCDE.

Cumulative Effects Conclusions

Alternative 1 maintains the status quo with regards to landscape level effects on grizzly bears. Untreated stands that have been affected by the mountain pine beetle would continue to unravel resulting in mixed habitat opportunities for grizzly bears.

Implementation of alternative 2 or 3 would contribute to the effects associated with past timber and fuels activities that are partially responsible for the existing condition. Specifically, the project area would become more open in the short term while stands regenerate and develop understories. Cover would be removed in both alternatives 2 and 3 adding to those impacts associated with past timber harvest and fuels activities. Implementation of either alternative 2 or 3 would contribute to the effects associated with the ongoing Red Mountain Flume/Chessman Reservoir project, private land timber harvest, and grazing, and the proposed Tenmile/South Helena project. As stands are thinned, conditions will favor production of herbaceous and shrub habitats that are attractive to grizzly bears. Alternatives 2 and 3 would also add to the impacts associated with annual road maintenance due to temporary road construction associated with those alternatives. Cumulatively, these activities may temporarily disrupt animal movement. Travel plan implementation, however, should offset impacts associated with alternatives 2 and 3 because it will result in the creation of large unroaded areas that should provide some additional secure habitat for grizzly bears. Alternatives 2 and 3 should complement the Forest plan amendment to incorporate relevant direction from the NCDE grizzly bear conservation strategy to existing Forest Plans.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

Vegetation management can negatively affect grizzly bears by (1) removing cover; (2) disturbing or displacing bears from habitat during the logging period; (3) increasing human/grizzly bear conflicts or mortalities as a result of unsecured attractants; and (4) increasing mortality risk or displacement due to new roads into previously roadless areas and/or increased vehicular use on existing restricted roads. Conversely, vegetation management may result in positive effects on grizzly bear habitat once the project is complete, provided key habitats such as riparian areas and known food production areas are maintained or enhanced. For instance, tree removal for thinning or timber harvest and prescribed fire can result in localized increases in bear foods through increased growth of grasses, forbs, and berry-producing shrubs (Zager et al. 1983).

Changes in the distribution, quantity, and quality of cover are not necessarily detrimental to grizzly bears. Grizzly bears will use a variety of habitats including open-canopied habitats such as areas where timber has been harvested (Waller and Mace 1997 and Mace and Waller 1997).

Both action alternatives would improve landscape level foraging habitat, enhance whitebark pine, result in short term reductions in cover, and potentially increase the risk of bear/human interaction during project implementation. However, implementation of either alternative 2 or 3 "***may affect but is not likely to adversely***" affect grizzly bears for the following reasons:

- A majority of the project area would remain untreated in either action alternative (71 percent in alternative 2 and 82 percent in alternative 3);
- Temporary roads would be closed to the public;
- Proposed treatments would promote the long-term sustainability of whitebark pine, increase stand and landscape level forage, and restore fire to the landscape while reducing the risk of stand replacing wildfire and a further reduction in grizzly bear habitat; and

- Proper food storage would be required for contractors and Forest administrators during project activities.

Regulatory Framework and Forest Plan Consistency

Forest Plan standards for grizzly bears that are applicable to this project are:

- A biological evaluation will be written for all projects that have potential to impact any T&E species or its habitat. All evaluations will address each projects potential to adversely modify a listed species habitat or behavior. If an adverse impact is determined, mitigation measures will be developed to avoid any adverse modification of a listed species habitat or behavior. If all possible mitigation measures do not result in a no affect determination, then informal and/or formal consultation with the U.S. Fish and Wildlife Service will be initiated. The analysis of TES species in the Wildlife Specialist's Report serves as the Biological Evaluation for this project. A separate Biological Assessment of T&E species will be prepared and submitted to the USFWS for consultation.
- Initiate field studies in undesignated areas known to be used by grizzlies, to determine if the areas should be designated as grizzly habitat. Until sufficient evidence is available to determine the status of these areas, manage them according to Appendix E, Grizzly Management Guidelines Outside of Recovery Areas. At this time, the size of the local grizzly population is unknown and its status uncertain. All that can be said, based on field observations to this point, is the following:
    - Population density is very low (only 5 verified occurrences in the general area 2004 to 2012—although several additional observations are highly credible).
    - Reproduction is uncommon (4 reports of a sow with cubs since 1991).
    - The stability and persistence of the current population may be tenuous (since the presence of grizzlies may be indicative of a linkage zone with transient individuals rather than an incipient Biological Activity Center) (*HFP*, Appendix E).

Recommendations for Removing, Avoiding, or Compensating for Adverse Effects

USFWS Terms and Conditions

In its *Biological Opinion on the Effects of the Helena National Forest Plan on Grizzly Bears* (USDI 2014), the USFWS has concluded that that continued implementation of the Helena Forest Plan in the Expanded Distribution Zone is not likely to jeopardize the continued existence of the grizzly bear. The HNF is thus able to go forward with actions such as the Telegraph Project as long as they comply with the "incidental take statement" in the Biological Opinion. Included in the statement are a number of non-discretionary "terms and conditions" with which the Forest must comply in order to "[r]educe the potential for mortality and displacement of grizzly bears on the Forest, both inside and outside the NCDE" (USDI 2014, p. 62-63).

The first two terms may be applicable to vegetation projects such as the Telegraph project: (1) The HNF will consult with the USFWS if a net increase in permanent roads in the Divide landscape exceeds 5 linear miles over the next 10 years (with decommissioning of roads being taken into account) and (2) consultation will also be required for a net increase of more than 30 miles of temporary roads in the landscape over the next 10 years. The remaining 3 terms deal with management of grazing allotments and do not apply to vegetation projects.

The Telegraph Project would not add any permanent roads to the landscape, but it would add up to 8.5 miles of temporary road (closed to the public) for the duration of the project (alternative 2). At this point, 8.5 miles falls short of the 30-mile threshold for the coming 10-year period.

USFWS Conservation Recommendations

In addition to these "terms and conditions," the USFWS has also included four "conservation recommendations" in its Biological Opinion. These involve (1) identifying and managing linkage habitat between ecosystems, (2) lowering road densities, (3) expanding food storage orders across the Forest (for back-country provisions, garbage, livestock feed, etc.), and (4) minimizing human activity in areas where grizzly bears concentrate seasonally.

As mentioned above, the project would not add to net density of permanent roads, nor would it have any effect on sites where grizzly bears are known to concentrate. The effect of the project on linkage for grizzly bears through the Telegraph area has been discussed earlier in this report and is not considered to be significant. The food storage order would be applied to all human activity associated with implementation of the project.

Wolverine

Affected Environment

Wolverine Biology

Population Parameters and Habitat Relationships

The wolverine (*Gulo gulo*) is the largest terrestrial member of the weasel (mustelid) family in North America. Wolverines are generally solitary animals that range widely through a variety of habitats. While generally moving within established home ranges, they exhibit flexible behavior when environmental conditions (such as food supply) change, leading to movement beyond normal boundaries (Hatler 1989). For the most part, wolverine habitat is best defined in terms of adequate year-round food supplies in large sparsely inhabited areas, rather than in terms of particular topography or plant associations (Kelsall 1981, cited in Banci 1994). The exception is the affinity that female wolverines exhibit for higher elevation alpine sites with deep snow accumulation: such habitats are critical for establishment of natal and maternal dens in late winter and spring.

Preferred ranges are large, isolated tracts of land supporting a diverse prey base (Hornocker and Hash 1981). Wolverines will range into roaded areas with a modicum of human activity, but this use often occurs in winter when many of these areas become "remote" because of winter conditions. In summer, wolverines typically move to back-country areas at higher elevation. These behaviors effectively separate wolverines and humans other than for rare encounters. Human encroachment into existing refuges may threaten the wolverine's ability to maintain basic life history requirements (Copeland and Hudak 1995). Human activity (road building, developed campgrounds) near subalpine boulder talus sites may eliminate historic foraging or denning habitat. It has been hypothesized that persistence of wolverines in Montana, despite unlimited historic trapping and hunting, may be attributed to the presence of designated wilderness and remote, inaccessible habitat (Hornocker and Hash, 1981).

Wolverines occur in low densities in all places they have been studied. This has been attributed to naturally low reproductive rates and delayed sexual maturity as well as the unreliability of adequate food supplies throughout the year (Banci 1994). Maintenance of large territories and susceptibility to trapping also play a role (Hatler 1989). Overall, food availability seems to be the primary factor

determining movement and specific habitat use and is probably the primary limiting factor for wolverine populations (Hornocker and Hash 1981; Hatler 1989).

Although the wolverine is primarily a scavenger, it forages for most of its own food during the summer. Common foods include ground squirrels and marmots in open habitats, snowshoe hares and porcupines in forested areas, and mice, insects, berries, eggs, and ground nesting birds wherever they are found (Foresman 2012 p. 301-302). In winter, wolverines rely on carrion, and therefore are largely dependent upon the presence of other predators—although they are also able to take advantage of animals dying from disease, starvation, and accidents (falls, avalanches). They establish food caches in winter, and are adept at locating and raiding caches made by other wolverines and other carnivores such as mountain lions and foxes (Banci 1994). In fall they take advantage of gut piles and carcasses produced by hunters.

Beginning in late winter, reproducing females establish a series of dens: natal dens (birthing), maternal dens (post-birth, pre-weaning), and post weaning dens (rendezvous sites) (Copeland 1996). Natal dens are established at high elevations, typically in talus or cirque basins while maternal dens occur both in talus and among fallen trees (Copeland 1996). These dens, in order to be effective, require deep snow that persists into the spring. Rendezvous sites may occur in talus or coniferous riparian zones. Protection of natal/maternal denning habitat is critical for wolverine persistence.

Data collected in northwestern Montana indicate that average yearly ranges are 262 mi^2 for males and 241 mi^2 for females (Hornocker and Hash 1981). Although wolverines maintain large home ranges and can utilize almost any habitat, they are sensitive to human disturbance and are especially susceptible to trapping because of their opportunistic eating habits. Trapping accounts for a high proportion of wolverine mortality, affecting even populations that are locally protected (Squires et al. 2007; Inman et al. 2007; Banci 1994; Hatler 1989).

Key components of wolverine ecology revealed by research over the past three decades can be summarized as follows: (1) wolverines need adequate space to maintain populations; (2) population fragmentation must be avoided to maintain genetic, social, and spatial continuity of subpopulations; (3) the environment must be capable of providing a varied seasonal diet; and (4) security areas must be available to provide undisturbed seclusion for reproducing females (Copeland and Hudak 1995).

Recent research suggests that an additional factor of key importance to wolverines is the need for sites, somewhere within the home range, that retain deep snow well into the spring. McKelvey and others (2011) have argued that while wolverines can be considered habitat generalists in many respects, the fact that females are highly dependent on deep snow for establishing and maintaining viable reproductive dens ties wolverine populations to areas with persistent spring snow. At present, this includes many of the major mountain ranges in the northern and central Rockies, as well as the Cascade Range in Washington and Oregon. The implication of this dependence is that wolverine habitat in western North America is likely to become smaller and more fragmented as global warming diminishes the capacity of many sites to provide suitable spring snow cover (McKelvey et al. 2011).

Human Influences

Influence of Access Routes

Extensive unroaded or sparsely roaded habitat is often cited as a characteristic component of wolverine habitat (Claar et al. 1999; Banci 1994; Kelsall 1981, cited in Banci 1994), but it is unclear whether this is a cause-and-effect phenomenon or simply a function of the species' tendency, for a variety of reasons, to frequent higher elevation areas inhospitable to most human development. It is also possible that more wolverines are present in large wildland areas because of lower trapping

mortality than occurs among those animals frequenting environments with ready road and trail access (Banci 1994).

Research throughout the Rocky Mountain region of Canada and the northern U.S. reveals no definitive conclusions as to whether wolverines are attracted to or avoid Forest roads and trails. Krebs et al. (2007) found that roads did not seem to influence habitat associations of male wolverines. Copeland et al. (2007) found no aversion or attraction of wolverines to maintained trails, although they noted that, wolverines frequently used snow-packed roads in their study area as winter travel routes. In reviewing other studies, they noted a general "spatial separation of wolverines and human-related infrastructure" but did not single out roads as a key factor.

The main impact of unpaved Forest roads and motor trails on wolverines comes from their role as snowmobile routes in winter for trappers and recreationists. They allow trappers to work trap lines in wolverine habitat that they would otherwise have difficulty reaching. Trapping has been cited as a primary source of wolverine mortality in a variety of studies (see Squires et al. 2007; Inman et al. 2007; Ruggiero et al. 2007; Banci 1994; Hatler 1989; Hash 1987). Roadways also provide snowmobilers with pathways up to high alpine basins where disturbance of natal denning habitat may be negatively impacting wolverine production in some areas (Claar et al. 1999; Banci 1994; Squires et al. 2007).

Influence of Timber Management

Although wolverines are frequently found in forested habitats, most researchers have concluded that they are not necessarily dependent on specific vegetation patterns of the sort that are typically manipulated by timber harvest, prescribed fire, or other forest management practices [see USFWS proposed listing of the wolverine: http://federalregister.gov/a/2013-01478]. While wolverines avoid active management operations in the forest (logging, burning, and associated activity), they often move through and make use of the new open environments once humans have abandoned the areas, particularly if prey is readily available.

Hornocker and Hash (1981) noted that wolverines in Montana cross new clearcuts, but usually at a brisk pace. On the other hand, they saw no differences in movements, habitat use, or behavior between wolverines occupying the half of their study area that had been logged and the half that was not. Copeland (1996) observed wolverines in Idaho traveling through and foraging in recently burned forest in spite of lost canopy cover. Krebs et al. (2007) found that male wolverines used recently logged areas in British Columbia but that females were less likely to do so. They theorized that this reticence was more an aversion to human activity and infrastructure than to vegetation patterns. Wolverines are more apt to use these areas once the new openings begin to fill in with seedlings and saplings.

Banci (1994) concluded that travel corridors between large unroaded refuges need not possess the optimal vegetation and other habitat attributes needed to support self-sustaining wolverine populations. She noted that females appeared more hesitant to move through large blocks of marginal habitat than males. Whereas extensive human settlement and highways may hinder or divert long-distance movement by wolverines, topographic features and vegetation patterns (including those generated by timber harvest) appear not to do so. Lyon and others (1994) indicate that while habitat change produced by logging is obviously disruptive to movement patterns of marten and fisher, it appears to be much less so for lynx and wolverine.

Influence of Recreation

Low levels of dispersed recreation typical of trail systems, backcountry campsites, and low-grade Forest roads appear to have little influence on wolverines (Copeland et al. 2007, p. 2210). More

concentrated forms of recreation such as developed campgrounds, ski areas, heavily used motor trails, and recreational cabins affect wolverines much as do most centers of human activity and infrastructure: wolverines avoid them for the most part, venturing in only when activity levels are low, typically at night, to investigate potential food sources. These forms of recreation tend to displace wolverines from habitat they might otherwise use or hinder their ability to take advantage of potentially available resources (Claar et al. 1999, p. 7.34-7.37). However, they seldom represent a direct mortality risk or a meaningful threat to wolverine population viability.

One class of recreation that may directly impact wolverine population processes involves high-country snowmobiling, skiing, and other backcountry winter activities in the vicinity of wolverine natal dens. Research as to the effects of such recreation on local wolverine productivity has been limited and, so far, inconclusive (Ruggiero et al. 2007; Krebs et al. 2007). However, given the limiting nature of natal denning habitat, the potential for any such impacts needs to be taken into account in management decisions. At this point, the primary threat to these natal and maternal denning habitats appears to be their slow demise due to climate change rather than from human interference (McKelvey et al. 2011).

Management Direction

Helena National Forest Approach

The wolverine receives no mention in the *Helena Forest Plan* (1986), but it has been listed as a "sensitive species" in USFS Region 1 since the late 1980s and thus has drawn special attention in environmental analyses. Because the wolverine is a habitat generalist in terms of the vegetation types it makes use of, less attention has been paid to crafting or protecting special forest configurations for its benefit. Rather, the focus has been on (1) preserving blocks of non-motorized habitat so as to provide refuge from human activity, (2) limiting winter trapper access into areas where wolverines might be present, and (3) restricting motorized winter recreation in areas that might support wolverine natal/maternal dens. In the Divide landscape, this has primarily involved closing roads, maintaining existing Roadless Areas, enlarging the size of areas with motorized restrictions, and expanding snowmobile closures.

While the HNF does not manage habitat specifically for wolverines in the Divide landscape, habitat management for other wildlife species serves to benefit wolverines. Ungulate carrion is a major food source, and management of elk and deer at levels sufficient to provide for hunting enhances the potential for this resource. Management for elk security also provides large blocks of non-motorized habitat that may provide havens for wolverines. Also, management aimed at improving connectivity of wildland habitat for a variety of species—by reducing roading and other forms of human intrusion—aids the ability of wolverines to move throughout the Divide and improves prospects for survival.

Winter tracking surveys since 2007 have helped decipher the size and distribution of the local wolverine population as well as identifying specific areas and habitat patterns important to wolverines in this landscape. The information useful in this transition area between western and central Montana where several species (goshawks, lynx, flammulated owls, pileated woodpeckers) regularly exhibit adaptive habitat use patterns that diverge from what research has shown to be the norm in "westside" environments. As adaptive and opportunistic animals, wolverines probably fit this profile as well.

Proposed ESA Listing

The U.S. Fish and Wildlife Service (USFWS) proposed listing the distinct population segment of the wolverine in the contiguous United States as "threatened" in February 2013 [50 CFR Part 17, 78 FR

7864]. The proposed rule would prohibit "take" of the wolverine from trapping, hunting, shooting, or any other means—with the exception of incidental take associated with resource management activities. While the Fish and Wildlife Service felt that trapping remained a substantial problem for wolverine populations—and one that needed to be curtailed—the primary threat to the species was global climate change, which is eroding the sustainability of deep-snow spring denning habitat. Activities such as winter recreation and timber harvest were not identified as meaningful threats to wolverine populations [50 CFR Part 17; Federal Register, vol. 78, no. 23, p. 7877-7879].

After more than 18 months of evaluation, the Service has now (August 2014) withdrawn its proposal to list the wolverine. This decision was based on their conclusion that the factors affecting the contiguous U.S. population were not as significant as initially believed [50 CFR Part 17; Federal Register, vol. 79, no. 156, p. 47522-47545]. The wolverine thus reverts to its previous status as a Region 1 sensitive species.

Wolverines in the Divide Landscape and the Project Area

Habitat in the Divide Landscape

Wolverines are distributed in disjunct patches of montane habitat across the northern Rocky Mountains of the United States. Population densities are highest in the main stem of the Rockies, tailing off in the island and peninsular ranges both east and west of the Continental Divide. Recent analysis of radio-telemetry data and subsequent habitat modeling (Inman et al. 2014) suggest that primary wolverine habitat in this region is concentrated in three large core areas: (1) the Northern Continental Divide ecosystem in northern Montana, (2) the Salmon–Selway region of northern and central Idaho, and (3) the Greater Yellowstone ecosystem of northwest Wyoming and southern Montana. In addition, a relatively small, isolated habitat block is located in the Bighorn Mountains of north-central Wyoming.

The Divide landscape lies within an area that Inman et al. (2013) refer to as the "Central Linkage Region"—a zone amidst the three large core areas that contains numerous small patches of primary habitat capable of supporting reproductive females. This region, while dominated by "dispersal habitat," provides key connectivity that allows wolverine populations in the complex of core areas (along with the linkage region) to function as a "***metapopulation.***" Habitat quality in the Central Dispersal Region need not be up to the standards required of the core population zones, but it does need to be sufficient to provide for regular wolverine movement throughout the metapopulation.

The Divide landscape, on average, provides drier habitat and less productive growing conditions than more optimal wolverine range in the core areas to the north, west, and south. In particular, the Divide supports less high alpine habitat, less old-growth forest, fewer moist forest habitats, less riparian and wetland, more grassland and shrubland, and more dry and open-grown forest than core area habitats. Recently burned-over forest is rare in this landscape, but beetle-killed stands now cover thousands of acres that 5 to 8 years ago were occupied by mature pine forest. A substantial segment of the landscape is thus in the early stages of transitioning from mature forest to early-seral forest. The implications of this change for wolverines are uncertain. However, given their adaptability and opportunistic use of a variety of habitat formations, they should be able to continue taking advantage of what the area has to offer, especially if prey abundance increases—as it often does in a shift to early seral environments.

Human activity and infrastructure (often tied to roads and trails) are widespread, but the impact across much of the landscape is intermittent and often modest. Within National Forest boundaries, few areas support enough consistent, concentrated human activity to repel wolverines, radically divert their travel routes, or block movement. Notable focal points of human presence include U.S.

Highway 12, the towns of Rimini and Unionville, the Luttrell pit mine waste repository, MacDonald Pass recreation area, four Forest campgrounds, a few sections of much-used Forest/County road, and a number of residences and smaller enterprises, most on private inholdings. Except for Highway 12, which bisects the landscape into northern and southern segments, the distribution of infrastructure is highly fragmented. In addition to within-landscape activity centers, the City of Helena, the towns of Elliston, Clancy, and Marysville, and a number of rural subdivisions lie adjacent to or within a couple miles of the National Forest boundary.

Table 170. Three measures of non-motorized sanctuaries available to wolverines in the Divide landscape under current road and motorized trail configurations

Measures of Non-Motorized Habitat	Number of Habitat Blocks	Average Block Size (acres)	Total Acres	Percent of Landscape
Connectivity Analysis: Non-Motorized Habitat Blocks >1,500 acres with No Road Buffer *	21	5,396	113,325	64%
Grizzly Bear Analysis: Non-Motorized Habitat Blocks >2,500 acres more than 0.3 mi from Open Roads *	8	6,801	54,405	31%
Elk Security Analysis: Non-Motorized Habitat Blocks >250 acres more than 0.5 mi from Open Roads	20	3,818	76,370	33%

* Acres and percentages in connectivity and grizzly bear analyses are based on the approximately 177,713 acres, which is slightly smaller than the Divide landscape: thus, they underestimate, somewhat, the extent of large unroaded habitat patches available to wolverines. Elk security analysis is based on the entire landscape (232,836 acres).

Wolverines are drawn to large blocks of habitat in which human presence is minimal. Several potential wolverine safe havens exist in the Divide landscape and are tallied in 3 ways: non-motorized habitat patches larger than 1,500 acres (habitat connectivity assessment); non-motorized habitat blocks larger than 2,500 acres at least 0.3 mile from open roads (grizzly bear core area analysis); and areas larger than 250 acres and at least 0.5 mile from open roads (elk security area analysis). Such habitat blocks—summarized in table 170—are important to male wolverines year-round and to adult females outside the natal denning season as areas in which they can forage, rest, breed, raise young, and travel with little human interference.

Wolverine habitat has been mapped in the Divide Landscape – South and includes areas of persistent spring snow (Copeland et al. 2010), and primary, maternal, and female and male dispersal habitat (Inman et al. 2013) (table 171 and figure 61).

Table 171. Acres of predicted wolverine habitat by source in the Divide Landscape and project area

Habitat	Divide Landscape - South	Project Area	Source
Areas of persistent spring snow	47,959	12,541	Copeland et al. 2010
Maternal habitat	40	0	Inman et al. 2013
Primary habitat	16,206	1,113	Inman et al. 2013
Male dispersal	152,013	23,669	Inman et al. 2013
Female dispersal	125,939	23,433	Inman et al. 2013

Areas of persistent snow and maternal habitat basically represent the same concept – reproduction habitat. Although reproduction habitat is broadly mapped, in actuality it is restricted to a narrow

range within this larger geographic extent. In Montana, natal dens are located on north aspects in avalanche debris typically in alpine habitats near timberline (Inman et al. 2007, pp. 71–72).

Copeland and others (2010) found that virtually the entire reproductive habitat that they studied occurred in areas of persistent spring snow. The strong association with areas of persistent spring snow as denning and year round habitat may be based on the fact that these areas are often removed from human use and habituation. The areas of persistent spring snow also represent yearlong habitat which along with the primary habitat identified by Inman and others (2013) has been identified as necessary for survival. Male and female dispersal habitat is important in restoring wolverines to unoccupied areas of historical range as well as increasing resiliency and genetic diversity (Inman et al. 2013).

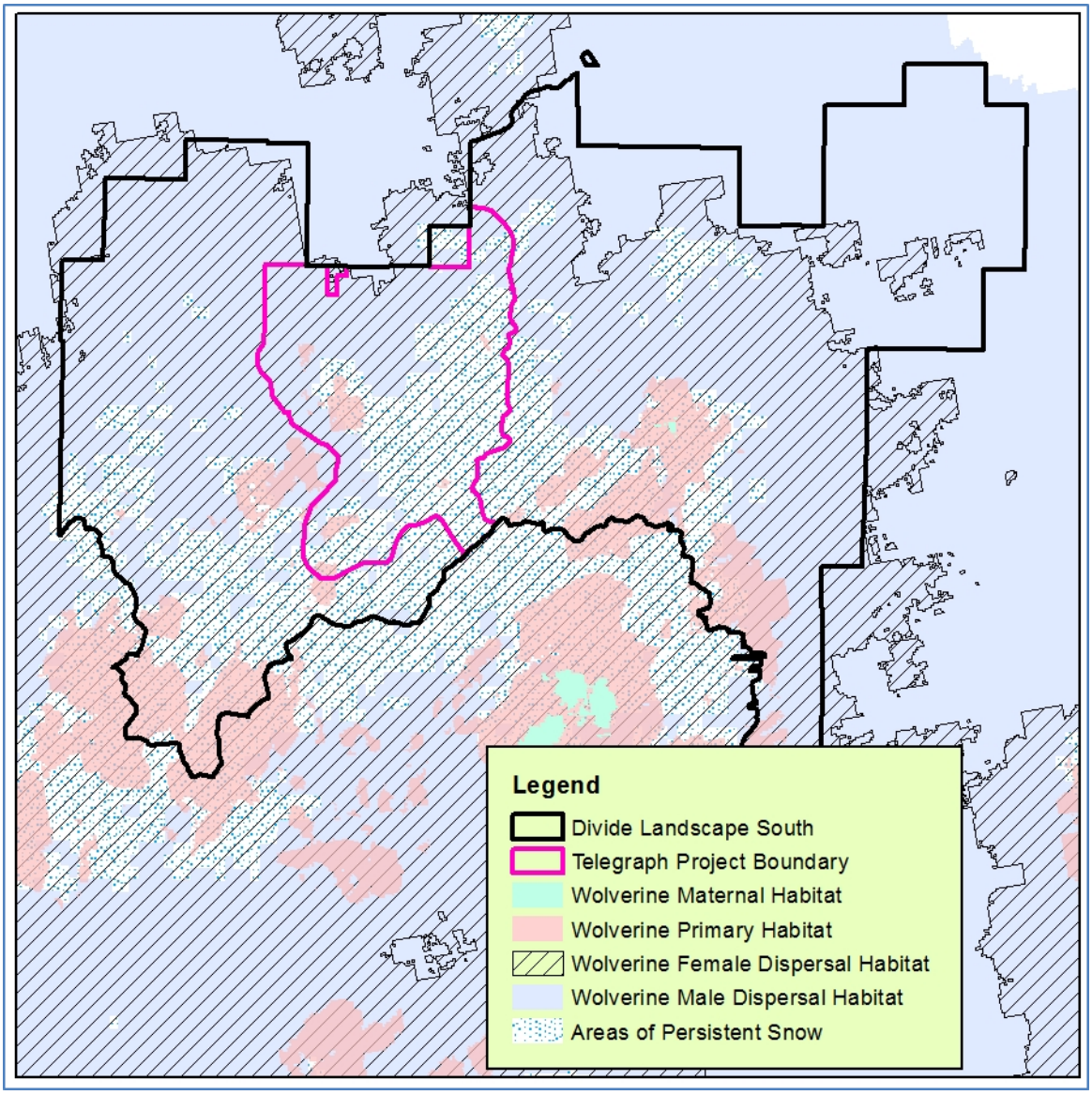


Figure 61. Wolverine habitats in the Divide Landscape – South

Wolverine Occurrence in the Landscape

Reports of wolverines in the Divide landscape have been infrequent but consistent over the past two decades. Prior to 2007, a majority of observations came from long-term residents in upper Telegraph Creek. Other reports came from around Jericho Mountain, the Occidental Plateau, and Lava Mountain in the southern part of the landscape and from the upper Little Prickly Pear drainage in the north. Observations have been made in all seasons: on snowmobile routes in winter, along roads and hiking trails in summer, around cabins in spring and fall, and in backcountry areas during hunting season. In 1995, a wolverine was trapped in Cataract Basin on the Beaverhead-Deerlodge NF just south of the HNF boundary.

More recently, winter tracking surveys by Wild Things Unlimited (Bozeman, Montana) have found wolverines along the Continental Divide both north and south of Highway 12 and in the eastern half of the Little Blackfoot watershed over a 6-year period (2007 to 2013). DNA analysis of scat and hair has verified the presence of two male wolverines (Gehman et al. 2009, p. 5; Pilgrim and Schwartz 2008; Pilgrim 2009). These animals have ranged widely in the central and southern parts of the Divide landscape and exhibit movement and behavior patterns consistent with those of local residents rather than those of transients moving through a linkage zone. In 2009, one animal was tracked through the town of Elliston and over to the Little Blackfoot River Road, where it continued to investigate the peripheries of residences, outbuildings, and other trappings of settlement. Track patterns suggest that individuals other than the two males may be present as well, but, to date, none have been verified. No females have been identified and no evidence of breeding has surfaced.

In the fall of 2008, a hunter photographed a large adult wolverine on an elk gut-pile in the vicinity of Greenhorn Mountain, about 5 miles northeast of Austin. Track surveys in the winter of 2008–2009 identified fresh wolverine sign in this area as well, and it is likely that the photograph is of one of the resident males that have been tracked by Gehman and his crews [*Photo 21*].

Photo 21. An adult wolverine photographed by a hunter near Greenhorn Mountain 11 miles north of the Telegraph project area in the fall of 2008. This is probably one of the resident males tracked through the project area by Wild Things Unlimited 2007 to 2012.

Wolverine Status in the Project Area

The Telegraph Creek project area has been the focus of considerable winter tracking effort in the Divide landscape by Wild Things Unlimited since 2005. Several of the DNA-verified samples that allowed the identification of individual wolverines were gathered in this area—Mike Renig/Little Flume Gulches, Jericho Mountain, Clemmer Gulch, and the Little Blackfoot River between 2007 and 2012 [see Gehman et al. 2008, 2009, 2010, 2012]. The two individuals (both adult males) that have been identified on several occasions have occupied home ranges that extend at least from Greenhorn Mountain north of U.S. Highway 12 to the headwaters of Telegraph Creek south of the Highway—an area of about 105 mi^2. This is substantially smaller than home ranges estimated for wolverines elsewhere in Montana—241 to 262 mi^2 for males (Hornocker and Hash 1981)—and thus probably represents only a partial home range.

Habitats in which wolverines have been tracked and identified during winter surveys in the greater Telegraph Creek and Little Blackfoot River drainages have included dense mature forest, regenerating cutting units of various density, talus slopes, and riparian areas. Much of the tracking has been through a mosaic of mature forest and early-seral forest stands created by timber harvest [see *Photos 22* and 23]. In winter the wolverines have often used packed snowmobile routes on Forest roads as travel routes. The project area does not include any obvious natal denning habitat, although it approaches some possible sites around Bison Mountain and Luttrell Peak to the south.

Photo 22. The mosaic of sapling-dominated clearcuts and mature forest in Mike Renig Gulch where wolverines have been tracked on a regular basis during the winters of 2006 through 2012. Most of the mature lodgepole pine overstory in this drainage is now dead.

Photo 23. Forest Road #1856 in upper Mike Renig Gulch. Winter tracking surveys have identified wolverines multiple times in this area. In winter, the road is unused by wheeled vehicles, but the snow surface is packed by snowmobiles, providing wolverines with a convenient travelway through the mature forest/ sapling clearcut mix and seen here.

Environmental Consequences

The following measures are used to evaluate the effects of the alternatives on wolverines and their habitat.

- Acres of primary habitat affected in the project area
- Effects of activities on wolverine dispersal and habitat connectivity

Desirable Wolverine Habitat Conditions

√ Undisturbed primary habitat
√ Effective habitat connectivity

Effects Common to All Alternatives

There are no effects with regards to wolverine that are common to all alternatives other than succession and natural disturbance processes that would continue through time.

Effects Common to All Action Alternatives

Timber harvest is proposed in modeled primary and male and female dispersal habitat and in areas of persistent spring snow in both action alternatives. There are no treatments proposed in wolverine maternal habitat. Vegetation management alone would not affect wolverine; however, there is the potential for disturbance to wolverines that may be present in the project area, albeit negligible.

Wolverine dispersal and habitat connectivity should not be affected by the proposed management activities. The Telegraph project area is currently heavily roaded; wolverines that may occur in the project area have most likely adjusted their movement patterns to account for current conditions.

Alternative 1

Direct and Indirect Effects

Alternative 1 should have no direct effects to wolverines that may occur in the project area. As the dead trees associated with the mountain pine beetle-fall to the ground, wolverines may need to re-adjust movement patterns to account for potential barriers created by large levels of down woody debris. Plenty of opportunities for movement will continue to be available in the non-forested, high ridge country.

Alternatives 2 and 3

Direct and Indirect Effects

Wolverine habitat in the project area has been classified as having areas of persistent spring snow, primary habitat, and dispersal habitat. These different classifications are the result of different prediction models and generally are overlapping. Several treatment units are located within wolverine habitat as described in table 172. The acres of treatments are duplicative where the habitat values overlap.

Table 172. Treatment units located in predicted wolverine habitat (acres)

Treatment type	Alternative	Areas of snow persistence habitat	Primary wolverine habitat	Female dispersal habitat	Male dispersal habitat
Regeneration harvest	Alternative 2	2,492	513	3,481	3,485
	Alternative 3	1,314	146	1,852	1,856
Intermediate harvest	Alternative 2	0	0	373	434
	Alternative 3	0	0	373	434
Precommercial Thinning	Alternative 2	967	17	1,762	1,785
	Alternative 3	547	14	1,265	1,289
Prescribed fire	Alternative 2	994	99	1,049	1,049
	Alternative 3	550	8	605	605

Several treatment units in alternative 2 overlap with the areas of persistent spring snow; less so in alternative 3. Most of the primary habitat would have some type of treatment in alternative 2; again, less so in alternative 3. All of the units in alternative 2 and 3 overlap with male and female dispersal habitat do to the ubiquitous nature of that habitat.

Little is known about how wolverines respond to the types of activities that are planned in the Telegraph project. However, wolverines have been documented to reproduce and survive in areas with high human use and activities (Federal Register 2013, page 7877) suggesting that wolverines can survive in areas with human use and disturbance. .

Although wolverines are frequently found in forested habitats, most researchers have concluded that they are not necessarily dependent on specific vegetation patterns of the sort that are typically manipulated by timber harvest, prescribed fire, or other forest management practices [see USFWS proposed listing of the wolverine: http://federalregister.gov/a/2013-01478]. While wolverines avoid active management operations in the forest (logging, burning, and associated activity), they often move through and make use of the new open environments once humans have abandoned the areas, particularly if prey is readily available.

Hornocker and Hash (1981) noted that wolverines in Montana cross new clearcuts, but usually at a brisk pace. On the other hand, they saw no differences in movements, habitat use, or behavior between wolverines occupying the half of their study area that had been logged and the half that was not. Copeland (1996) observed wolverines in Idaho traveling through and foraging in recently burned forest in spite of lost canopy cover. Krebs et al. (2007) found that male wolverines used recently logged areas in British Columbia but that females were less likely to do so. They theorized that this reticence was more an aversion to human activity and infrastructure than to vegetation patterns. Wolverines are more apt to use these areas once the new openings begin to fill in with seedlings and saplings.

Banci (1994) concluded that travel corridors between large unroaded refuges need not possess the optimal vegetation and other habitat attributes needed to support self-sustaining wolverine populations. She noted that females appeared more hesitant to move through large blocks of marginal habitat than males. Whereas extensive human settlement and highways may hinder or divert long-distance movement by wolverines, topographic features and vegetation patterns (including those generated by timber harvest) appear not to do so. Lyon and others (1994) indicate that while habitat change produced by logging is obviously disruptive to movement patterns of marten and fisher, it appears to be much less so for wolverine.

Treatments planned in male and/or female dispersal habitat are not expected to significantly alter use of the project area by wolverines. Wolverines may adjust movement patterns to avoid the activities associated with the planned treatments; however, these impacts should only last while activities are ongoing. A majority of the project area would remain untreated thereby providing opportunities for wolverines to move through the project area unencumbered by human activity. Given that harvest and prescribed fire patterns would match historical patterns; these anticipated shifts would be no greater than what wolverines would typically do after small to moderate-sized natural disturbances.

Key sites of particular interest to wolverines—primarily riparian areas—would be left mostly intact and the capacity of these sites to produce prey and other food sources useful to wolverines would not be impaired. Riparian areas would be buffered as part of project-level design. Mechanical equipment is limited in these areas as well as tree removal.

The size and configuration of the planned treatments, particularly when surrounded by an expanse of denser cover, would be unlikely to discourage wolverine foraging if food sources are present. Nor would they prevent wolverines from crossing the openings when moving through the area. As previously mentioned, wolverines have been observed crossing new openings created by logging and are known to continue using newly harvested areas in much the same way as they do adjacent unlogged areas (Hornocker and Hash 1981).

As the USFWS has noted in its proposed rule to list the wolverine, “Wolverines are not thought to be dependent on specific vegetation or habitat features that might be manipulated by land management activities, nor is there evidence to suggest that land management activities are a threat to the conservation of the species” [http://federalregister.gov/a/2013-01478].

The project includes road reconstruction and creation of temporary roads that will be decommissioned after the project is implemented. As indicated above, two-lane highways or roads with less improvement are not absolute barriers to wolverine movement and dispersal (Federal Register 2010 page 78048). Because these roads are temporary and/or not improved, they are not expected to be a barrier to wolverine movements.

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on wolverine habitat in the context of the myriad of other past, present, and future effects on wolverine habitat from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. The following table summarizes the key items that are taken into consideration for the cumulative effects analysis for wolverine habitat. See also Appendix E in the Wildlife Specialist Report, *Cumulative Effects*, for more information.

Table 173. Cumulative effects considerations for wolverine habitat in the Divide Landscape - South

Parameter	Discussion
Spatial Boundary	The spatial boundary is expanded to the point at which wolverine habitat is no longer measurably affected. The Divide Landscape - South satisfies this requirement because this is the scale at which the effects to wolverine habitat can be examined at the stand or treatment unit. The Divide Landscape - South also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the early 20th century to those future projects and effects that are either listed in our SOPA or are planned or implemented on private land within the Divide Landscape-South.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Of importance to wolverine are activities that reduce populations directly or indirectly through human activities.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include trapping, road construction, area snowmobile closures, and the Statewide OHV Plan.
	Ongoing and future activities include trapping, recreational activities, Divide Travel Plan, small mining operations, the Tenmile/South Helena project, and private land development. Climate change is also a concern for wolverines.
Measurement Indicators	Measurements include effects to natal denning habitat and habitat connectivity.
Thresholds	Thresholds are based on sensitive species determinations.
Methods	Past, ongoing, and reasonably foreseeable activities are described qualitatively based on impacts to natal denning habitat and wolverine connectivity.
Assumptions	The assumptions for describing past, ongoing, and foreseeable activities are based on wolverine research.

Past Activities

Wolverines had been heavily trapped in the early part of the 20th century; since that time populations have rebounded as predator control efforts subsided and trapping regulations become more restrictive (Aubry et al. 2007, p. 2151).

Activities that have locally reduced the effectiveness of potential wolverine habitat to one degree or another include: numerous road permits allowing access across HNF land to private holdings; retention of private recreational residences on HNF land (esp. in the linkage zone at MacDonald Pass); small mining operations (under the 1872 Mining Act) in areas where wolverines have been observed; construction and maintenance of communications sites and power lines; development and retention of numerous snowmobile trails in potential wolverine habitat; retention of numerous dispersed camping sites and unrestricted back-country recreational use.

These activities increase, to one degree or another, the potential for wolverine-human encounters and reduce the country through which wolverines are able to roam generally free from human influence. Few, if any, of these enterprises are likely to disrupt wolverine natal denning sites—the exception being large-scale, year-round mining operations at high elevation (the Luttrell Pit at the southern edge of the analysis area being the only current example). Other activities that may approach potential denning habitat do not occur during the wolverine denning period (winter and early spring). High-elevation snowmobile routes and play areas, which have caused problems for denning wolverines in other parts of the northern Rockies, are not located near perspective denning sites in the Divide landscape - South.

New road systems associated with timber sales, some of which remain open to vehicle use, have reduced unroaded wolverine habitat and increased access for trappers. These roads have reduced unroaded wolverine habitat and have increased access for trappers. These include Bison Creek, Mike Renig Gulch-Hahn Creek, Slate Creek, Lump Gulch, Ophir Creek-Cave Gulch, Deadman, among others. Timber harvest itself has a mixed effect on wolverine habitat and the ability of wolverines to avoid humans and find food. In general, projects that have removed good quality cover and complex understory habitat supporting diverse potential food sources have been detrimental. Those that have improved habitat productivity by opening up dense, depauperate forest and increasing edge and ecotone may be beneficial.

Area closures for snowmobiles in the Electric Peak and Lazyman-Black Mountain Roadless Areas; establishment of the Statewide OHV Plan, which prohibits riding off established motor routes; road and motor trail closures associated with timber harvest projects (Clancy-Unionville, Sound Wood, Mullan Pass, Lava Mountain, Treasure Mountain). These decisions have expanded blocks of non-motorized habitat and potential wolverine refuges.

Ongoing Activities

Private land development (primarily rural home building) is continuing to create more sites that prove problematic for animals attempting to move through or occupy the landscape (barriers to movement, habitat loss, food attractants, dogs). Many of these developments are at low elevation in areas seldom traversed by wolverines, but some are associated with higher elevation inholdings (Telegraph Creek, Ontario Creek, Little Blackfoot, upper Tenmile) and may create problems. The town of Rimini and a number of dwellings on mid-high elevation Forest inholdings occupy ground that might otherwise be favorable as wolverine habitat. Cabins used only seasonally or intermittently throughout the year, especially those that harbor stored food, may attract wolverines.

The Red Mountain Flume/Chessman Reservoir Project, located east of the Continental Divide, is resulting in the removal of 490 acres of primarily dead lodgepole pine. While this project includes

harvest of dead trees that could conceivably provide woody debris accumulations in which wolverines might den, the potential for future denning in the proposed harvest units once trees fall is low (elevations are too low, there are no avalanche chutes or large rockslides nearby, density of large dead trees is generally too low, most areas are too close to regular human activity). Wolverines could use accumulated deadfall, if not for denning, then for resting or escape cover. Removal of dead trees could thus influence future movement patterns.

Reasonably Foreseeable Activities

Reasonably foreseeable activities on the HNF that may affect wolverine habitat, especially dispersal include the Divide Travel Plan and the Tenmile/South Helena Vegetation Project. The Divide Travel Plan would result in the closure, at least seasonally, of several miles of roads that are currently open. This would be beneficial to wolverine by providing large, unroaded blocks of habitat. Where roads remain open, wolverine movement patterns have most likely already been adjusted. The Tenmile/South Helena Project could result in large openings that could cause wolverines to shift their movement patterns.

The primary foreseeable activity on non-Forest land within the cumulative effects area that can affect wolverines is the ongoing development of private inholdings (building construction, road building, forest clearing, local mining, and general human activity).

Cumulative Effects Conclusions

Selection of alternative 1 would not contribute to the past, ongoing, or reasonably foreseeable activities except that the existing road density would remain unchanged. However, wolverines that may utilize the project area and vicinity most likely have already adjusted their use of the area to the current conditions.

Implementation of either of the action alternatives may contribute to the effects associated with past, ongoing, and reasonably foreseeable activities. However, given the abundance and wide distribution of non-harvested areas, the low density of the local wolverine population, and the adaptability of wolverines to a wide array of habitat formations, it is highly unlikely that the proposed projects would have any major influence on the ability of wolverines to continue to occupy the landscape

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

Overall, implementation of either of the action alternatives should have minimal on wolverine habitat. According to the USFWS 12-month review, "[i]t is clear that wolverines can coexist with some level of human disturbance and habitat modification. How much is too much is not known. The proximity of wolverine habitats to areas heavily or moderately used for dispersed recreation needs more study, especially where there is overlap during the denning season. What little information exists suggests that wolverines can adjust to moderate habitat modification, infrastructure development, and human disturbance" (USDI 2010).

Furthermore, the 2013 proposed wolverine rule states that *"[w]olverines are not thought to be dependent on specific vegetation or habitat features that might be manipulated by land management activities, nor is there evidence to suggest that land management activities are a threat to the conservation of the species"* (Federal Register 2013, page 7879). *"The available scientific and commercial information does not indicate that other potential stressors such as land management, recreation, infrastructure development, and transportation corridors pose a threat to the DPS"* (Federal Register 2013, page 7880). .

The desired condition for wolverine habitat includes undisturbed primary habitat that remains free from disturbance and intact habitat connectivity that facilitates unimpeded movement. Although both action alternatives include treatments in primary habitat, the research supports that wolverines would not permanently avoid these areas. The action alternatives are not expected to result in barriers to dispersing individuals since a majority of the project area under either alternative would remain untreated.

Regulatory Framework and Forest Plan Consistency

The wolverine is listed as a sensitive species in Region One. Federal laws and direction applicable to sensitive species include the National Forest Management Act (NFMA), the Forest Service Manual, and the Helena National Forest Plan. The NFMA requires the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" [16 U.S.C. 1604(g)(3)(B)].

Section 2672.4 of the Forest Service Manual provides direction that biological evaluations will be prepared for all Forest Service planned, funded, executed, or permitted programs and activities for possible effects on endangered, threatened, proposed, or sensitive species. The objectives of the biological evaluation include ensuring that Forest Service actions do not contribute to loss of viability of any native or desired non-native plant or contribute to animal species or trends toward Federal listing of any species.

All alternatives would be consistent with the NFMA requirement for diversity of plant and animal communities and ecological sustainability. At the Helena National Forest Scale, key wolverine habitat is protected by wilderness and roadless designation as well as unroaded areas. At the Region 1 scale, the majority of modeled wolverine habitat is protected within the Bob Marshall Wilderness complex and Mission Wilderness, with additional habitat in Glacier National Park providing connectivity to Canada. Therefore, while climate change and other activities outside of Forest Service control may impact wolverines or their habitat, effects would be negligible and this project "***may impact individuals but would not likely result in a trend toward federal listing or threaten viability for the population or species."*** See also the Viability Analysis Section and Appendix B.

There are no specific Forest Plan Standards applicable to management of wolverine habitat.

Forest Plan Management Indicator Species

The *Helena Forest Plan* requires that populations of "indicator species" be monitored to measure the effects of management activities on representative wildlife habitats [those most likely to be affected by Forest management] (*HFP*, p. II-17). This standard represents the primary mechanism that most Northern Region Forests have used to implement the NFMA mandate that viable populations of all native and desirable non-native wildlife species be maintained. If populations of management indicator species (MIS) remain viable, it is assumed that the habitats on which they depend are sufficiently robust to maintain the population viability of other wildlife species dependent on those habitats.

Four management indicator species (MIS) species are discussed in detail:

- *American marten* – indicator for mature forest,
- *Hairy woodpecker* – indicator for snags,
- *Northern goshawk* – indicator for old-growth forest,
- *Pileated woodpecker* – indicator for old-growth forest.

The *Forest Plan* also designates indicators for threatened and endangered species (grizzly bear, wolf, bald eagle, peregrine falcon—species listed at the time of *Forest Plan* release in 1986) and hunted species (elk, mule deer, bighorn sheep). The status of species in these groups is discussed elsewhere in this report.

American Marten

Affected Environment

Marten Habitat

The marten (*Martes americana*) is the *Helena Forest Plan* management indicator for mature forest habitats. High quality habitat for marten consists of moist, structurally complex, mature forest with moderate to high crown closure and a generous component of large dead trees and logs (Buskirk and Ruggiero 1994). Stumps and coarse woody debris are critical habitat components that provide for foraging, resting, and denning (Coffin 1994; Spencer 1987). Snags are sometimes used as overnight dens during severe winter weather (Ruggiero et al. 1994). Chapin et al. (1997) found that vertical and horizontal structure of the forest was more important than age or species composition. Drier, younger, or more open-canopied forests with few dead trees and uncluttered understories do not provide marten with the key habitat components they need to readily find prey, den, and survive the winter (Coffin et al. 2002, p. 13-14). These stands, however, do provide forested connectivity between preferred habitats. Connectivity habitat of this sort may be provided by mature stands of dry Douglas-fir, lodgepole pine, and whitebark pine or by pole-sized stands of any conifer species.

Overhead cover is a key habitat element for marten. They are usually considered to be an “interior forest species” in that they do best when patches of mature forests are large and non-linear. They may be sensitive to patch size and they generally avoid large, uncluttered openings such as meadows and new clearcuts. Reluctance to cross or forage in these areas is probably due to a variety of unfavorable conditions: low densities of preferred prey, poorly developed subnivean zones (areas under the snow) in winter, more severe local climate conditions, and little protection from predators. Thompson (1994) found higher densities of marten in unlogged forests versus logged forests, which he concluded was most likely a result of lower predation risk. Tomson (1998) hypothesized that marten do not necessarily avoid openings but are more vulnerable to larger predators when crossing openings.

As a result, landscapes containing large, well-connected patches of mid and late seral forest are more likely to sustain higher numbers of marten than more fragmented or naturally-patchy landscapes. Marten may regularly take advantage of smaller forest openings stocked with coarse woody debris, but the best habitat is characterized by continuity and minimal fragmentation of the forest continuum (Wasserman et al. 2012). Preference for continuous mature forest is strongest during the winter—which may be related to increased success of encountering and capturing prey in the complex subnivean environment of the forest understory (Thompson and Colgan 1994).

In some areas, marten have been found to make regular use of structurally complex burns (with no tree canopy, but abundant woody debris and shrub cover). In other areas, however, they seldom venture into uncanopied burned habitat (Buskirk and Ruggiero 1994, p. 25, 26). The probability of marten using abundant coarse woody debris with little overhead cover—as would be produced by insect or disease outbreaks—is unclear. While most studies suggest that the complexity of physical structure near the ground (such as provided by coarse woody debris) is the most important limiting factor for marten (see, for example, Andruskiw et al. 2008), the fact that marten avoid non-forested habitats suggests that overhead cover is a primary limiting factor (see, for example, Buskirk and Ruggiero 1994). The “jackstraw” piling up of dead trees (≥6 inches dbh) would provide much more

complex near-ground cover for resting, breeding, and foraging than would the "clean" understories provided by most mature lodgepole pine stands.

Marten Populations

Marten population densities and trends are difficult to evaluate: long-term data sets are rare, and populations often fluctuate dramatically over short periods of time, in large part because of variable trapping pressure. Where reasonably accurate data have been obtained, population densities have been very low compared to most other mammals. Densities throughout North America are generally in the range of 1.5 to 9.3 marten per 10 mi² (Buskirk and Ruggiero 1994, p. 14-15).

Estimates for trapped populations in Montana have generally been on the lower end of this range. Recent studies in 3 trapped populations in southwest Montana estimated average minimum densities of 0.3 to 1.5 marten per 10 mi² (Coffin et al. 2002, p. 23-24). Densities in nearby Yellowstone National Park at the same time were estimated at 1.4 marten per 10 mi² (Bissonette and Sherman 1992 cited in Coffin et al. 2000, p. 26). Estimates have been higher for some untrapped populations. In Glacier National Park, Hawley and Newby (1957) reported minimum densities of 2.6 to 6.4 marten per 10 mi² during a population high and 0.7 to 3.3 per 10 mi² during a population low. Coffin et al. (2002, p. 28) concluded that regularly trapped marten populations could remain relatively stable if their ranges were near protected or unroaded areas that provided a regular source of immigrants.

Marten home ranges vary widely in size but they are large by mammalian standards—which correlates with their naturally low population densities (Buskirk and Ruggiero 1994, p. 15, 28). Ranges tend to be larger in forests that support less prey and that have more openings, such as parks, meadows, and clearcuts (Soutiere 1979; Coffin et al. 2002, p. 6). A 3-year marten study in southwest Montana found average winter-spring home ranges of 8,026 acres (males) and 2,669 acres (females) in the West Yellowstone area and ranges of 3,085 acres (males) and 2,202 acres (females) in the more productive West Big Hole area (Coffin et al. 2002, p. 5-6). Samson (2006), however, has used a range of 1,920 acres for marten in the northern Rockies, based on data accumulated from a number of studies. In general, a single male home range will encompass 2-3 female ranges, and researchers have concluded that the male home range should be used in determining how much habitat is needed for viable marten reproduction in any given area (Lacey and Clark 1993; Buskirk and Ruggiero 1994, p. 27).

Population Status and Habitat in the Project Area

Local Population

Marten are not easily monitored because their population densities are low and they spend most of their time in structurally complex habitats where they are difficult to detect. It is known, however, that they are found throughout the Divide landscape wherever suitable habitat occurs—primarily in mid-high elevation forests dominated by subalpine fir, Engelmann spruce, and lodgepole pine with pockets of coarse woody debris. Marten are rare in lower elevation ponderosa pine and dry Douglas-fir forests (Ruggiero et al. 1994, p. 22), although these habitats sometimes provide linkage between forests suitable for long-term occupancy.

Evidence for the presence of marten has come from regular winter tracking surveys south of Highway 12 by Montana Fish Wildlife and Parks, from more recent tracking surveys in the little Blackfoot watershed by Wild Things Unlimited (Gehman and others 2006–2012), and from observations during general wildlife surveys over the last 18 years (Helena National Forest wildlife observation files). These observations are insufficient to derive population parameters but they give a general picture of marten distribution and habitat use and show that marten population densities are

low throughout much of the landscape. This is a function of a number of factors: past trapping, a relative abundance of naturally unsuitable habitat (dry ponderosa pine and Douglas-fir forest, dry grassland), a predominance of mature and pole-sized forest not yet old enough to provide prolific large woody debris (a function of historic fire patterns and past timber harvest), natural and human-induced fragmentation of optimal habitat sites, and inherently low population densities regardless of habitat conditions.

The Montana Natural Heritage (MNH) database provides relative estimates of marten distribution based on the number of observations reported in different latitude-longitude blocks across the state. The MNH lists the global status of marten as '*G5'*—defined as "*common, widespread, and abundant (although it may be rare in parts of its range), not vulnerable in most of its range."* The MNH describes the statewide status as *'S4,'* which is *"apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining"* (http://fieldguide.mt.gov/displayClasses.aspx?Kingdom=Animalia). For the Divide landscape, the database shows the highest number of observations (15 to 20) in the greater Telegraph Creek drainage and lowest number in the lower Little Blackfoot/ Spotted Dog/ Elliston Creek area (1 to 7). The rest of the landscape has produced an average of 8 to14 observations. From 1995-2008 there were 15 recorded observations within the project area and 2 within the combination boundary.

Local Habitat Capability

Marten habitat is modeled according to Samson (2006) as described in the *Criteria for Wildlife Models Helena National Forest*. Samson uses a home range figure based on the average size of male home ranges in the northern Rockies as derived from a number of field studies. Because marten home range size is sensitive to habitat quality and food availability, the initial average acreage has been adjusted to 1,920 acres in order to account for sufficient habitat in scarce food years. Currently, according to this model, there are 12,036 acres of potential marten habitat in the Telegraph project area and 35,023 acres in the combination boundary. Although this habitat is not continuous (Figure 9), it is more often than not connected by corridors or blocks of forested "travel" habitat and thus is not as fragmented as it appears in figure 62. Given these circumstances, the Telegraph project area should be able to support 6 pairs of marten, while the combo area may be able to support 18 pairs.

Marten require large snags, stumps, and logs for resting, natal denning, and foraging. They utilize a variety of standing dead trees when foraging but they are more strongly associated with larger snags for denning (Coffin 1994; Forest Carnivore Species Team 1995). While snags in the 7- to 11.9-inch size class are now abundant in the project area (a product of the mountain pine beetle epidemic), few are available in larger size classes, and none are available in the greater than 20+ inches dbh size class (see table 93 for snags and size class per acre in the project area). Preferred levels of down woody debris range from 10 to 20 tons per acre (Warren 1990)—generally greater than 10 tons per acre for den sites and greater than 20 tons per acre for foraging. Concentrations of 100-hour fuels averaged across the project area are around 1.5 tons per acre—well below the preferred levels for marten habitat. However, the 1,000-hour fuels, at 8.8 tons per acre, are fairly close to suitable denning habitat and there are localized areas that comprise higher concentrations of larger logs.

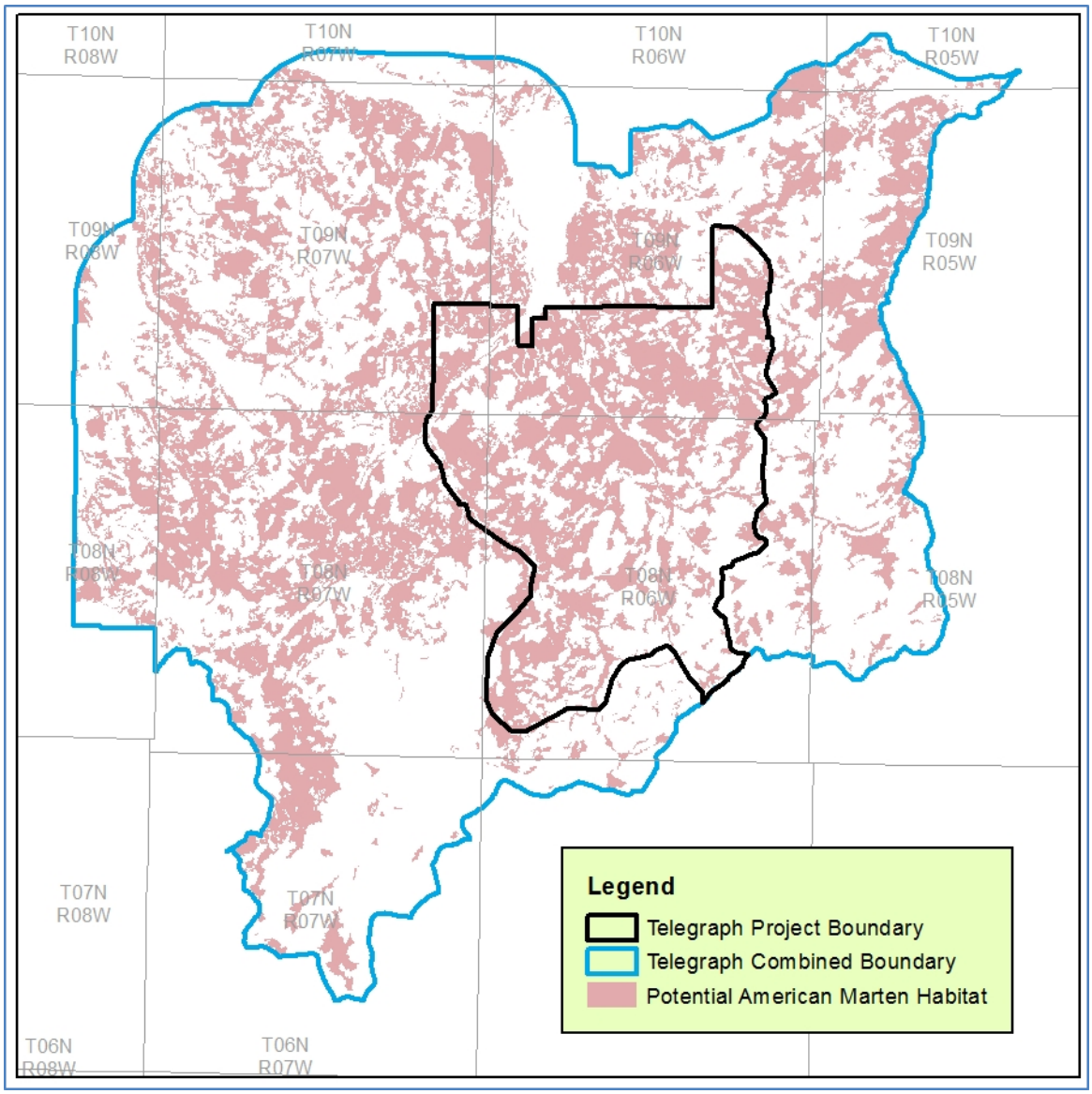


Figure 62. Potential marten habitat in the Telegraph project area based on the habitat model developed by Samson (2006)

The current pine beetle epidemic is changing potential habitat patterns for marten in the project area and across the Divide landscape as a whole wherever lodgepole pine is a predominant component. On the one hand, the bounty of mid-sized snags and logs is highly beneficial to marten. On the other hand, the natural thinning, and in some cases, outright loss of the forest canopy as trees fall creates a less favorable environment for them. So, the effect of the new beetle-created environment on marten habitat use patterns remains an unknown quantity: marten may avoid the new uncanopied arrays of coarse woody debris or they may incorporate them into their habitat use patterns, given their relatively high abundance of prey combined with a modicum of shelter and concealment from predators.

Photo 24. Suitable marten habitat in Mike Renig Gulch. This stand is a mix of several conifer species (with Engelmann spruce dominant in this view) only partly influenced by mountain pine beetle. Canopy closure remains good and coarse woody debris is well distributed on the forest floor. This is a good example of pre-beetle marten habitat.

Environmental Consequences

The following measurements are used to evaluate effects to martens associated with the alternatives

- Effects to snags and down woody debris
- Acres of marten habitat treated

Desirable American Marten Habitat Conditions
√ Snag and down wood habitat for foraging and nesting habitat
√ Canopy cover >25%
√ Trees >9” dbh

Effects Common to All Alternatives

Under all alternatives, natural processes and disturbances at all scales will continue to create snags. Public firewood cutting is permitted and could reduce the snag resource adjacent to roads. Large untreated areas would remain on the landscape where snag creation and attrition processes would be undisturbed. In the long term, snags are likely to become rare as the current “snag pulse” is lost to natural attrition. Additionally, while lodgepole pine snags are abundant, snags of other species and of large size are limited.

Effects Common to All Action Alternatives

Timber harvest would remove marten habitat under all both action alternatives. Intermediate harvest is expected to retain some features of marten habitat such as requisite canopy cover (>25 percent)

and stand size as described in the American Marten models. Regeneration harvest is not expected to retain marten habitat.

Prescribed fire in the action alternatives should result in the creation of some snags and subsequent down woody debris habitat by killing trees. Small fuels would be consumed through underburning but these fuels are currently not limited on the landscape and are of lesser importance to marten than the larger down wood.

Studies have indicated that snags and down wood are important habitat components for martens as cover, rest sites, den sites, under snow structures, and hunting (Bull et al. 1999). Standing dead trees would be left intact in all harvest units to meet Forest Plan standards except where they pose a safety hazard. Snags are more likely to be retained in group shelterwood and prescribed fire treatments because they are less likely to pose a safety hazard in those units. Design elements are also in place to protect large down wood.

Alternative 1

Direct and Indirect Effects

There are no direct effects to marten habitat under the alternative 1. The project area currently provides snags and down woody debris (See Snags and Down Woody Debris Section) but in lodgepole pine dominated stands, canopy cover is lacking so suitability of those areas as marten habitat is marginal. Down wood habitat will increase under alternative 1 as snags created by the mountain pine beetle outbreak fall to the forest floor. Wildlife risks associated with the high level of tree mortality in the project area would most likely increase as trees fall.

Alternatives 2 and 3

Direct and Indirect Effects

Alternatives 2 and 3 would affect approximately 3,181 acres and 1,967 acres, respectively, of marten habitat (table 174). Of these, 1,817 are proposed for regeneration harvest in alternative 2 and 1,037 acres in alternative 3. Intermediate harvest is proposed on 386 acres in both alternatives. Prescribed fire is proposed on 491 acres in alternative 2 and 231 acres in alternative 3. Intermediate harvest treatments should retain some characteristics of marten habitat. Allowing light to penetrate the forest floor will increase forest floor production and understory, resulting in an increase in small mammal habitat as more niches become available to small mammals. Treatments are designed to modify fire behavior and therefore should render the area less susceptible to stand-replacing fire. However, martens are not likely to utilize units in which canopy cover will be reduced below 25 percent through harvest or prescribed fire.

Table 174. Acres of potential marten habitat affected by treatment type and alternative

Alternative	Regeneration Harvest	Intermediate Harvest	Prescribed Fire	Precommercial Thinning
Alternative 2	1,817	386	491	488
Alternative 3	1,037	386	231	314

Snags and down wood habitat will be retained in harvest units (except where snags pose a safety hazard). Ample dead wood habitat will remain throughout the project area due to the mountain pine

beetle outbreak. As a result, ample nesting, roosting, and foraging opportunities will remain for martens in the Project area.

Under alternative 2, 8.5 miles of temporary roads would be constructed for the project and obliterated post-implementation. Alternative 3 includes 3.4 miles of temporary roads. These roads would be closed to the public so snag attrition associated with firewood retrieval should not be an issue.

Effects to marten are also tied to the ability of martens to move through treated areas. Cover will decline in treated areas and forest obligates that regularly move long distances under cover such as marten are likely to choose alternate routes through more dense forest habitat in the Project area.

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on marten habitat in the context of the myriad of other past, present, and future effects on marten habitat from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. The following table summarizes the key items that are taken into consideration for the cumulative effects analysis for marten habitat. See also Appendix E in the Wildlife Specialist Report, *Cumulative Effects*.

Table 175. Cumulative effects considerations for marten habitat

Parameter	Discussion
Spatial Boundary	The spatial boundary is expanded to the point at which marten habitat is no longer measurably affected. The combination boundary satisfies this requirement because this is the scale at which the effects to the marten habitat in the Project area would no longer be measurable. The combination boundary also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1950s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the combination boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the age class, density, and species composition of the existing marten habitat that comprises the combination boundary today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, and private land timber harvest.
	Ongoing and future activities include personal fire wood cutting, post and pole permits, and the Divide Travel Plan.
Measurement Indicators	Measurements include effects to nesting and foraging habitat.
Thresholds	There is no specific threshold.

Parameter	Discussion
Methods	Past, ongoing, and reasonably foreseeable activities are described quantitatively based on acres of habitat affected. Impacts of past activities are based on the FACTS database and summarized according to the types of treatments recorded in the database. The effects on marten habitat are based on observed changes to stand structure in the tree dominance types that are capable of providing marten habitat. See *Criteria for Wildlife Models Helena National Forest* (USDA 2009a) and the *Forested Vegetation Background Report.*
Assumptions	Intermediate and regeneration harvest are assumed to remove marten habitat; fuels activities are assumed to create open understories and promote shrub and grassland regeneration.

Past Activities

Several past activities never had or no longer have present effects to which the project would contribute. Specifically, projects that involved vegetation manipulation (e.g., trail reconstruction, timber harvest, and fuels activities) may have impacted marten habitat at the time of the activity. Some of these impacts may still be apparent in those areas not yet capable of meeting marten habitat requirements. Table 176 summarizes the effects of timber harvest during three time periods on marten habitat currently existing in the Project area. Most of the stands that have been harvested in the past do not yet provide marten habitat today. Areas that were treated in the 1960s are beginning to develop stand characteristics suitable for use by martens. Areas more recently harvest have not yet reached stand structure characteristic of marten habitat.

Fuels activities that occurred in the past mainly focused on reducing surface fuels. Many of these areas that were treated prior to the 1980s have returned to their ‘pre-treatment’ conditions especially in favorable growing conditions that accelerate understory development. Fuels activities that have occurred since the 1980s have also reduced surface fuels and created more open conditions that favor shrub and grassland development. These activities have contributed to structural characteristics that may provide some prey habitat although use by martens that may be present in the project area would be negligible.

Table 176. Past Forest Service timber harvest activities and their impacts on the availability of marten habitat in the combination boundary

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Regeneration Harvest Intermediate Harvest	3,079 264	Potential habitat that was regenerated during this time currently comprises pole size trees (5-10" in size) that currently do not provide marten habitat. Intermediate harvest treatments that occurred during this time are now open grown stands that include large trees some of which may be prey habitat but not marten denning or breeding habitat.
Forest Service Timber Harvest 1980s through 1990s	Regeneration Harvest Intermediate Harvest	2,684 316	Potential habitat that was regenerated during this time currently comprises young sapling sized trees (up to 5" in size) that currently does not contribute to marten habitat. Intermediate harvests have resulted in stands that are open grown today with larger trees; however the understories aren't as developed as those areas treated at an earlier time. These stands may provide some prey habitat; however, denning and breeding habitat have not yet developed.
Forest Service Timber Harvest 2000 to 2014	Regeneration Harvest Intermediate Harvest	236 2,558	Potential marten habitat that was regenerated at this time is currently in the stand initiation phase and in some instances large trees remain. These areas do not provide marten habitat today. Intermediate treatments resulted in stands with larger trees and open understories that may provide some prey habitat but where stand conditions are open, marten most likely will not use these areas.

Ongoing Activities

Ongoing activities that have effects to marten habitat are summarized in table 177.

Table 177. Ongoing activities that may impact marten habitat in the combination boundary

Activity	Effects to Marten Habitat
Firewood Cutting and Post and Pole Permits	Ongoing firewood cutting and post/pole permits result in removal of snags and subsequent down woody habitat and reduces availability of denning habitat for marten.
Timber Harvest on Private Land	Private land logging will continue to remove snags and impact marten habitat.

Reasonably Foreseeable Activities

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next five decades. Private lands within the combination boundary but outside of the project area are a mix of lodgepole pine-dominated stands with a similar history and lower elevation stands dominated by Douglas-fir. Much of the lower elevation component has also been

subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain. Implementation of the Divide Travel Plan, pending a decision, would result in several miles of road closures that would preclude firewood retrieval in most cases (exceptions include opening some of these areas to firewood gathering on a limited basis as needed to address fuel loading concerns). Conversely, the roads that would remain open under the Divide Travel Plan would continue to be used for firewood gathering; however, since this is already ongoing the impacts to snags, and potential marten habitat, would remain the same as the current situation along these open roads.

Cumulative Effects Conclusions

Implementation of alternative 1 would contribute to the effects of past timber harvest because forested stands that are killed by mountain pine beetles would revert to early seral stages similar to those early seral stands that were created as a result of regeneration harvest from the 1980s through today. Ongoing and reasonably foreseeable projects to which alternative 1 would contribute effects include firewood retrieval, the Divide Travel Plan, and private land timber harvest.

Implementation of alternatives 2 or 3 would contribute to the effects of past timber harvest and fuels activities that have shaped the existing condition by further reducing marten habitat. Although, areas within which intermediate harvest and/or prescribed fire are planned should provide habitat for prey for martens. Alternatives 2 and 3 would also contribute to the effects associated with private land timber harvest and development, firewood retrieval, and the Divide Travel Plan. As with these projects, implementation of alternatives 2 or 3 would result in the removal denning habitat and the composition of prey habitat would be changed to favor prey species associated with early seral forests (except in the case of private land development where habitat may be permanently removed). There will be fewer open roads remaining in the Project area post-implementation, thereby reducing marten susceptibility to trapping.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

Alternative 1 would put future marten habitat at risk by leaving heavy fuel loads in the project area. Under conditions favorable for catastrophic fire, fire would result in mature stands reverting back to early seral conditions and restoration of marten habitat would take several decades.

The action alternatives would remove potential marten habitat. In the short term, alternative 3 impacts the fewest acres and retains more of those characteristics favorable to martens (i.e., canopy cover greater than 25 percent, tree size greater than 9 inches dbh). Although, it’s possible that over time, as stands stagnate and become denser, wildfire could remove more potential marten habitat under alternative 3 than alternative 2, since fewer acres remain untreated. However, risk of wildfire is present under all alternatives. Alternative 2 has the potential to create structural components of marten habitat more quickly than alternative 3 since more acres are treated and treatments are designed to improve stand and tree vigor.

The desired condition for martens includes snags and down woody debris for foraging and nesting, canopy cover greater than 25 percent and an average snag diameter of 9 inches. Intermediate harvest and prescribed fire are generally designed to retain at least 25 percent canopy cover while regeneration harvest results in canopy cover less than 25 percent. Of the action alternatives, alternative 3 would retain more canopy cover and therefore potentially more marten habitat than alternative 2, at least in the short term. However, implementation of any action alternatives will

result in snags 9 inches and greater in diameter being retained in the project area where feasible and where they do not create a safety hazard.

Furthermore, a minimum of 10 tons per acre would be retained in all treatments in all forest types except the dry Douglas-fir in order to provide down woody debris for marten in the short term. Marten are not expected to utilize the lower elevation portions of the project area since these areas tend towards naturally lower amounts of down woody debris than mid and high elevation sites. Residual trees and snags that are retained in treatment units would provide down woody debris in the long term except in those areas that are clearcut and where snags have been removed due to safety concerns.

Regulatory Framework and Forest Plan Consistency

The marten is a management indicator for mature forest species; as such it's intended to be a bellwether of the effects of management activities on representative wildlife habitats with the objective of ensuring that viable populations of existing native and desirable non-native animal species are maintained.

Federal laws and direction applicable to management indicator species include the National Forest Management Act (NFMA), the Forest Service Manual, and the Helena National Forest Plan. The NFMA requires the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" [16 U.S.C. 1604(g)(3)(B)]. All alternatives are consistent with this requirement.

The mountain pine beetle epidemic in the project area and combination boundary has resulted in a loss of canopy cover such that areas affected by the pine beetle no longer provide suitable marten habitat. However, implementation of any action alternative will result in the retention of some forested stands with canopy cover greater than 25 percent. These stands will continue to provide habitat for martens and for other mature forest species. None of the alternatives place martens at a risk of loss of viability forestwide. See the Viability Analysis Section.

Forest Plan Standards applicable to martens are those that provide thresholds for snags. The amount of snags in a given area is, of course, directly related to the amount of down woody debris that would become available as snags fall. Marten depend on both snags and down woody debris for nesting and roosting, as well as for foraging. See the Forest Plan Consistency section for Snags and Down Woody Debris Habitat.

Monitoring

Monitoring element C8 focuses on martens. Martens were chosen as a management indicator species (MIS) because they are associated with mesic mature and late-successional forests. Specifically, they require at least 25 percent canopy cover and generally avoid large openings. Consequently, they are sensitive to management actions. Furthermore, because they are predators they are good indicators of ecosystem health due to their position on the food chain.

The intent of this monitoring element is to *"measure the effect of management activities on representative wildlife habitats with the objective of ensuring that viable populations of existing native…species are maintained"* (*Forest Plan* p. II/17). Monitoring will allow us to determine if the forestwide goal – *maintain and improve the habitat over time to support big game and other wildlife species* (*Forest Plan* p. II/1) – is being achieved. The emphasis of the goals and objectives is habitat.

According to the Forest Plan EIS, Appendix B (p. B/68), old growth requirements of the Forest Plan are intended to provide the minimum management requirements for several species including martens.

Old growth on the Helena Forest has been reported in the *Forested Habitats of Special Concern Background Report*. There are three 3rd order drainages associated with the Project area (1106B, 1107, and 1108-1); 5 percent of each has been designated to be managed as old growth, selecting known old growth or the "next-best thing." All stands were reviewed with aerial photography and past activity layers. Additionally, in 2010, field verification of sample stands was completed. Currently, there is 12.5 percent old growth within the project area, and 11.1 percent within the combo area, 9.8 percent within the Divide Landscape and 8.4 percent forestwide.

Snags are also a consideration for martens. Snags are abundant in the smaller size classes with very few large snags present on the Forest. This is primarily due to a lack of large trees across the Forest. Snags will continue to be abundant as the mountain pine beetle expands; however, large snags will continue to be rare.

Habitat analyses and survey data indicate marten habitat is well distributed and occupied on the Forest. However, as the mountain pine beetle runs its course, old growth and mature habitat will decrease, the extent to which is unknown. (See also the *Viability Analysis* Section). Outyear monitoring will occur in the project as part of *Forest Plan* monitoring specific to element C8.

Northern Goshawk

Affected Environment

Habitat use and Population Processes

The northern goshawk (*Accipiter gentilis*) is the only large diurnal raptor adapted to interior forest environments in the northern Rockies. Common elements of goshawk habitat are large blocks of older forest with tight groups of large nesting trees, abundant prey (squirrels, hares, grouse, larger songbirds), and mid-level flyways. Throughout most of the Rocky Mountain region, optimal habitat for goshawks is provided by old-growth Douglas-fir and ponderosa pine forest—and for that reason, the species was chosen as a management indicator for those habitats in the *Helena Forest Plan* (and in most other Northern Region Forest Plans). Since the 1980s, however, copious field research and survey work have shown that goshawks are more versatile in their use of habitat than was believed when the Forest Plans were written. Goshawks have specific requirements for nesting and post-fledging habitat (close-canopied mature forest) but otherwise reveal themselves as forest generalists, not particularly useful as old-growth indicators (Braun et al. 1996; Reynolds et al. 1992; Clough 2000; McGrath et al. 2003).

Surveys over the past 15 years on the Helena, Beaverhead-Deerlodge, Lewis and Clark, and Medicine Bow National Forests have found that goshawks will nest and forage in stands of mature lodgepole pine as long as the basic structural attributes they need are in place and prey is adequate (Lemke 1993; Squires and Ruggiero 1996; Clough 2000). In the more fragmented forest environments east of the Continental Divide where mountains and prairies intermingle, goshawks often occupy mosaics of forest and grassland or a mixture of different forest seral stages. They are drawn also to aspen stands because of the robust populations of potential prey these habitats support (grouse, cottontails, snowshoe hares, ground squirrels, mourning doves, flickers, small owls, and numerous large songbirds and woodpeckers). Goshawks are capable of foraging through open parks and woodlands and along forest edges. In certain circumstances, they do so on a regular basis (Younk and Bechard 1994). But regardless of the structural diversity of foraging habitat and of

goshawk ranges in general, nesting and post-fledging habitat inevitably requires cohesive stands, or at least substantial patches, of dense-canopied mature forest.

Goshawks can use small patches of mature habitat to meet their nesting requirements within a mosaic of habitats of different age classes (Samson 2006). Squires and Ruggiero (1996) found that goshawks were adept at locating suitable microsites within lodgepole pine stands that otherwise did not appear to be suitable for nesting. This was further substantiated by McGrath et al. (2003), who found that many of their sampled goshawks were nesting in non-typical habitat to the extent that the researchers were unable to differentiate between actual nests and random locations in a "blind sample comparison." In Nevada, Younk and Bechard (1994) studied goshawks that nested in aspen stands and preyed mostly on ground squirrels in shrub-steppe habitat. In the upper Clark Fork drainage, Clough (2000) found no difference in goshawk nest density between drainages that were heavily-forested and un-fragmented, versus drainages that were heavily-fragmented by openings (old clearcuts). While habitat structure and prey abundance determine whether or not a given area can be occupied, nest distribution across the landscape is dictated by territoriality and nest success is determined by spring weather (Joy 2002; Reich et al. 2004).

Extensive survey work over the past 18 years has demonstrated that goshawks are widespread across the "eastside" Forests of Montana (the Helena, Lewis and Clark, Beaverhead-Deerlodge, Gallatin, and Custer National Forests). They maintain large home ranges, estimated at around 5,000 to 6,000 acres per pair (Reynolds et al. 1992; Clough 2000), and, as a result, population densities are naturally low, even where suitable habitat is abundant. In areas with high prey populations and optimal habitat structure, home ranges may be smaller or overlap. Goshawks can hunt through a diversity of habitat formations as long as prey is adequate, and most of a goshawk home range consists of diverse foraging habitat and other sites unsuitable for nesting (Reynolds et al. 1992). Nesting stands and post-fledging areas (PFAs), which require more specialized habitat structure, make up a much smaller portion of the home range—usually no more than a few hundred acres. On the HNF, nest sites and surrounding PFAs sometimes cover less than 100 acres. These are forested areas dominated by mature trees with enough closed canopy to provide screened nesting sites, suitable microclimate, abundant prey, and security from open-forest predators.

Loss of habitat to clearcut logging, stand-replacing fire, and other agents of canopy fragmentation are primary threats. Goshawks are sensitive to human disturbance of nest sites and can be very aggressive in defending the nest and the larger area within which newly fledged young are operating (post-fledging area) [personal observation, Helena and Beaverhead-Deerlodge National Forests 1987–2012]. They may occupy the same nest stand in consecutive years but rarely the same nest (although they may return to an old nest 2 or 3 years later). Just as often, they may move to a new stand elsewhere in the home range. Because of their large home ranges and their natural tendency to cycle among different nest sites between years, they are able to adapt to many environmental changes (such as fire, timber harvest, and insect outbreaks) by moving to adjacent undisturbed sites.

Goshawk Populations

The only nation-wide estimates of goshawk population trends comes from the recently-released results of the North American Breeding Bird Survey (BBS), 1966-2013. These data indicate that northern goshawk declined by approximately 1 percent in the Northern Rockies during that period and by 3.34 percent in Montana (figure 63 and http://www.mbr-pwrc.usgs.gov/bbs/bbs.html). However, Andersen et al. (2005, p. 7) conclude that "BBS data are inadequate to estimate population trend for goshawks both because the number of routes on which goshawks are detected and the encounter rate of goshawks on these routes are too low." The BBS also cautions that the data has deficiencies. In particular, (1) the regional abundance is less than 0.1 birds/route (very low abundance), (2) the sample is based on less than 5 routes for the long term (very small samples),and

(3) the results are so imprecise that a 5 percent per year change would not be detected over the long term (very imprecise).

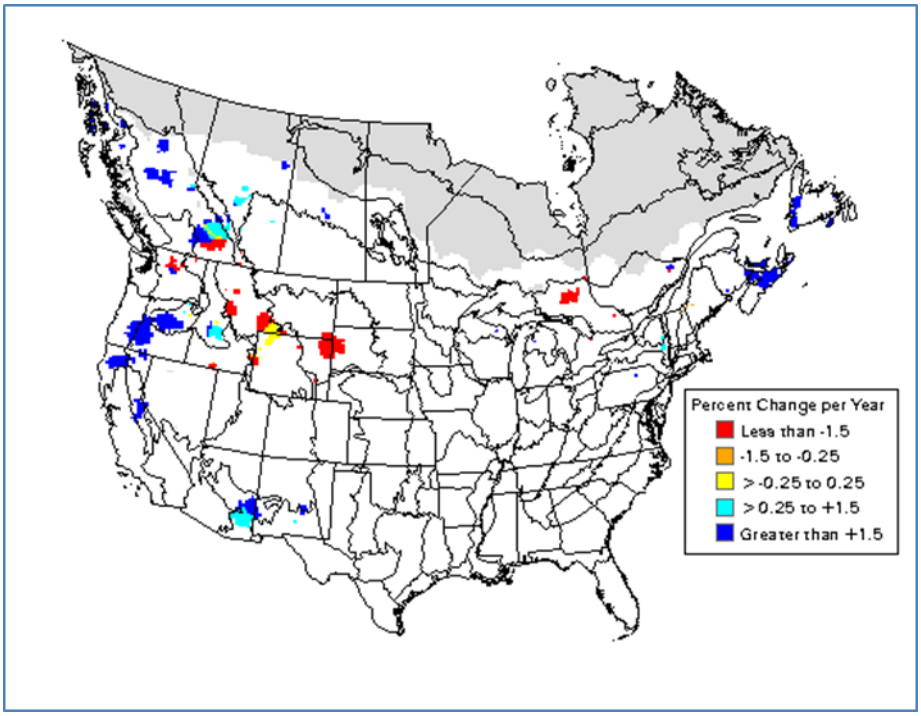


Figure 63. BBS Trend Map, 1966 to 2013 Percent change in trend for northern goshawks (Source: Sauer *et al*. 2014)

Some authors had hypothesized that goshawk populations may be declining (Bloom et al. 1986 as cited in Andersen et al. 2005, Crocker-Bedford 1990, Zinn and Tibbits 1990 as cited in Squires and Kennedy 2006). Hoffman and Smith (2003) analyzed migration data and concluded that uncertainly exists as to the status of western goshawk populations. Kennedy (1997) and Andersen et al. (2005) concluded that current sampling techniques may be inadequate to determine if goshawk populations are declining, increasing, or remaining stable. Squires and Kennedy (2006) conclude that this difficulty is due to several factors including: (1) goshawks are secretive and difficult to survey and (2) many studies have small sample sizes.

While the BBS shows a 1 percent decline in overall population trend, the Montana Natural Heritage database lists the global status of northern goshawks as 'G5'—that is, *"common, widespread, and abundant (although it may be rare in parts of its range), not vulnerable in most of its range."* The goshawk's statewide status is 'S3,' which is defined as *"potentially at risk because of limited and/or decline numbers, range, and/or habitat, even though it may be abundant in some areas."* See http://fieldguide.mt.gov/displayClasses.aspx?Kingdom=Animalia.

Goshawk Management

The goshawk has been a management indicator species for old-growth forest since the release of the *Helena Forest Plan* in 1986. Between 1991 and 1997, environmental organizations submitted petitions to have the goshawk listed under the Endangered Species Act; but in 1998, the USFWS concluded that since goshawks were well distributed throughout their historical ranges and that there was no evidence of declining population trends, listing was not warranted (USDI 1998). The goshawk was also listed for several years as a sensitive species in USFS Region 1 (the Northern

Region)—a status that ended in 2006 for the same reasons that had led the USFWS declining to add it to the Endangered Species list. The species, however, remains a focal point of keen interest for wildlife biologists, forest managers, and certain segments of the public [see USDA 2009c, p. 4-6].

Regional Guidance

In recent years, goshawk management guidance in USFS Region 1 has responded to a number of findings, summarized in the *Northern Goshawk Northern Region Overview* (USDA 2009c, p. 30-31):

- The species is considered globally secure; but because some segments of the Montana population show limited numbers or declining habitat, regular monitoring of local populations will continue to be needed.
- The USFWS has concluded that "the goshawk population is well distributed and stable at the broadest scale" [63 Fed. Register 35183].
- Breeding goshawks and their habitat appear abundant and well-distributed across FS Region 1.
- Each National Forest in Region 1 appears to have more than enough habitat to maintain a minimum viable population (Samson 2006).

Helena National Forest Guidance

On the HNF, long-term survey efforts (searching for new nests and monitoring known nests) over the last 20 years has revealed a regular distribution of goshawk home ranges across forested areas of the Divide landscape and the National Forest as a whole. Though not all potential home ranges have been surveyed, those nest sites that have been identified have typically been spaced about 3 to 4 miles apart. In any given year, not all sites have been found to be active (either because goshawks were not there or surveys could not locate them). But after several years of fieldwork, the pattern of active and inactive nests has pointed to a well distributed array of sites capable of supporting breeding goshawks. These positive results have not lessened survey efforts on the Forest: the goshawk remains a species managed via a fine-filter approach, which requires considerable attention being be paid to site-specific detail over broad areas. And now, with the mountain pine beetle epidemic having substantially modified the kinds of nesting and foraging habitats available to goshawks, regular monitoring is of particular value in determining how goshawks are adapting to the changes and how fine-filter management needs to respond.

Although the *Forest Plan* intends that the goshawk is to be an indicator of the health of old-growth forest habitats, it is, in practice, managed more as a "species of special concern," whose habitat needs are accommodated regardless of whether the result leads to optimal old-growth management. In terms of specific habitat management tactics, forest managers in the northern Rockies over the last two decades have most commonly drawn upon detailed guidelines from Reynolds and others (1992). But, because these guidelines were designed for goshawks in Southwestern ponderosa pine forests, the HNF supplements this information with more local guidance (Clough 2000; Samson 2005; USDA 2009c).

Southwestern U.S. Management Guidelines

Reynolds et al. (1992, p. 3-4, 13-15) defined 4 key habitat areas for goshawks: *nest stands*, *post-fledging areas (PFAs)*, *foraging areas*, and the *nesting home range* as a whole. The ***nest area*** is the center of all activity associated with breeding. Reynolds and his team determined, through radio telemetry, that in Arizona ponderosa pine forests, breeding goshawks typically range through a nest area of about 30 acres. Nest areas inevitably include one or more stands dominated by large old trees with dense canopy closure. In some cases, the bulk of the nest area may be occupied by dense, old-tree habitat, but more often, these sites are scattered throughout the nest area, connected by a larger

matrix of younger trees with more irregular canopy closure. Most goshawks have 2 to 4 alternate nest areas in their home range, and Reynolds recommends that, in managing goshawk habitat, 180 acres of nest area be retained.

Post-fledging areas (PFAs) surround nest areas and provide a haven in which young birds can develop flying and hunting skills. In Arizona, they range from about 300 to 600 acres in size (420-acre average) and encompass a variety of forest types and canopy covers with enough vegetative diversity to support a good prey base. The PFA is the area defended by adult goshawks during the nesting season. ***Foraging areas*** surround PFAs and average roughly 5,400 acres in size. Goshawk foraging areas are typically dominated by mature forest with relatively open understory (to allow for more efficient hunting), but because of their size, they usually encompass a diversity of habitat formations, including open-grown forest, grassland-shrubland, meadows, early-seral forest, clusters of dead trees, and human-made openings. Goshawks prefer to forage in mature forest, but because they are opportunistic hunters, Reynolds feels that the areas in which they choose to forage are governed more by prey density than by habitat structure (Reynolds et al. 1992, p. 4, 14-19). The goshawk ***breeding home range*** consists of the sum of the above 3 component areas. Reynolds recommends managing for home ranges of about 5,820 acres in the southwest. The actual size of a given range, however, is a function of the availability and distribution of nesting stands and the quality of the foraging area: ranges are likely to be larger where prey is less abundant, less diverse, and more erratically distributed.

Other Management Reviews

The habitat requirements of goshawks and the role that these needs ought to play in directing forest management have not been without controversy. In a comprehensive status review of the species in 1998, the USFWS found that while the goshawk typically uses mature forests or larger trees for nesting (the nest area), it can otherwise be considered a forest habitat generalist that makes use of a variety of forest types and ages. The review found no evidence that the goshawk is dependent on large, unbroken tracts of old-growth or mature forest (USDI 1998).

Conversely, Greenwald et al. (2005) in a literature review of selected studies concluded that goshawks select mature to old-growth forests and criticized the management recommendations of Reynolds et al. (1992). Reynolds, however, rebutted Geenwald's conclusions in a comprehensive review of literature that supported the USFWS review (Reynolds et al. 2005). The rebuttal found that Greenwald's criticisms were based on misunderstandings of the desired goshawk habitats outlined in Reynolds et al. (1992), under-appreciation of the variation in vegetation structure among forest types and seral stages used by goshawks, disregard of the ecological factors limiting goshawks, failure to understand the dynamic nature of forest habitats, and an incomplete review of the literature (Reynolds et al. 2008).

Local Considerations

At project level, goshawk management tends to focus on maintaining the integrity of local nest areas and post-fledging areas. Foraging areas are large and often amorphous to a degree that researchers and fieldworkers may not be able to detect any differences between habitat in the foraging area and that of surrounding areas (McGrath et al. 2003). As a result, unless a project is altering major blocks of vegetation over an area the size of a goshawk home range in a way that would substantially limit goshawk foraging options, the composition of foraging areas is seldom mapped out in detail.

While Reynolds et al. (1992, p. 20-30) have provided detailed estimates as to the optimal characteristics of goshawk breeding ranges in the Southwest, survey and monitoring on the HNF have often found goshawks occupying home ranges with attributes uncharacteristic of those described by Reynolds. Local goshawks appear to be quite flexible as to the size and composition of

the habitat units in which they are able to live and successfully raise young—often nesting in smaller, more fragmented stands and foraging in more open environments than has been considered the norm. This flexibility, however, is now being severely tested, with large portions of the forest overstory dead and devoid of foliage. The chances of local goshawks finding anything approaching the optimal habitat described in the Southwest guidelines are slim. We have analyzed Reynolds' Southwest forest guidelines to the Telegraph project area and the Divide landscape for purposes of providing perspective. But the usefulness of the exercise in determining how goshawks are using available resources in this changing environment is limited.

Population Status and Habitat in the Project Area

Goshawk Monitoring

Regular goshawk inventory and monitoring has been ongoing in the Divide Landscape and across the Forest since the early 1990s. Table 178 summarizes survey efforts from 1992 to 2014. These efforts have involved perusal of past and proposed project areas, surveys of old-growth stands and project areas as a whole, follow-up of reported sightings, and monitoring of previously identified nest sites. One active goshawk nest identified in 2009 is within the project area in the main stem of lower Telegraph Creek. We assume that more nests have been active in and around the project area over the past 20 years than have been verified. A number of goshawks have often been heard or observed behaving as if defending a nest site, but then the nest could not be located. Most of these observations occurred in areas where we would have expected a nest to have been established based on habitat conditions and distances to other nests.

In keeping with the role of the goshawk as a management indicator species for old-growth, 3 old-growth units in the Telegraph project area were surveyed for goshawks in 2012 with no detections. An additional grouping of 9 old-growth units was surveyed in the eastern part of the combination boundary (around Tenmile Creek), resulting in the location of one goshawk in that area. In 2013, 41 old growth units were surveyed in the Telegraph project area also with no detections.

Table 178. Summary of Goshawk Survey Efforts in the Divide Landscape, 1992-2014. Highlighted rows are in the Telegraph combination boundary

Location	Year Surveyed	Type of Survey	Results
Banner Creek	1999	Field reconnaissance	Prob. active nest; goshawk seen.
Banner Creek	2001	Field reconnaissance	Prob. active nest; goshawk seen.
Blackfoot Meadows	1994	Field reconnaissance	Prob. active nest; goshawk seen.
Blackfoot Meadows	1999	Field reconnaissance	Response; prob active nest; goshawk seen.
Blackfoot Meadows	2000	Field reconnaissance	Prob. active nest; goshawk seen.
Blackfoot Meadows	2001	Field reconnaissance	Prob. active nest; goshawk seen.
Blackfoot Meadows	2002	Field reconnaissance	Prob. active nest; goshawk seen.
Brooklyn Bridge	1996	Field reconnaissance	Prob. active nest; goshawk seen.
Brooklyn Bridge	1998	Field reconnaissance	Prob. active nest; goshawk seen.
Brooklyn Bridge	2004	Known territory	Prob. active nest; goshawk seen, territory considered occupied.

Location	Year Surveyed	Type of Survey	Results
Brooklyn Bridge	2005	Known territory	No detection.
Brooklyn Bridge	2011	Known territory	No detection.
Colorado Gulch	2005	Project area	This nest was reported by a private landowner in the vicinity of the nest. We have not been able to find the nest itself although surveys have been conducted in the vicinity, particularly in 2014.
Connors Gulch	2001	Field reconnaissance	Response.
Connors Gulch	2002	Field reconnaissance	Prob. active nest; goshawk seen.
Connors Gulch	2004	Known territory	No detection.
Deadman Creek	2005	Known territory	No detection.
Elliston Face	2005	Project area	Active nest located.
Elliston Face	2006	Known nest	Goshawks detected foraging.
Grizzly Gulch 3	2014	Project area	Active nest; appear to have fledged (2) young.
Grizzly-Orofino Gulch	1996	Field reconnaissance	Prob. active nest; goshawk seen.
Hope Creek/Spring Gulch	2005	Known territory	No detection.
Jackson Creek	1996	Field reconnaissance	Active nest.
Jericho Creek (TE NOGO Jericho Creek including alternate nests)	2014	Project area	Nest
Kading-Limburger Springs	2005	Known territory	No detection.
Little Blackfoot (Nests ‘LB1151 Nest 2’ and ‘LB1087’)	2010	Planning area	Two active nests.
Little Blackfoot	2011	Known nests	Goshawks detected.
Little Blackfoot	2007	Planning area	Goshawks detected.
Little Buffalo Gulch	1996	Field reconnaissance	Prob. active nest; goshawk seen. An active nest was never located although there have been ample goshawk sightings over the years.
Little Corral Gulch	1996	Field reconnaissance	Prob. active nest; goshawk seen. An active nest was never located although there have been ample goshawk sightings over the years.
Little Corral Gulch	1998	Field reconnaissance	Response. Prob. an active nest. An active nest was never located although there have been ample goshawk sightings over the years.

Location	Year Surveyed	Type of Survey	Results
Little Corral Gulch	2002	Field reconnaissance	Prob. active nest; goshawk seen. An active nest was never located although there have been ample goshawk sightings over the years.
Little Corral Gulch	2004	Known territory	Prob. active nest; goshawk seen. An active nest was never located although there have been ample goshawk sightings over the years. Occupied territory.
Little Corral Gulch	2005	Known territory	No detection. Prob. active nest. An active nest was never located although there have been ample goshawk sightings over the years.
Little Corral Gulch	2011	Known territory	No detection. Prob. active nest; goshawk seen. An active nest was never located although there have been ample goshawk sightings over the years.
Lower Little Blackfoot	2001	Field reconnaissance	Prob. active nest; goshawk seen.
Lower Tenmile Creek	2002	Field reconnaissance	Prob. active nest; goshawk seen.
Mike Renig Gulch	1999	Field reconnaissance	Prob. active nest; goshawk seen; response.
Monarch Creek	1999	Field reconnaissance	Prob. active nest; goshawk seen.
Monarch Creek	2002	Field reconnaissance	Prob. active nest; goshawk seen.
Monarch Creek	2004	Known territory	No detection.
Mt. Helena Ridge	2005	Known territory	Goshawk nest found in October of 2005 with goshawk activity nearby; no additional follow-up since 2005.
Ontario Creek	2002	Field reconnaissance	Prob. active nest; goshawk seen.
Ophir Creek-Black Mountain	2005	Known territory	No detection.
PSU 11028	2005	Primary Sample Units – Regional Surveys	No detection.
Rowe Gulch	1997	Field reconnaissance	Response.
South Fork Quartz Creek	1996	Field reconnaissance	Active nest.
South Fork Quartz Creek	1998	Field reconnaissance	Active nest.
South Fork Quartz Creek	2004	Known territory	No detection.
South Fork Quartz Creek	2011	Known territory	No detection.
South Helena	2006	Project area	Pot. active nest ; goshawks detected foraging.

Location	Year Surveyed	Type of Survey	Results
Spring Gulch	2000	Field reconnaissance	Active nest.
Spring Gulch	2002	Field reconnaissance	Active nest.
Spring Gulch	2004	Known territory	Occupied.
Squaw Gulch	1996	Field reconnaissance	Prob. active nest; goshawk seen.
Stemple Pass	1998	Field reconnaissance	Response.
Sweeney Creek	2004	Known territory	Occupied.
Sweeney Creek	2011	Known territory	No detection.
Sweeny Creek	1992	Field reconnaissance	Prob. active nest; goshawk seen.
Telegraph Creek	1995	Field reconnaissance	Prob. active nest; goshawk seen.
Telegraph Creek	2001	Field reconnaissance	Prob. active nest; goshawk seen.
Telegraph Project Area	2008	Project area	No detections.
Telegraph Project Area (Telegraph Nest 1)	2009	Project area	Active nest.
Telegraph Project Area	2012	Project area, Old growth survey	No detections.
Telegraph Project Area	2013	Old growth survey	No detection.
Ten Mile Creek	2010	Project area	Two detections.
Ten Mile Creek	2011	Project area	Goshawk detected.
Ten Mile Creek	2012	Telegraph project within Combo area, old growth survey	One detection.
Ten Mile Creek	2013	Old growth survey	No detection.
Ten Mile Creek	2014	Project area	No detections.
Ten Mile Creek (TM NOGO Nest)	2013	Project area	Nest located; adults did not return to nest.
Upper Lump Gulch	1992	Field reconnaissance	Response.
Upper Lump Gulch	1997	Field reconnaissance	Prob. active nest; goshawk seen.
Upper Lump Gulch	2002	Field reconnaissance	Prob. active nest; goshawk seen.
Upper Lump Gulch	2004	Known territory	No detection.
Upper Travis Creek	2011	Known territory	No detection.

Table 179. Known nests within the combination boundary

Year Found	Nest I.D.	Status
2005	Elliston Creek-Kinney Gulch	Alternate
2007	Elliston Creek	Alternate
2009	Telegraph Nest 1 [Project area]	Active
2010	LB1151 Nest 2	Active
2010	LB1087	Active
2014	TE NOGO Jericho Creek (4 nests) [Project area]	Inactive (active in 2012)

Because of their close proximity on the landscape and years of occupancy, three of the nests (Elliston, Elliston-Kinney, and LB1151-Nest 2) probably represent a single home range occupied over several years. Likewise, the four nests found in Jericho Creek (TE NOGO Jericho Creek *et al*.) are quite close and undoubtedly represent a single territory. The Telegraph Nest 1 and LB1087-Nest 2 (in the vicinity of the Carbonate King mine west of the Little Blackfoot River) appear to represent two separate home ranges. The circular home ranges and PFAs shown in figure 64 and figure 65 are idealized depictions based on the guidelines in Reynolds et al. (1992): 5,000 acres for home ranges, approximately 415 acres for PFAs. Actual home range boundaries are undoubtedly more irregular and fluid—shifting from year to year depending on nest location, vegetation condition, prey distribution, and the location of adjacent goshawk home ranges.

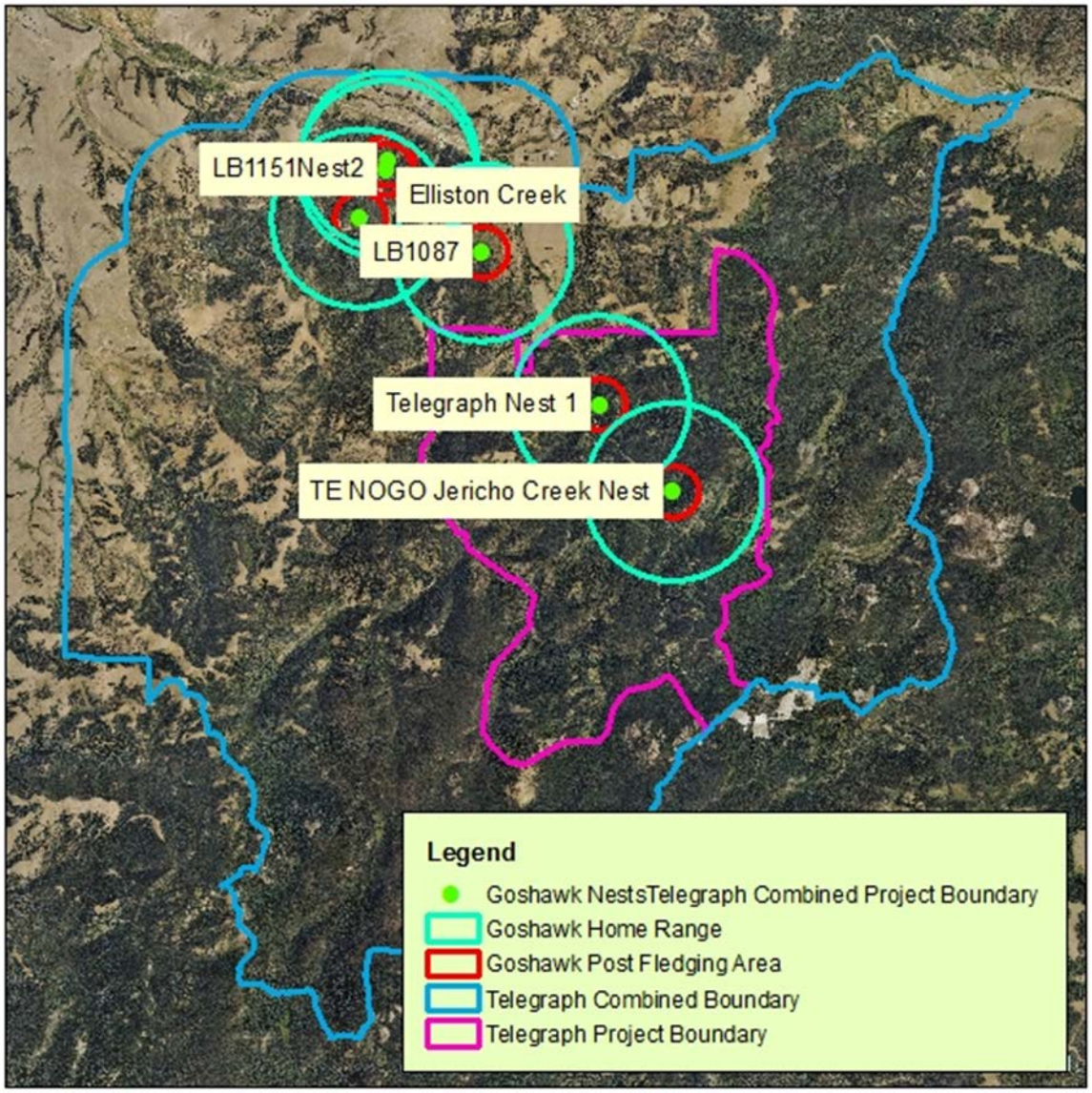


Figure 64. Telegraph combination boundary (blue) and Project Area (purple) with idealized goshawk home ranges (blue); post-fledging areas (orange); and nest sites (green).

Potential Population Density

Currently, there are two sets of guidelines available for determining how much nesting habitat might be needed by a pair of breeding goshawks in the Rocky Mountain area. Reynolds et al. (1992) guidelines for southwestern forests recommend at least 180 acres per goshawk pair in patches of 30 or more acres. The Northern Region Overview guidelines (USDA 2009c) recommend up to 240 acres per pair in patches of 40 or more acres. Based on habitat modeling, the project area contains 9,524 acres of potential goshawk nesting habitat, of which 8,351 acres are in patches of 40 acres or more. In the absence of territoriality, this could provide nesting opportunities for up to 35 goshawk pairs at 240 acres of nesting habitat in patches of 40 acres or more per pair.

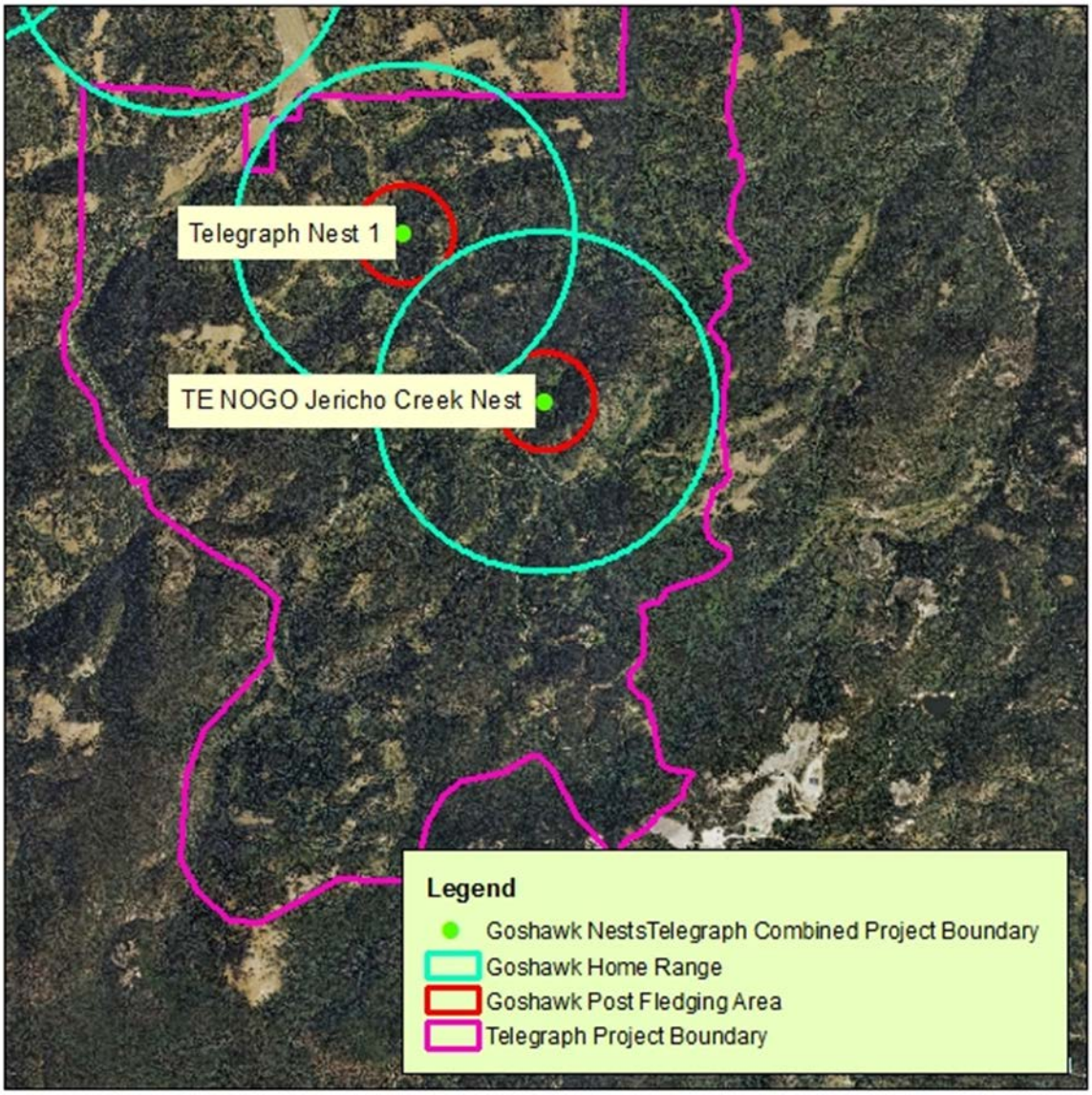


Figure 65. Telegraph Goshawk Nest #1 in the northern part of the project area about ¼ mile east of Telegraph Creek and Jericho: 5,820-acre home range (teal outline); 600 acres PFA (red outline); nest site (green dot).

Knowing that goshawks are territorial, however (at least with regard to PFAs), and that the average spacing between neighboring home ranges in the Divide landscape (where several adjacent ranges have been identified) is 3 to 4 miles, these calculations would seem to overestimate potential goshawk density in the project area. However, when using both the Northern region and Southwestern U.S. guidelines for home range sizes of at least 5,000 acres respectively, which are more congruous with active nest sites spaced 3 to 4 miles apart—it is likely that the project area could support no more than five goshawk ranges, even assuming some home range overlap. This would be true regardless of which set of guidelines are applied. What the calculation of available habitat for the two sets of guidelines does suggest, however, is that there is more than enough suitable nesting habitat in the project area to support the five nesting pairs.

Thousands of acres of mature forest dominated by lodgepole pine—much of it potential goshawk habitat—have been defoliated by mountain pine beetle infestation across the landscape. Before the loss of forest foliage, the goshawks that were monitored changed nest sites each year but, in most cases, remained within the same nest stand complex—typically nesting somewhere between a few hundred feet to a mile away from the previous year's site. With the loss of several hundred acres of viable nesting habitat, suitable nest stands have become smaller and more fragmented. The choices open to local goshawks have become more limited, particularly in terms of finding a new nest site close to the one used the year before. Birds that have been nesting in pine forest must now switch to viable green stands of Douglas-fir and, to a lesser extent, Engelmann spruce, subalpine fir, and, perhaps, aspen. This, in turn, is making it more difficult for fieldworkers to relocate goshawk pairs from year to year. At this point it is difficult to know whether the drop in goshawk survey numbers over the last couple years reflects an actual decline in the local population or our inability to locate still-resident goshawks displaced to new locations. The actual effect of the beetle outbreak on the HNF goshawk population will become evident as survey efforts continue to go forward over the next few years.

Habitat Analysis

Nesting and Foraging Habitat R1 VMap Analysis

Goshawk nesting and foraging habitat (which involves considerably more than just old-growth) is modeled according to Samson (2006) as described in the *Criteria for Wildlife Models Helena National Forest* (USDA 2009a) and according to vegetation diversity as described in *Northern Goshawk Northern Region Overview: Key Findings and Project Considerations* (USDA 2009c) [See following section]. R1 VMap has been used to depict and quantify the nesting and foraging habitat in the Telegraph project area and within the combination boundary. Table 180 summarizes goshawk nesting and foraging habitat at both scales. Of the project area acres, approximately 143 acres of nesting habitat are also designated as old growth.

Table 180. Goshawk nesting and foraging habitat in Telegraph Project area and the combination boundary (based on R1-VMAP)

Analysis Scale	Nesting Habitat Acres	Foraging Habitat Acres
Combination Boundary	36,671	78,192
Project Area	9,524	17,709

Assuming an average home range of 5000 acres per nesting pair, the project area (23,670) potentially supports about 4 to 5 goshawk pairs, although the birds have a considerably smaller array of nest stands to choose from than prior to the beetle infestation. Out of the 9,524 acres of potential nesting habitat, 8,351 acres are in patches of 40 acres or more. Thus, there is more nesting habitat available in the project area than the amount that is needed to provide for 4 to 5 nesting pairs of goshawks according to Reynolds et al. (1992) guidelines that recommend at least 180 acres in patches of 30 acres or more of nesting habitat per pair or according to the Northern Region Overview (USDA 2009c) guidelines that recommend up to 240 acres per pair in patches of 40 or more acres. The same criteria are true for the combination boundary (117,966 acres of which 36,671 acres are nesting habitat and of that 31,387 are in patches of 40 acres or more), which should be able to support roughly 23 goshawk pairs [see previous section on *Potential Population Density*].

Northern Goshawk Regional Overview Analyses

The characteristics of the Project area as goshawk foraging habitat, as well as the post fledging area (PFA), are also based on diversity matrices described in the guidelines identified in the *Northern Goshawk Northern Region Overview: Key Findings and Project Considerations* (USDA 2009c).

Home Range/Foraging Area Analysis

Table 181 summarizes the composition of dominant vegetation recommended for goshawk home ranges in the southwestern U.S. by Reynolds et al. (1992) compared with that found in occupied goshawk home ranges in (1) the Flint Creek Range of west-central Montana (Clough 2000) (average of 19 home ranges) and in the Telegraph project area. The home range/foraging area diversity matrix for Montana goshawks is compared to Reynolds et al. (1992) to determine if the diversity matrix falls within the range of Reynolds' recommendations.

Table 181. Dominant vegetation composition of *foraging habitat* in goshawk home ranges in the Telegraph Creek area (based on R1-VMAP estimates) compared with ranges in west central Montana (Clough 2000) and recommendations for ranges in the southwestern U.S. (Reynolds *et al*. 1992).

Stand Size Classes	Recommendations for Home Ranges in the Southwest U.S. (Reynolds et al. 1992)	Existing Condition on Home Ranges in West-Central Montana (Clough 2000)	Existing Condition Telegraph Project Area % (acres)
Grass/Forb/Shrub	10%	7%	6% (1,365)
Seedling/Sapling (<5 inch dbh)	10%	9%	5% (1,184)
Small Poles (5-10 inch dbh)	20% *	65%	33% (7,834)
Large Poles (Mature) (>10 inch dbh)	60% *	11%	55% (12,905)
> 5.0 inch dbh with >50% canopy cover	60% (>12 inch dbh)	69%	81% (19,202)**

*Reynolds' small poles are 5 to 12 inches dbh, large poles >12 inches dbh [dbh = diameter at breast height].
**Telegraph canopy cover (>40%) and pole dbh (> 5.0 inches) are based on categories associated with the R1-VMAP dataset

As can be seen in table 181, the percentages of grass/forb/shrub and seedling/sapling habitats in active goshawk ranges in west-central Montana and the Telegraph area are somewhat similar to what is recommended in the Southwest guidelines. There is considerable variation, however, within the mid and late-successional forest categories. West-central Montana ranges include more of the smaller trees (66 percent small poles) whereas the Southwest guidelines recommend a predominance of larger trees (60 percent large poles). The Telegraph area falls closer to the Southwest guidelines at 33 percent small poles and 55 percent large poles (mature trees). In spite of such deviation from the recommended structure, the fact remains that Montana forests with the composition shown in Table 181 do support goshawks: these figures are for successfully occupied home ranges. So, at least part of the Telegraph project area is providing habitat that is within the range of what goshawks perceive as suitable. The two documented home ranges in the Project area (Telegraph Nest #1 and TE NOGO Jericho) retain an abundance of pole and mature forest in spite of the mountain pine beetle outbreak because due to a preponderance of Douglas-fir. Other parts of the project area and the combination boundary include more lodgepole pine and thus retain less viable pole/mature forest habitat.

PFA Area Analysis

Post-fledging areas (PFAs) require an ample representation of pole and mature forest with relatively high canopy closure in order to provide a protected environment for young birds newly out of the nest. Nonetheless, given that PFAs often cover several hundred acres and need to provide habitat for diverse prey as well as cover, most of them are fairly heterogeneous environments. There is considerable variation in their composition within a given Forest, a geographic region, and, in particular, between regions. Whereas 66 percent of PFAs in west central Montana were found to be comprised of trees ≥5 inches dbh and greater than 50 percent canopy cover (Clough 2000), this was true of only 36 percent of PFAs in eastern Oregon (Desimone 1997 as cited in USDA 2009c; McGrath et al. 2003). In areas where site conditions, such as moist north slopes, can support high tree canopy covers, a canopy coverage greater than 70 percent is suggested for the Northern Rocky Mountain Ecological Province, but coverage of only greater than 50 percent for the Middle and Southern Rocky Mountain Ecological Provinces (Samson 2005).

Table 182 summarizes the vegetation composition of PFAs recommended by Reynolds et al. (1992) and compares it with that of PFAs in west-central Montana Clough (2000) (excerpted from the *Northern Goshawk Northern Region Overview: Key Findings and Project Considerations* USDA 2009c) and the PFAs of the two known nests in the Project area.

Table 182. Dominant vegetation composition of *post-fledging areas (PFAs)* in goshawk home ranges in the Telegraph Creek area (based on R1-VMAP estimates) compared with ranges in west central Montana (Clough 2000) and recommendations for ranges in the southwestern U.S. (Reynolds et al. 1992).

Stand Size Classes	Recommendations for PFAs in the Southwest U.S. (Reynolds *et al*. 1992)	Existing Condition on PFAs in West-Central Montana (Clough 2000)	Existing Condition on the TE NOGO Jericho Nest PFA % (acres)	Existing Condition on the Telegraph Nest #1 PFA % (acres)
Grass/Forb/Shrub	10%	7%	2% (10)	8% (40)
Seedling/Sapling (<5 inch dbh)	10%	9%	3% (11)	0% (0)
Small Poles (5-10 inch dbh)	20% *	66%	41% (170)	19% (78)
Large Poles (Mature) (>10 inch dbh)	60% *	11%	53% (220)	70% (292)
> 5.0 inch dbh with >50% canopy cover	60% (>12 inch dbh)	69%	88% (365)**	80% (333)**

* Reynolds' small poles are 5 to 12 inches dbh, large poles >12 inches dbh [dbh = diameter at breast height].
**Telegraph canopy cover (>40%) and pole dbh (> 5.0 inches) are based on categories in the R1-VMAP dataset

There is considerable variation between the PFAs of the two known nests in the project area, let along as compared to Reynolds et al. (1992) and Clough (2000). This underscores that goshawks tend to be highly variable in their habitat selection.

Environmental Consequences

Effects to goshawk habitat are based on impacts to habitat modeled according to Samson (2006) as described in *Criteria for Wildlife Models Helena National Forest* (USDA 2009a) AND based on changes in vegetation diversity as described in Northern Goshawk Northern Region Overview: Key Findings and Project Considerations. Effects to Northern Goshawk are evaluated according to the following measures:

- Acres of foraging and nest habitat treated in the Project area
- Home range/foraging area diversity matrix post-treatment percentages in the Project area
- PFA diversity matrix post-treatment percentages

Desirable Northern Goshawk Habitat Conditions

√ Between 180 and 240 acres nesting habitat per 5,000-acre territory

√ Heterogeneous foraging habitat including mature forest as well as a mix of other forest and non-forest components

√ Approximately 420 acres post fledging habitat that includes some mid to late-seral forests with structural diversity in the understory

Effects Common to All Alternatives

Untreated portions of the Project area will continue to progress through succession regardless of alternative. Disturbance processes including climate change, insect and disease, and fire will continue to influence the Project area.

Effects Common to All Action Alternatives

Samson (2005) summarized recent (2000 and newer) studies on the effects of vegetation treatments on northern goshawks that show, among others, that: (1) the majority of goshawk pairs move from nest stands when stand structure is modified by more than 30 percent (Penteriani and Faivre 2001, p. 213); (2) human disturbance is not a factor if 70 percent of the nest stand structure is maintained and timber management operations are time restricted during the nesting period (McGrath *et al.* 2003 as cited in Samson 2005, p. 37); this is accomplished via a ‘no activity’ buffer around the nest sites until the nest is no longer occupied and a timing restriction in the post-fledging area from 15 April through 15 August to protect goshawk pair and young from disturbance ; (3) timber harvest has no effect on goshawk breeding area occupancy, nest success, or productivity 1 to 2 years after treatment (Moses and Garton 2004 as cited in Samson 2005, p. 36); and (4) no difference in the productivity of northern goshawks occurs in logged versus unlogged areas (Penteriani and Faivre 2001, p. 213).

Disturbance thresholds identified in numbers (1) and (2) above will be addressed through application of ‘no treatment zones’ in areas surrounding active nest sites. This will be achieved by restricting any treatments in any stand that provides nesting habitat for active nests identified through field validation prior to or during project implementation. In addition, no ground disturbing activities will occur within the PFA from mid-April through August 15 to ensure that the goshawk family is adequately protected during the courtship, egg-laying, incubation, early nestling, and late fledging periods at any active nest site.

Activity timing recommendations vary among researchers. Reynolds et al. (1992 at p. 24, southwestern U.S.) recommend “no adverse management activities in the PFA during the nesting

season, March 1 – September 30." Penteriani and Faivre (2001, Eastern Europe) recommend restricting activities from February to August. Others have suggested restricting timber management operations to avoid activity during the breeding through fledging time periods (McGrath et al. 2003, eastern Oregon). Fledging dates can vary by geographic area, elevation, or spring weather. In western Montana, Clough (2000) found a random sample of breeding goshawks began incubating eggs on May 5 (±1.42 days 90 percent CI); hatched June 6 (±1.42 days); and fledged July 12 (±1.42 days). On average then, goshawks in Clough's study were likely capable of sustained flight by August 10 (±1.42 days), 65 days-post hatching. In northern Idaho (R1), Moser and Garton (2009) experimentally tested the impacts of clearcutting the nest area on goshawk re-occupancy rates and productivity and found that re-occupancy of the nest area was not impacted 1 to 2 years post harvest provided harvest activities occurred after August 15, and adequate nesting habitat remained in the PFA post-treatment. Given the above, localized data may be used to substantiate entry into the PFA prior to September 30. Data collected at the active goshawk nest sites indicate that goshawks fledged by August 15 in 2010. Site-specific data will continue to be used and if needed, timing restrictions will be designed to reflect variations in fledging dates.

Goshawks occur in forests that evolved under a diversity of fire regimes including mixed-severity and stand-replacing events. Reynolds et al. (1992) and Graham et al. (1999) have suggested that the use of controlled fire and thinning may improve habitat for goshawks by creating favorable conditions for goshawks and their prey. Common effects of prescribed fire in the project area include: promoting diameter growth in overstory trees, creating open understories, and maintaining down woody debris favorable for goshawk prey species.

None of the action alternatives will treat stands that meet old growth characteristics as described in Green et al. (1992) and summarized in the *Forested Habitats of Special Concern Background Report.* Therefore, there are no impacts to goshawk habitat from the treatment of old growth. Stands that currently do not meet old growth criteria but that have been identified as areas to manage for old growth should eventually give rise to goshawk habitat as long as conditions are sufficient to promote large tree growth with a diverse understory. There will be no further discussions on this topic.

Alternative 1

Direct and Indirect Effects

There are no direct effects associated with alternative 1. Some components of northern goshawk habitat would most likely decrease under this alternative, particularly in Douglas-fir stands that currently provide the majority of goshawk habitat in the project area. Many of these stands are surrounded by lodgepole pine stands which are primarily dead, killed by mountain pine beetles. These stands are highly susceptible to stand replacement fire as evidenced the MacDonald Pass Fire of 2009. This fire resulted in high levels of stand replacement with a majority of the overstory trees killed by fire. The MacDonald Pass Fire comprised stand characteristics similar to the Project area - large areas of homogenous stands of lodgepole pine. However, in the short term (up to 10 years), all old forest habitat comprised of Douglas-fir dominated stands would continue to be available in a variety of connected patch sizes.

Lodgepole pine stands that may have provided goshawk habitat in the past no longer provide adequate nesting habitat; some foraging habitat may be provided in some of these dead stands though. However, based upon Squires and Ruggiero (1996) goshawks are adept at finding suitable microsites within stands that otherwise do not appear to be suitable nesting habitat. This is further substantiated in McGrath et al. (2003); one of their sampled goshawks were nesting in non-typical habitat to the extent that McGrath was unable to differentiate between actual nests and random locations in a "blind sample comparison." Despite the fact that lodgepole pine stands may no longer

provide suitable nesting habitat, goshawks will most likely continue to take advantage of microsites in the project area.

The Project area should continue to provide adequate foraging habitat; however, red squirrel densities may be declining due to reduced cone crops in mountain pine beetle killed stands. Red squirrels are a primary prey item for goshawks

Alternatives 2 and 3

Direct and Indirect Effects

Nest Habitat Analysis

Effects to goshawk habitat associated with alternatives 2 and 3 are summarized in table 183. Alternatives 2 and 3 would result in the regeneration of 1,468 and 813 acres of nesting habitat, respectively. While these acres will no longer provide nesting habitat they may provide a diversity of foraging opportunities. Intermediate harvest is proposed on approximately 363 acres of nesting habitat in both alternatives. These intermediate harvest treatments are designed to retain some key components of goshawk nesting habitat - i.e., large trees, large snags, and at least 20 percent canopy cover. However, because canopy reductions can result in increased solar radiation and heat stress as well as increased visibility to predators (USDI 1998), these areas are not expected to provide nesting habitat post-treatment. Prescribed fire treatments—all mixed severity—are proposed on 238 acres of nesting habitat in alternative 2 and 142 acres in alternative 3 and are assumed to remove nesting habitat characteristics. However, the prescribed fire treatments should open up the understory and create down woody debris habitat for goshawk prey.

Table 183. Acres of potential goshawk habitat treated by treatment type and action alternative*

Alternative	Regeneration Harvest Nest / Forage	Intermediate Harvest Nest / Forage	Precommercial Thinning Nest / Forage	Prescribed Fire Nest / Forage
Alternative 2	1,468 / 3,164	363 / 360	397 / 1,331	238 / 682
Alternative 3	813 / 1,663	363 / 360	286 / 947	142 / 419

*Total acres of nesting and foraging habitats are not calculated since acres are not additive – i.e., some acres in the project area provide BOTH nesting and foraging habitat

There are currently 9,524 acres of nesting habitat in the project area. Upon implementation of either alternative 2 or 3, 7,454 acres will remain in alternative 2 and 8,205 acres in alternative 3 assuming that regeneration and intermediate harvest as well as mixed-severity prescribed fire treatments remove nesting habitat (precommercial thinning is not expected to remove nesting or foraging habitat such that treated areas would no longer provide nesting or foraging habitat). Of these acres, there are 5,637 acres in patches of 40 acres or more in alternative 2 and 6,642 acres in patches of 40 acres or more in alternative 3. The project area comprises about 4 to 5 home ranges; therefore, the project area should consist of at least 1,200 acres of nesting habitat post-treatment with patch sizes of 40 acres or more according to USDA (2009c) [This is based on 240 acres per 5,000 acres]. The acres remaining post-treatment in alternative 2 (5,637 acres) or alternative 3 (6,642 acres) exceed these guidelines.

Other portions of the project area that are proposed for treatment may experience an increase in habitat for goshawk competitors such as red-tailed hawks and great horned owls. Treatments that

favor the creation of early successional habitat are beneficial to these species (Woodbridge and Detrich 1994).

Home Range/Foraging Habitat Analysis

Goshawks' use of the overall home range during the nesting season is poorly understood (Squires and Kennedy 2006). Some studies have suggested that goshawks need a narrow range of habitat conditions in the foraging area, similar to those found in the nest area (Beier and Drennan 1997; Finn et al. 2002; Greenwald et al. 2005). However, a larger number of studies have reported that goshawks use a broad range of habitat conditions in the foraging area (Reynolds et al. 1992; Bright-Smith and Mannan 1994; Hargis et al. 1994; Beier and Drennan 1997; and Northern Goshawk page 13 summarized in Squires and Kennedy 2006), which reflects their opportunistic, generalist diet.

Prey abundance and availability are important considerations in determining impacts of management activities on goshawks. Squires and Reynolds (1996) suggested that prey abundance influences goshawk productivity and home range occupancy. Food limitations may also result in adult starvation. The availability of food items is also important; a high abundance of a particular food item may not benefit goshawks if they are unable to fly or hunt due to dense forest conditions.

A summary by the USDI (1998) and Reynolds et al. (1992) listed several prey species as particularly important to the goshawk throughout its range. Of those, the following are found in the project area: chipmunks, cottontail rabbits, snowshoe hares, Douglas squirrels, red squirrels, American robins, Steller's jays, ruffed and blue grouse, common crows, and northern flickers.

Reynolds et al. (1992) recommended that goshawk foraging areas should include a variety of habitats and ages to support an abundant prey base. Although the species on which goshawks prey vary among forest types, there are a few habitat features that appear to be important to a variety of prey species (Reynolds et al. 1992, USDI 1998). These features include snags, downed logs, large trees (over 18 inches in diameter), openings and associated herbaceous and shrubby vegetation, interspersion (the degree of intermixing of vegetation structural stages), and canopy cover. Reynolds et al. (1992) also recommended forest areas managed for goshawk prey species include large trees scattered throughout the foraging area in order to provide hiding, feeding, denning, and nesting areas for selected goshawk prey species (USDI 1998). For example, red squirrels select closed mature forests and tend to avoid areas of high interspersion. Grouse, on the other hand, respond positively to high interspersion of openings and older forests. Other prey species, such as American robins, are habitat generalists and are abundant in most structural stages (Reynolds et al. 1992).

Approximately 3,164 acres of foraging habitat would be regenerated in alternative 2, and 1,663 acres in alternative 3. Three hundred and sixty acres would be treated with intermediate harvest in both alternatives. Prescribed fire would be applied to 682 acres of foraging habitat in alternative 2, and 419 in alternative 3. Regeneration harvest treatments would open up stands and remove understory vegetation while retaining some large trees depending on the type of regeneration harvest. For example, shelterwood treatments would retain between 40 and 75 trees per acre with an average diameter of 10 inches while seed tree cuts would retain between 20 and 50 trees per acre with an average diameter of 9 inches. These types of treatments tend to benefit habitat generalists like robins and flickers both of which are important goshawk prey items. Intermediate harvest treatments would retain large trees where they are available and promote open understories and a subsequent increase in shrub and herbaceous vegetation depending on site conditions. Intermediate harvest treatments would benefit habitat generalists as well as those species associated with openings and herbaceous and shrub understories such as grouse. Prescribed fire will also promote an open understory and may also kill some overstory trees. Both prescribed fire and thinning may improve foraging habitat for goshawks by opening up dense understory vegetation, creating snags, downed logs, woody debris,

and other conditions that may benefit goshawk prey species (Reynolds et al. 1992, Graham et al. 1999).

Changes in the vegetation diversity within the project area are also analyzed to reflect the importance of retaining a broad range of habitat conditions for goshawk foraging habitat (USDA 2009c). Table 184 summarizes the changes in vegetation in the project area relative to recommendations developed by Reynolds et al. (1992).

Table 184. Foraging area diversity matrix in the project area (all home ranges combined) by alternative

Life form/VMAP Tree Size Class (dbh)/Canopy Cover	Alternative 1 % (acres)	Alternative 2 % (acres)	Alternative 3 % (acres)	Reynolds *et al*. (1992) % (Size class)
Shrub/Forb/Grass	6% (1,365)	6% (1,365)	6% (1,365)	10%
Tree/0.0–4.9 inch	5% (1,184)	19% (4,600)	13% (2,998)	10% (0–5 inch dbh)
Tree/5.0–9.9 inch	33% (7,834)	26% (6,271)	30% (7,073)	20% (5–12 inch dbh)
Tree/10.0 inch plus	55% (12,905)	47% (11,054)	50% (11,851)	60% (>12 inch dbh)
> 5.0 inch dbh with >50% Canopy Cover[1]	81% (19,202)	67% (15,876)	74% (17,439)	60% (>12 inch dbh)

[1] Existing condition is based on canopy cover >40% and > 5.0 inch dbh based on categories associated with the R1-VMAP dataset.

Regeneration and intermediate harvest associated with alternative 2 or 3 will create a mosaic of seral stages in the project area that should provide a diverse prey base for goshawks. While the percentage of shrub/forb/grasses does not change in any alternative, prescribed fire should improve the vigor of these vegetation communities that benefit goshawk prey species such as ground squirrels and grouse. The habitat requirements of important prey (i.e., snowshoe hare, ground squirrel, red squirrel, grouse species) include early seral to mature forests and forest openings (Squires and Kennedy 2006). Hargis et al. (1994) concluded that an “emphasis should be placed on creating or maintaining vegetation diversity,” and "that timber harvests be designed to create a juxtaposition of seral stages.” So, even though the foraging habitat diversity post-treatment is not similar to Reynolds et al. (1992), it is compatible with their objectives of providing quality habitat for goshawk prey and providing conditions that enhance goshawk foraging opportunities (Ibid p. 26).

Post-Fledging Area Analysis

Approximately 121 acres of the Telegraph Nest 1 PFA will be treated in alternative 2; 22 acres of the TE NOGO Jericho nest. One hundred ten acres of the Telegraph Nest 1 PFA will be treated in alternative 3 and 12 acres of the TE NOGO Jericho nest (table 185 and table 186).

The PFA diversity analysis is completed for the two known nests (USDA 2009c). Table 185 and Table 186 summarize the changes in seral stages, canopy cover, and shrub/forb/grass communities relative to those percentages recommended by Reynolds et al. (1992) and those described by Clough (2000) in Montana. The implementation of alternative 2 would result in less than a higher percentage of change in those structural conditions where treatments will generate changes to the existing condition than alternative 3.

Table 185. Post-Fledging Area Diversity Matrix for Habitat Analysis by Alternative for the Telegraph Nest 1 PFA

Life form/VMAP Tree Size Class (dbh)/Canopy Cover	Alternative 1 Acres (%)	Alternative 2 Acres (%)	Alternative 3 Acres (%)	Reynolds *et al*. (1992) Percent (Size class)	Clough (2000) West Central Montana
Shrub/forb/grass	8% (40)	8% (40)	8% (40)	10%	7%
Tree/0.0 – 4.9 inch	0% (0)	16% (66)	15% (62)	10% (0–5 inch dbh)	9%
Tree/5.0 – 9.9 inch	19% (78)	19% (79)	18% (73)	20% (5–12 inch dbh)	66%
Tree/10.0 plus	70% (292)	55% (228)	56% (213)	60% (>12 inch dbh)	11%
≥ 5.0 inch dbh with ≥50% Canopy Cover[1]	80% (333)	64% (265)	66% (272)	60% (>12 inch dbh)	69%

[1] Existing condition is based on canopy cover >40% and > 5.0 inch dbh based on categories associated with the R1-VMAP dataset

Table 186. Post-Fledging Area Diversity Matrix for Habitat Analysis by Alternative for the TE NOGO Jericho Nest PFA

Life form/VMAP Tree Size Class (dbh)/Canopy Cover	Alternative 1 Acres (%)	Alternative 2 Acres (%)	Alternative 3 Acres (%)	Reynolds *et al*. (1992) Percent (Size class)	Clough (2000) West Central Montana
Shrub/forb/grass	2% (10)	2% (10)	2% (10)	10%	7%
Tree/0.0 – 4.9 inch	3% (11)	3% (11)	3% (11)	10% (0–5 inch dbh)	9%
Tree/5.0 – 9.9 inch	41% (170)	41% (170)	41% (170)	20% (5–12 inch dbh)	66%
Tree/10.0 plus	53% (220)	53% (220)	53% (220)	60% (>12 inch dbh)	11%
≥ 5.0 inch dbh with ≥50% Canopy Cover[1]	88% (365)	88% (365)	88% (365)	60% (>12 inch dbh)	69%

[1] Existing condition is based on canopy cover >40% and > 5.0 inch dbh based on categories associated with the R1-VMAP dataset

The data indicate that the diversity of conditions in the PFAs remaining post-treatment is not necessarily aligned with either Reynolds or Clough in all cases. However, these changes are aligned with certain desired PFA conditions described by Reynolds et al. (1992, pp. 22-24) that include the following:

- Provide hiding cover for fledglings;
- Provide habitat for prey and foraging opportunities for adults and fledgling goshawks during the fledgling-dependency phase;

- Provide snags and down woody debris;
- Minimize disturbance during the fledgling-dependency period by restricting activities during this time;
- Treatments in the early seral stages should result in lower basal area to promote tree growth;
- Treatments in the older seral stages should promote irregular spacing;

Alternatives 2 and 3 are both designed to achieve the aforementioned desired conditions in the PFAs. No ground disturbing activities will occur inside the PFA from 15 April through 15 August to protect the goshawk pair and young from disturbance during the breeding season. Several snags will remain post-treatment due to the abundance of snags that have been created as a result of the mountain pine beetle and as a result of meeting Forest Plan standards (See Snags and Down Woody Debris).

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on goshawk habitat in the context of the myriad of other past, present, and future effects on goshawk habitat from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. The following table summarizes the key items that are taken into consideration for the cumulative effects analysis for goshawk habitat. See also Appendix E in the Wildlife Specialist Report, *Cumulative Effects*.

Table 187. Cumulative effects considerations for goshawk habitat

Parameter	Discussion
Spatial Boundary	The spatial boundary is expanded to the point at which goshawk habitat is no longer measurably affected. The combination boundary satisfies this requirement because this is the scale at which the effects to the approximate three home ranges in the Project area would no longer be measurable. The combination boundary also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1950s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the combination boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the age class, density, and species composition of the existing goshawk habitat that comprises the combination boundary today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include the forestwide Roadside Hazard Tree Removal and Fuels Reduction Project, fuels activities, and private land timber harvest.
	Ongoing and future activities include personal fire wood cutting, the Red Mountain/Chessman Flume project, the Tenmile South Helena vegetation project, and private land timber harvest and development.
Measurement Indicators	Measurements include effects to foraging and nesting habitat.
Thresholds	The threshold is the amount of remaining nesting habitat in the combination boundary in patches of 30 or 40 acres.

Parameter	Discussion
Methods	Past, ongoing, and reasonably foreseeable activities are described quantitatively based on acres of foraging or nesting habitat affected. Impacts of past activities are based on the FACTS database and summarized according to the types of treatments recorded in the database. The effects on goshawk habitat are based on observed changes to stand structure in the tree dominance types that are capable of providing goshawk habitat. See *Criteria for Wildlife Models Helena National Forest* (USDA 2009a) and the *Forested Vegetation Background Report.-*
Assumptions	Intermediate and regeneration harvest are assumed to remove foraging or nesting habitat; fuels activities are assumed to create open understories and promote shrub and grassland regeneration.

Past Activities

Several past activities never had or no longer have present effects to which the project would contribute. Specifically, projects that involved vegetation manipulation (e.g., trail reconstruction, timber harvest, and fuels activities) may have impacted goshawk habitat at the time of the activity. Some of these impacts may still be apparent in those areas not yet capable of meeting goshawk habitat requirements. Table 188 summarizes the effects of timber harvest during three time periods on goshawk habitat currently existing in the Project area. Most of the stands that have been harvested in the past do not yet provide nesting habitat while most of those stands do provide foraging habitat for goshawks today.

Fuels activities that occurred in the past mainly focused on reducing surface fuels. Many of these areas that were treated prior to the 1980s have returned to their 'pre-treatment' conditions especially in favorable growing conditions that accelerate understory development. Fuels activities that have occurred since the 1980s have also reduced surface fuels and created more open conditions that favor shrub and grassland development. These activities have contributed to structural characteristics that currently provide both nesting and foraging habitat.

Table 188. Past Forest Service timber harvest activities and their impacts on the availability of existing goshawk habitat in the combination boundary

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Regeneration Intermediate	3,079 264	Potential habitat that was regenerated during this time currently comprises pole size trees (5-10" in size) that contribute to foraging habitat today. Intermediate harvest treatments that occurred during this time are now open grown stands that include large trees some of which may be providing nesting habitat.
Forest Service Timber Harvest 1980s through 1990s	Regeneration Intermediate	2,684 316	Potential habitat that was regenerated during this time currently comprises young sapling sized trees (up to 5" in size) that contributes to foraging habitat today. Intermediate harvests have resulted in stands that are open grown today with larger trees; however the understories aren't as developed as those areas treated at an earlier time. These stands may provide some nesting habitat; at a minimum foraging habitat is currently being provided in these stands.

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest 2000 to 2014	Regeneration Intermediate	236 2,558	Potential goshawk habitat that was regenerated at this time is currently in the stand initiation phase and in some instances large trees remain. These areas mainly provide foraging habitat today. Intermediate treatments resulted in stands with larger trees and open understories that may provide some nesting habitat but a majority of these stands currently provide foraging habitat.

Ongoing Activities

Ongoing activities that have effects to goshawk habitat are summarized in table 189.

Table 189. Ongoing Activities that May Impact Goshawk Habitat

Activity	Effects to Goshawk Habitat
Red Mountain Flume/Chessman Reservoir Project	The Red Mountain Flume/Chessman Reservoir project is focusing on the removal of dead and dying lodgepole pine, much of which is no longer goshawk nesting habitat. In the long term, goshawk habitat should be improved as stands regenerate.
Firewood Cutting	Ongoing firewood cutting results in removal of snags along roadsides and reduces snag availability in those locations.

Other ongoing activities that may impact goshawk habitat include general road use and management which could disturb nesting birds depending on the level of use and activity. Private land development, primarily along the eastern fringe of the combination boundary, would also impact potential goshawk habitat through removal of trees that provide habitat and permanent conversation to non-forest.

Reasonably Foreseeable Activities

The Tenmile/South Helena Vegetation Project, which would remove dead trees and thin young conifer stands on over 20,000 acres just west of the Continental Divide, would remove goshawk nesting habitat and create changes to the existing foraging habitat. The effects associated with the Telegraph project would be cumulative to those anticipated from the Tenmile/South Helena project.

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next several years. Private lands within the combination boundary but outside of the project area are a mix of lodgepole pine-dominated stands with a similar history and lower elevation stands dominated by Douglas-fir. Much of the lower elevation component has also been subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain and, hence, effects to goshawk habitat.

Cumulative Effects Conclusions

Implementation of alternative 1 would contribute to the effects of past timber harvest because forested stands that are killed by mountain pine beetles would revert to early seral stages similar to those early seral stands that were created as a result of regeneration harvest from the 1980s through today. Alternative 1 would also contribute to the effects associated with the Roadside Hazard Tree and Fuels Reduction Project and the Red Mountain Flume/Chessman Reservoir project. As the landscape continues to change due to mountain pine beetle mortality under alternative 1, the resultant early seral stages would add to those created during implementation of the Roadside Hazard Tree project and the Red Mountain/Chessman Flume project.

Implementation of alternatives 2 or 3 would result in the regeneration of 1,468 and 813 acres of nesting habitat respectively and 3,164 and 1,663 acres of foraging habitat, respectively. These activities along with the intermediate harvest and prescribed fire in both alternatives would contribute to the effects associated with past timber and fuels activities that have shaped the existing condition. Alternatives 2 and 3 would also contribute to the effects associated with the Roadside Hazard Tree and Fuels Reduction Project, the Red Mountain Flume/Chessman Reservoir project, private land timber harvest and development and firewood retrieval. As with these projects, implementation of alternatives 2 or 3 would remove nesting habitat; the composition of foraging habitat would be changed to favor prey species associated with early seral forests (except in the case of private land development where habitat may be permanently removed). However, ample acres of nesting habitat will remain to provide the requisite amount per home range. The combination boundary is 117,966 acres which includes about 23 goshawk home ranges. About 5,520 acres of nesting habitat is needed to provide 240 acres of nesting habitat per home range in patches of 240 acres or more. After implementation of either alternative 2 or 3, goshawk nesting habitat would continue to be available on approximately 28,644 and 29,669 acres respectively, well in excess of that needed to provide nesting habitat for up to 23 pairs of goshawks.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitment of resources.

Conclusions

Alternative 1 retains the status quo. Clearly, portions of the project area, primarily Douglas-fir dominated stands, provide adequate nesting and foraging habitat to support active goshawk nests. These Douglas-fir dominated stands will continue to provide nesting habitat in the short term (up to 10 years). Stands impacted by the mountain pine beetle will continue to lose nest habitat characteristics and to the extent that the ongoing mountain pine beetle mortality exacerbates wildfire, even the Douglas-fir forests may be susceptible to loss. Conversely, as a result of fire suppression, many of the forested stands in the Project area that have not been killed by mountain pine beetle are developing dense understories which makes it difficult for goshawk foraging. There is evidence to suggest that goshawks, as large-bodied, visual predators, avoid overly dense habitats where physical or visual access to prey is limited. Habitat management practices, particularly fire suppression activities, which have allowed forests to become too dense for flight below or within the canopy may also be detrimental (Reynolds 1983). Such overly dense forest structures would limit goshawk detection of and access to prey. Harvest practices such as light thinning may, in these cases, actually improve or create foraging habitat for goshawks.

Both action alternatives will result in the retention of more than enough nesting habitat for the 5 home ranges in the project area and the 23 home ranges in the combination boundary. Alternative 3, however, will retain more nesting habitat than alternative 2, at least in the short term. This is noteworthy because goshawks exhibit high nest site fidelity even in situations when the nest site has

been modified (Reynolds 1983, Woodbridge and Detrich 1994, Patla 1997)**.** The implication of this behavior is that fidelity to nest areas may override response to reduced suitability and result in a lag effect before goshawks re-locate to more suitable habitat which in turn could affect reproductive success. While evidence exists to support a diversity of seral stages in the PFA, retaining the integrity of the PFA in the short term could be beneficial for those goshawks that have been nesting in the project area over the last few years. However, Squires and Kennedy (2006) in their assessment of the current knowledge and information needs for goshawks concluded that forest management, such as controlled fire and thinning, may improve or degrade habitat depending on implementation, especially as they affect the density of large trees and canopy closure. There are no treatments proposed within the large tree size class (10 inches or larger). Also, Reynolds et al. (1992) recommend thinning and burning in the PFA to meet desired stand conditions.

Alternative 2 would result in greater vegetation diversity than alternative 3. Hargis et al. (1994) concluded that "emphasis should be placed on creating or maintaining vegetation diversity" and "that timber harvests be designed to create a juxtaposition of seral stages." Alternative 2 would result in the removal of more snags that provide foraging habitat than alternative 3; however, snags will remain abundant within the project area as a result of the mortality associated with the mountain pine beetles.

Vegetative changes associated with both action alternatives would result in reduced forest canopy cover in some stands which, in turn, may favor the habitat needs of more open-forested competitors, such as red-tailed hawks, thereby decreasing the amount of habitat available to goshawks (USDI 1998). Gatto et al. (2005) and Reynolds et al. (1992) indicated that goshawks have approximately 48 percent dietary overlap in prey species with red-tailed hawks, including prey that occupy a variety of unforested, forested, and forest edge habitats. However, La Sorte et al. (2004) noted distinct differences in how goshawks and red-tailed hawks use habitats at fine and larger landscape scales. For example, red-tailed hawks choose nest-sites on steep slopes with dense understories, enter the nest from above the canopy, and have a commanding view of the surrounding country from the nest. Conversely, goshawks choose nest-sites on moderate slopes with mature trees and open understories, enter the nest from below the canopy, and have a limited view from the nest. Red-tailed hawk nesting territories are often comprised of large open patches with scattered trees in fragmented forest, whereas goshawk nesting territories are often more continuous forest with smaller openings and edges. Theoretically then, goshawk habitat may be reduced with increased fragmentation and red-tailed hawk habitat may increase (La Sorte et al. 2004). Whether some threshold level of fragmentation exists, beyond which red-tailed hawks completely replace goshawks, is unknown. To date, no scientific studies have conclusively documented such a replacement.

The desired condition for goshawks includes (1) 240 acres nesting habitat per 5,000-acre territory; (2) heterogeneous foraging habitat including mature forest as well as a mix of other forest and non-forest components; and (3) approximately 420 acres post-fledging habitat that includes some mid to late-seral forests with structural diversity in the understory. Implementation of either of the action alternatives would result in the retention of the requisite amounts of nesting habitat.

Risks of wildfire associated with alternative 1 are high and if wildfire takes hold in the project area, nesting habitat could be eliminated. The action alternatives are designed to promote stand sustainability through time which in turn could result in the retention of more nesting habitat over time in the project area. Alternatives 2 and 3 are designed to promote long-term resiliency and sustainability of the forested stands in the project area. However, overall, alternative 3 would result in fewer impacts to goshawk habitat.

In summary, goshawk habitat would continue to be available at the project level and beyond. forestwide habitat thresholds have not been breached (See *Viability* Section) and there are ample

reasons to infer that goshawks and their habitat will be maintained at the Forest level (excerpted from USDA 2009c):

- Goshawk habitat in R1 is abundant and well distributed where it occurs naturally, and more forest, and therefore nesting habitat, exists on today's landscape than what occurred historically (Samson 2005).
- There have been substantial increases in connectivity for forested habitat since Euro-American settlement (Samson 2005).
- The level of timber harvest of the forested landscape in R1 is insignificant (Samson 2005).
- The suppression of natural ecological processes has increased and continues to increase theamount of forested habitat (Samson 2005).
- Not a single known nest site in R1 is isolated from other known nests by more than the goshawks' estimated dispersal distance.
- The northern goshawk is secure in terms of persistence (http://www.natureserve.org/explorer /serve/NatureServe; accessed March 30, 2009.
- Below (and not above) a threshold of 20 to 30 percent of historical habitat amounts, the effects of fragmentation (i.e., patch size and isolation) are suggested to have a negative impact on species persistence. No indication exists that forested ecosystems in R1 have reached the 20 to 30 percent threshold of historical.
- Forested systems in R1 are more extensive and are less fragmented than in historical (approximately 1800 A.D.) times from an increase in conifers into grasslands (Hessburg and Agee 2003; Gallant et al. 2003; Hessburg et al. 2005).
- The effects of habitat fragmentation on birds are less in the western United States compared to the Midwestern and eastern United States because western landscapes were naturally more fragmented in historical times.
- A comparison of habitat estimates for maintaining viable populations to that available on each Forest indicates that habitat is available in excess to that needed, given the natural distribution of the species and its habitat as mapped and according to the scientific literature (Samson 2006).

Regulatory Framework and Forest Plan Consistency

The goshawk is a management indicator for old growth dependent species; as such it's intended to be a bellwether of the effects of management activities on representative wildlife habitats with the objective of ensuring that viable populations of existing native and desirable non-native animal species are maintained.

Federal laws and direction applicable to management indicator species include the National Forest Management Act (NFMA), the Forest Service Manual, and the Helena National Forest Plan. The NFMA requires the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" [16 U.S.C. 1604(g)(3)(B)]. All alternatives are consistent with this requirement. Goshawk habitat would continue to be abundant and well-distributed and species' viability would be maintained across the Forest. See also the Viability Analysis Section.

Monitoring

The Forest Plan requires that monitoring of goshawk habitat take place in order to "measure the effect of management activities on representative wildlife habitats with the objective of ensuring that

viable populations of existing native…species are maintained" (Forest Plan p. II/17). Monitoring allows us to determine if the forestwide goal – maintain and improve the habitat over time to support big game and other wildlife species (Forest Plan p. II/1) – is being achieved. The emphasis of the goals and objectives is habitat. The monitoring scale is forestwide.

Monitoring element C7 focuses on northern goshawks, among other species. The northern goshawk was chosen as an MIS species for old growth due to the diverse prey base and nesting habitat commonly found in late-successional forests. Dispersion of late-successional habitat throughout the Forest was considered important for goshawks although recent science has shown that goshawks also make use of a wide variety of habitats so long as a diverse prey base is present along with mature trees for nesting.

Old growth on the Helena Forest has been reported in the *Forested Habitats of Special Concern Background Report*. Currently, there is approximately 8 percent old growth forestwide and approximately 10 percent in the Divide landscape. However, as the mountain pine beetle runs its course, old growth will decrease the extent to which is unknown. Snags are abundant in the smaller size classes with very few large snags present on the Forest. This is primarily due to a paucity of large trees across the Forest. Snags will continue to be abundant as the mountain pine beetle expands; however, large snags will continue to be rare. For now, the habitat requirements for northern goshawks as prescribed by the Forest Plan are being met and, as summarized in the Viability Section, goshawk viability is being maintained forestwide. See also Appendix D, *Viability Analysis*.

Pileated Woodpecker

Affected Environment

Habitat Use

The pileated woodpecker (*Dryocopus pileatus*) serves as a *Forest Plan* indicator for old-growth forests because of its need to nest in large diameter snags that occur most frequently in advanced mature stands (Bull and Holthausen 1993). As well, it is often described as a "keystone species" because of the disproportionate effect it has on its environment, in spite of its inevitably low population density. Pileated woodpeckers create numerous large excavations in dead trees that are then used by a variety of secondary cavity dwellers; they enlarge cavities in living trees providing unique habitat for other species; they hasten the decay process in the live trees they excavate and in the logs they break apart while foraging (Bull and Jackson 1995). This "ecosystem engineering" alters the physical structure of the environment in ways that influence habitat opportunity for other species and general ecosystem processes (Aubry and Raley 2002).

In the Northern Rockies, pileated woodpeckers inhabit mixed conifer stands of various configurations, focusing on western larch and ponderosa pine as the key tree species. They also nest and feed in black cottonwood bottoms when they are available (McClelland and McClelland 1999; Hutto 1995). While pileated woodpeckers are most often found in mature and old forests, they frequently forage in immature forest stands with large residual trees, logs, and stumps left by previous disturbance (logging, burning) [see review in Bonar 2001, p. 3]. While the woodpeckers seem to prefer "closed" stands, Bull et al. (2007, p. 325-326) found that substantial loss of canopy closure due to high natural tree mortality did not appear to be detrimental to the birds as long as large dead or live trees and logs were abundant.

For nesting and roosting, pileated woodpeckers require large standing dead trees [typically greater than 30 inches diameter breast height (dbh)]. The availability of night-time roosting sites, provided

most frequently by large hollow trees, has been hypothesized to be even more of a limiting factor than the presence of potential nest sites (Aubry and Raley 2002). Foraging sites are provided by standing trees (dead and alive) and by large logs and stumps, where the woodpeckers feed on a variety of wood-boring insects, preferably carpenter ants (Bull 1987; Bull et al. 1997). The pileated woodpecker is powerful enough to excavate deep foraging cavities in undecayed living conifers (Bull and Jackson 1995)—which opens up a wider range of feeding possibilities than is immediately available to other local woodpeckers.

Pileated woodpeckers are very mobile and are considered a large-patch-size species. Their home ranges are extensive and require a generous percentage of unlogged or partially logged forest with a reasonable distribution of large trees. The average size of 27 home ranges (sometimes referred to as "territories") in good quality habitat in the Pacific Northwest has been calculated at 1,234 acres (just under 2 square miles) (Bull and Holthausen 1993; Mellen et al. 1992). This translates to relatively low population density even in optimal habitat. Pileated woodpeckers have seldom been studied in more marginal habitats that characterize much of the east slope of the northern Rockies in Montana, but field observation suggests that population densities are appreciably lower in these environments. One study in Alberta found a strong correlation between habitat quality and territory/home range size: Pileated woodpeckers had much larger territories where potential foraging substrates and cavity trees were more sparse. The larger territories, however, did not result in reduced fitness: Productivity and survival were actually higher than those reported for prime habitat in the Pacific Northwest (Bonar 2001, p. 66).

Regional and Statewide Populations

The Montana Natural Heritage database lists the global status of pileated woodpeckers as *'G5'*: "common, widespread, and abundant (although it may be rare in parts of its range), not vulnerable in most of its range." Statewide status in Montana is *'S3,'* which is defined as "potentially at risk because of limited and/or decline in numbers, range, and/or habitat, even though it may be abundant in some areas" (see http://fieldguide.mt.gov/).

According to the North American Breeding Bird Survey (BBS), pileated woodpecker populations have been trending upward over a majority of the woodpecker's range in North America since 1966—thus its *G5* ranking (http://www.mbr-pwrc.usgs.gov/bbs/bbs.html). In the western U.S., problem areas are dispersed here and there in California, Idaho, Washington, and eastern Oregon, but the general trend across the region is positive (figure 66). The same pattern is true of western Canada. In Montana, in spite of its *S3* ranking, the pileated woodpecker has been increasing across virtually all of its range in the state since 1966, as can be seen in figure 66 (trend estimates for pileated woodpeckers between 1966 and 2013 are 1.74 percent for the Northern Rockies region and 1.5 percent for Montana).

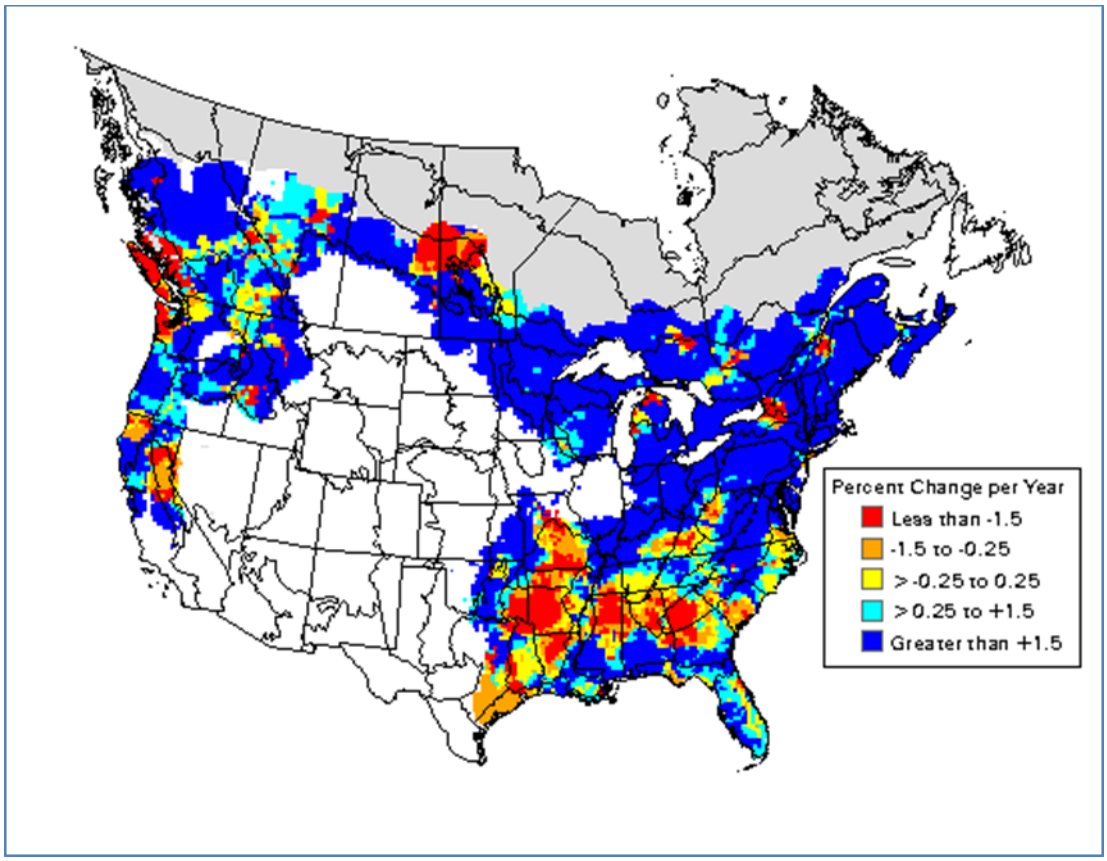


Figure 66. Breeding Bird Survey (BBS) population trend map, 1966–2013: percent change in trend for pileated woodpeckers (Source: Sauer et al. 2014)

Several factors have probably contributed to the significant increase of pileated woodpeckers over much of the Western and Central BSC regions since the 1960s and, especially, since the early 1980s. Most are related to the availability of large trees and unlogged habitats—in particular, management for late successional forest reserves specifically for wildlife in the Pacific Northwest and a general policy in recent years of retaining most large-diameter trees, dead and alive, on federal lands throughout the Northwest and the northern Rockies (Bull and Jackson 2011).

Population Status and Habitat in the Project Area

Local Observations

No pileated woodpeckers have been tallied in the Telegraph Project area or the combination boundary during formal bird surveys over the last two decades, but several have been noted during wildlife and old-growth surveys and others have been reported by Forest Service workers and members of the public. The *Northern Region Landbird Monitoring Program*, which conducted surveys in the Divide landscape along established transects from 1994 through 2006 did not detect any pileated woodpeckers in the Telegraph project area (1 transect) or the combination boundary area (5 transects). Other recent efforts include old-growth survey routes in the project area and in the combination boundary in 2012, none of which produced pileated woodpecker detections.

The Montana Bird Distribution Database has one record of a pileated woodpecker in the Project area and two in the combination boundary (http://mtnhp.org/Tracker/NHTMap.aspx?elcode=ABNYF12020). Between 2007 and 2008, over

3,000 points were surveyed in 63 percent of old growth units across the Forest as part of the *Northern Region Landbird Monitoring Program–Birds in Old Growth* inventory effort. These surveys resulted in 5 pileated woodpecker detections in the combination boundary—all around MacDonald Pass. Recent wildlife surveys have located pileated woodpeckers twice in the project area (in upper Mike Renig Gulch and Little Flume Gulch, both in 2012) and once again in the combination boundary (two birds together just north of MacDonald Pass in 2011).

In the Divide landscape, pileated woodpeckers are typically located in older Douglas-fir and ponderosa pine stands in a variety of settings and also in mixed conifer forests in draws, riparian bottoms, and at the heads of drainages—forest environments capable of producing large trees. A majority of stands in the project area and combination boundary are dominated by lodgepole pine, which are too small to support pileated woodpecker nest cavities and are generally considered sub-optimal as feeding sites (although the woodpeckers have been observed feeding on these trees). Pileated woodpeckers are generally easy to detect because of their high visibility, loud calls, forceful drumming, and distinctive tree excavations. So, the dearth of detections during these field efforts is an indication of how uncommon they are in the Divide landscape.

Project Area Habitat and Populations

Habitat

Old-growth on the Helena Forest has been reported in the *Forested Habitats of Special Concern Background Report*. There are three 3rd order drainages associated with the Project area (Mike Renig gulch, Telegraph Creek, Ontario Creek), and 5 percent of each has been designated to be managed as old growth or as viable candidate old-growth. All stands have been reviewed with aerial photography and past activity layers. Additionally, in 2010, field verification of sample stands was completed. Currently, there are 231 acres of old growth in the project area (1 percent) and a total of 1,162 acres in the combination boundary (1 percent). This compares to about 10 percent old-growth in the Divide Landscape as a whole and 8 percent forestwide. The lower numbers for the project area and combination boundary reflect the dominance of lodgepole pine, which generally does not achieve old growth characteristics on the HNF.

All of the old-growth tallied above is considered to be "optimal" pileated woodpecker habitat—stands in which the woodpeckers can nest and forage. Pileated woodpeckers, however, cast a much wider net in terms of the kinds of habitats they will use in northern Rocky Mountain environments—particularly where they will forage. To get at the potential of the project area and combination boundary to produce this habitat, R1-VMAP was used to detect habitat as defined by models described in Samson (2006). These models do not distinguish between summer nesting and winter foraging habitat[2] because the variables needed to define these components are not available in R1-VMAP. As a result, table 190 and figure 67, below, confound these two habitat functions: that is, all of the "suitable habitat" shown here is suitable for foraging, but a much smaller percentage of it is suitable for nesting as well.

[2] "Winter foraging habitat" is used to gauge the amount of year-round foraging habitat that a pair of woodpeckers will need because the birds need to range over a larger area to find adequate food in winter than at other times of year (Samson 2006, p. 65).

Table 190. Potential pileated woodpecker habitat (foraging and nesting) in the Telegraph project area and combination boundary based on R1 VMap

Analysis Scale	Acres of Pileated Woodpecker Habitat	Acres of Overlap of Pileated Woodpecker Habitat with Old Growth
Project Area	7,643	136
Combination Boundary	24,785	519

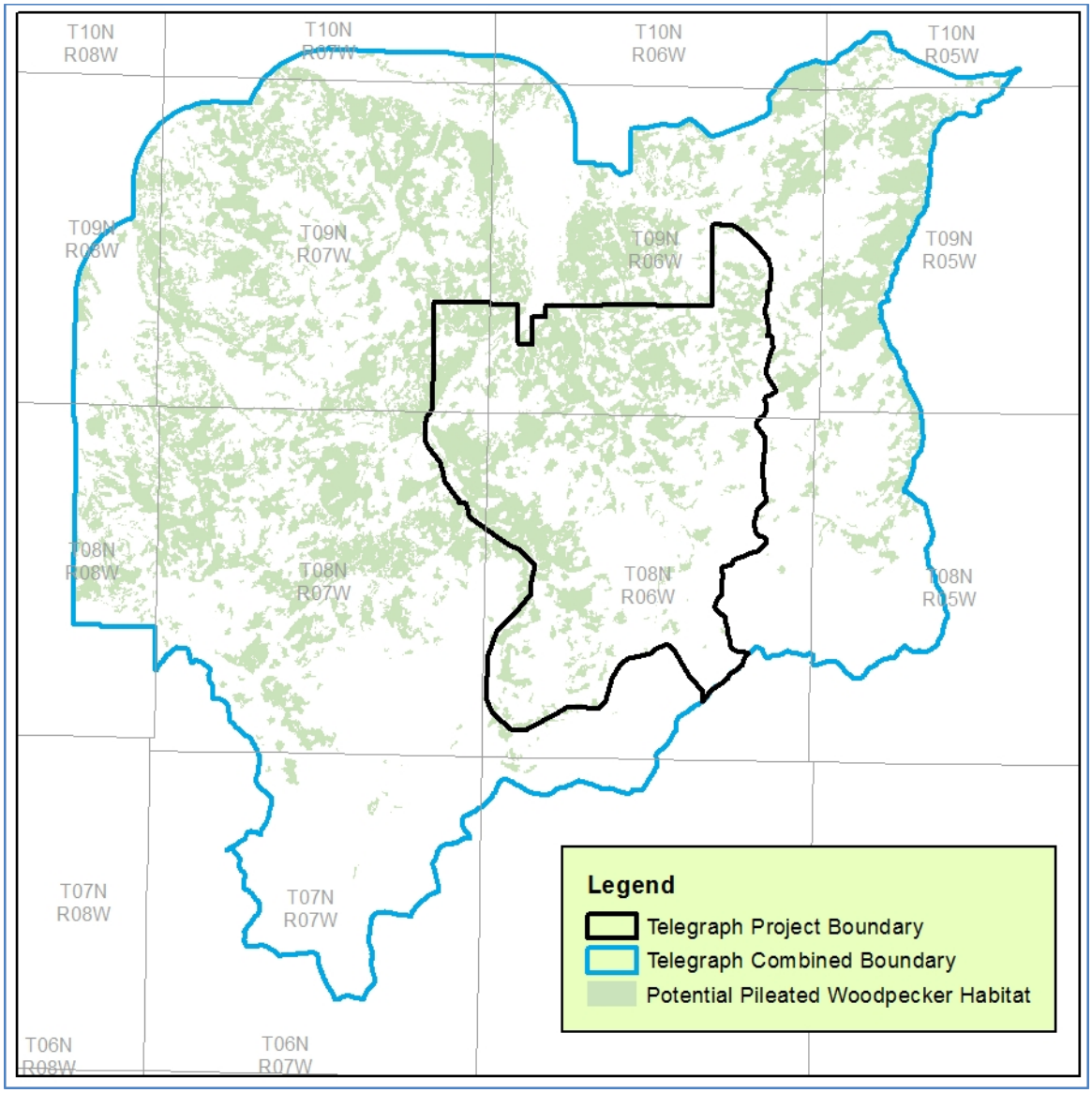


Figure 67. Pileated woodpecker habitat based on the habitat model developed by Samson (2006)

The effect of the beetle-kill (which, by 2009, had affected 94 percent of the project area) on the ability of the landscape to support the woodpeckers over the long term is uncertain. The food supply has escalated dramatically as insect-laden dead trees have proliferated, but the ability of these trees to support bark beetles and other wood-boring insects will decline over the next 5 to 10 years

(Edworthy et al. 2011). Once the standing snags have fallen, the resulting logs will provide habitat for wood ants on which the woodpeckers thrive. On the other hand, the absence of overhead cover creates an environment less conducive to some of the ants, which prefer shade (Bull et al. 1997). Foraging opportunity in the post-beetle-kill environment is thus a mixed bag.

Pileated woodpeckers nest in dead or dying trees, which, in the northern Rocky Mountains, average 30 inches in diameter (dbh) with a minimum dbh of 20 inches (McClelland and McClelland 1999). While occasional use of smaller trees for nesting has been recorded in the Pacific Northwest and in Alberta (Bonar 2001), it has seldom been documented in this part of Montana (http://bna.birds.cornell.edu/bna/species/148/articles/breeding). Since more than 90 percent of the newly dead trees in the project area are lodgepole pine, virtually all of which are too small to serve as nest trees, nesting opportunity has not changed in any significant way. Where large ponderosa pine have succumbed to the beetle infestation, new nest sites are available, but ponderosa pine, while distributed here and there throughout the combination boundary, is scarce in the project area proper (less than 1 percent of the project area and combination boundary comprise ponderosa pine). So, while ponderosa pine would be the preferred nesting tree, pileated woodpeckers in the project area are obliged to look for nesting opportunities primarily in older stands of Douglas-fir and, to a lesser extent, Engelmann spruce, subalpine fir, and black cottonwood—the same kinds of trees available for nesting prior to the beetle outbreak.

Logging over the past century removed the majority of large trees from portions of the project area. Most snags that might have been left after logging have since fallen. Fire suppression has resulted in higher tree densities with smaller diameter classes. Table 191 summarizes the status of snags in the forestwide and in the Divide Landscape. Snags are abundant at the 7- to 12-inch size class and should provide adequate foraging habitat. However, few snags are available that meet the size that pileated woodpeckers need for nesting (greater than 20 inches dbh). Large live trees are also limited in the project area (table 192). Due to the landscape predominance of lodgepole pine, there are virtually no estimated snags greater than 20 inches dbh.

Table 191. Snags per acre at broad scales, forest plan size classes (summary database)

Forest Plan Size Classes	Snags per acre HNF-wide	Snags per acre Divide Landscape
7–11.9” dbh	49.64	63.66
12–19.9” dbh	12.10	9.93
>20” dbh	1.15	0.41
Live Trees/Acre >20” dbh	2.04	2.18

Table 192. Snags per acre by forest plan size classes, project area and combination boundary

Forest Plan Snag Size Classes	Project Area	Combination Boundary
7–11.9”	49.64	69.42
12–19.9”	9.03	10.03
20”+	0.00	0.00
Live TPA 20”+	3.01	1.67

Population Potential

Home ranges needed to sustain a pair of pileated woodpeckers vary considerably in size across the west, ranging from 793 acres in northeast Oregon to 5,243 acres in Alberta (Samson 2006, p. 66). McClelland et al. (1979) report "feeding territories" of 500 to 1,000 acres in western larch dominated stands in the northern Rockies. Home range size is dependent on the availability of nesting habitat and, in particular, on the density and continuity of foraging habitat (Bonar 2001, p. 66). Suitable habitat generally requires average canopy cover over 30 percent, a reasonable distribution of nesting trees 20 inches or more dbh, and widespread foraging habitat with trees 10 inches or more dbh (Samson 2006).

The smaller home ranges (feeding territories) reported for Oregon and Northern Rockies larch stands are in areas where desirable habitat components are relatively abundant and continuously distributed. In the lodgepole pine dominated forests of the Telegraph Project area, good nesting habitat is spotty due to a lack of large snags and feeding habitat is fragmented across the landscape (figure 67)—more like the habitat described by Bonar (2001) in Alberta, where home ranges are very large. For all of these reasons, it is expected that the pileated woodpeckers in the project area would need up to 1000 acres of habitat per home range. As such, the project area could support up to 7 pileated woodpecker home ranges (based on the availability of 7,643 acres of habitat), depending on the distribution of suitable nesting habitat. Likewise, the combination boundary could support up to 24 ranges (based on the availability of 24,785 acres of habitat).

Given the paucity of pileated woodpecker observations in this area over the past two decades, however, it is obvious that the actual population density in these areas is considerably less than what the estimated habitat potential suggests.

Environmental Consequences

The following measures are used to evaluate effects to pileated woodpeckers:

- Effects to snags and dead wood habitat
- Effects to pileated woodpecker habitat

Desirable Pileated Woodpecker Habitat Conditions

√ Large trees for nesting habitat

√ Dead and down wood habitat for foraging habitat

Effects Common to All Alternatives

Under all alternatives, insect infestations will continue to create snags and provide pileated woodpecker habitat. Public firewood cutting is permitted and could reduce snags adjacent to roads. Large areas of untreated stands would remain on the landscape where natural snag creation and attrition processes would proceed unabated.

Effects Common to All Action Alternatives

Timber harvest will affect pileated woodpecker habitat. Nesting habitat should be minimally affected, however, since treatments are designed to retain large trees and snags within units. Specifically, intermediate harvest and group shelterwood treatments would generally retain stand structure suitable as nesting habitat. Other treatments such as shelterwoods and seedtree regeneration will retain some nesting habitat in the form of legacy trees left on site as part of the tree retention

guidelines. Clearcut treatments with reserve trees generally will not retain nesting habitat. Large snags would be left intact in all harvest units except where they pose a safety hazard. Snags remaining in units would no longer be surrounded by a closed forest and would therefore nest habitat effectiveness would be reduced.

Timber harvest is expected to reduce future foraging habitat for pileated woodpeckers since treatment objectives include reducing stand susceptibility to insects and disease. The MPB outbreak has now subsided, largely due to host depletion and has progressed out of the outbreak phase in general, but should remain on the landscape in endemic quantities. Meanwhile the Western spruce bud worm (WSB) is now moving into the project area in greater concentrations than was seen in the past. WSB is actively defoliating Douglas-fir, spruce, and subalpine fir, contributing to stress which can predispose stands to beetles. Treatments associated with the action alternatives are designed to reduce stand vulnerability.

WSB defoliation has been widespread across the HNF over the last several years. Generally, treatments that reduce conditions conducive to spruce budworm will impact woodpecker foraging habitat. Spruce budworms are a primary prey item for carpenter ants which are in turn a primary prey item for pileated woodpeckers. Indirect effects to pileated woodpeckers could therefore occur through reductions in spruce budworm which in turn could reduce carpenter ant populations.

None of the action alternatives will treat stands that meet old growth characteristics as described in Green et al. (1992) and summarized in the *Forested Habitats of Special Concern Specialist* Report. Therefore, there are no impacts to pileated woodpecker habitat from the treatment of old growth. Stands that currently do not meet old growth criteria but that have been identified as areas to manage for old growth should eventually give rise to pileated woodpecker habitat as long as conditions are sufficient to promote large tree growth. There will be no further discussions on this topic.

Prescribed fire could further reduce foraging opportunities for pileated woodpeckers. Preliminary research (Bull et al. 2005) indicates that charred logs may result in fewer ants which in turn results in decreased foraging opportunities for pileated woodpeckers. The action alternatives included prescribed fire. Where this overlaps with potential pileated woodpecker habitat, foraging habitat could be impacted. In other instances, incidental mortality of trees associated with burning could produce future nesting habitat.

Alternative 1

Direct and Indirect Effects

There are no direct effects associated with alternative 1. Pileated woodpecker habitat would most likely continue to decline in areas impacted by mountain pine beetle in terms of canopy cover loss. However, sufficient snags will be available in the project area at least for foraging. There are no snags greater than or equal to 20 inches dbh for nesting in either the project area or within the combination boundary (table 193). There are live trees in this size class that could provide nest trees overtime.

Table 193. Snags per acre by forest plan size classes, project area and combination boundary

Forest Plan Snag Size Classes	Project Area	Combination Boundary
7–11.9”	49.64	69.42
12–19.9”	9.03	10.03
20”+	0.00	0.00
Live TPA 20”+	3.01	1.67

The natural distribution and abundance of snags has been altered over the past several decades due to fire suppression, timber harvest, and other human activities (Korol et al. 2002). It’s evident that small snags have increased in the project area over time due most likely to fire suppression which has resulted in dense mid-sized trees more susceptible to disturbance agents like mountain pine beetle. Pileated woodpeckers are generally associated with large snags. As stands continue to stagnate and become denser with smaller diameter trees, even as they die and become snag habitat, it’s likely that snags will not be of sufficient size for pileated woodpeckers.

Spruce budworm populations would continue to increase in the short term until such time as the populations naturally stabilize and decline. Foraging habitat would be abundant in the short term as large dead wood accumulates on the forest floor.

Alternatives 2 and 3

Direct and Indirect Effects

Alternative 2 would affect approximately 1,717 acres of pileated woodpecker habitat (table 194*)*. The impacts to pileated woodpecker habitat depend on the type of proposed treatment. Bunnell et al. (2002) found that partial harvest did not affect the abundance of primary nesters in most cases. In some cases, abundance increased perhaps due to small openings and creation of edges. Of those acres of pileated woodpecker habitat affected under alternative 2, approximately 361 acres would be treated with intermediate harvest. Impacts to pileated woodpecker habitat would not be as pronounced in intermediate harvest treatment units relative to those in regeneration harvest treatment units (approximately 859 acres). Prescribed fire is proposed for 149 acres; where fire consumes down woody debris, foraging habitat for pileated woodpeckers would be reduced. Under alternative 3, 1,279 acres of pileated woodpecker habitat would be treated of which 361 acres are intermediate harvest (same as alternative 2); 543 with regeneration harvest, and 107 with prescribed fire. Alternative 3 would have fewer impacts on pileated woodpecker habitat than alternative 2, particularly with regards to regeneration harvest. The precommercial thinning should have little impact on pileated woodpecker habitat.

Table 194. Acres of potential pileated woodpecker habitat treated by treatment type and alternative

Alternative	Regeneration Harvest	Intermediate Harvest	Prescribed Fire	Precommercial Thinning	TOTAL
Alternative 2	859	361	149	348	1,717
Alternative 3	543	361	107	268	1,279

Snag and down woody habitat will continue to be abundant in the project area at least in the 7- to 11.9-inch size class (see *Snags and Down Woody Debris* Section*)*. Most of the project area will

remain untreated. These areas will continue to provide plenty of snags and down woody debris for foraging; however, canopy cover and large snags suitable for nesting are lacking across the project area so it is unlikely that pileated woodpeckers would be able find adequate nesting habitat across much of the project area.

In the long term, catastrophic losses due to disturbance would be reduced in alternatives 2 and 3, thereby retaining some level of pileated woodpecker habitat in the project area over time. Treatments designed to improve tree growth will benefit woodpeckers by promoting large trees and subsequent large snag habitat in the project area. This would occur primarily within the units slated for intermediate harvest; however, snag recruitment would occur at a slower pace than under untreated conditions since treatments are designed to increase tree vigor and lower susceptibility to mortality.

Under alternative 2, 8.5 miles of temporary roads would be constructed for the project and obliterated post-implementation. Alternative 3 includes 3.4 miles of temporary roads. These roads would be closed to the public so snag attrition associated with firewood retrieval should not be an issue.

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on pileated woodpecker habitat in the context of the myriad of other past, present, and future effects on this habitat from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. Table 195 summarizes the key items that are taken into consideration for the cumulative effects analysis for pileated woodpecker habitat (see Appendix E, Wildlife Specialist Report, *Cumulative Effects*).

Past Activities

Several past activities never had or no longer have present effects to which the project would contribute. Specifically, projects that involved vegetation manipulation (e.g., trail reconstruction, timber harvest, and fuels activities) may have impacted pileated woodpecker habitat at the time of the activity. Some of these impacts may still be apparent in those areas not yet capable of meeting pileated woodpecker habitat requirements, particularly large snags needed for nesting. Table 196 summarizes the effects of timber harvest during three time periods on pileated woodpecker habitat currently existing in the Project area. Most of the stands that have been harvested in the past do not yet provide nesting habitat while most of those stands do provide foraging habitat for pileated woodpeckers today.

Fuels activities that occurred in the past mainly focused on reducing surface fuels. Many of these areas that were treated prior to the 1980s have returned to their ‘pre-treatment’ conditions especially in favorable growing conditions that accelerate understory development. Fuels activities that have occurred since the 1980s have also reduced surface fuels and created more open conditions that favor shrub and grassland development. These activities have contributed to structural characteristics that may currently provide both nesting and foraging habitat.

Table 195. Cumulative effects considerations for pileated woodpecker habitat in the combination boundary

Parameter	Discussion
Spatial Boundary	The spatial boundary is expanded to the point at which pileated woodpecker habitat is longer measurably affected. The combination boundary area satisfies this requirement because this is the scale at which the effects to this habitat can be examined at the stand or treatment unit. The combination boundary also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1950s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the Project boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the age class, density, and species composition of pileated woodpecker habitat that comprises the Project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, private land timber harvest, and the Forestwide Hazardous Tree Removal and Fuels Reduction Project.
	Ongoing and future activities include personal fire wood cutting, Divide Travel Plan, and private land timber harvest.
Measurement Indicators	Measurements include effects to pileated woodpecker habitat.
Thresholds	Forest Plan Standards of a minimum of 2 snags per acre by 3rd order drainage.
Methods	Past, ongoing, and reasonably foreseeable activities are described quantitatively based on acres of pileated woodpecker habitat affected. Impacts of past activities are based on the FACTS database and summarized according to the types of treatments recorded in the database. The effects on pileated woodpecker habitat are based on observed changes to stand structure.
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized.

Table 196. Past Forest Service timber harvest activities and their impacts on the availability of existing pileated woodpecker habitat in the combination boundary

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Regeneration	3,079	Although no pre-harvest data exist on snag levels, it's probable that most snags that were present at the time were removed during timber harvest. However, the Forest Plan established snag standards in 1986 which most likely resulted in greater snag retention than prior to Forest Plan development.
	Intermediate	264	
Forest Service Timber Harvest 1980s through 1990s	Regeneration	2,684	
	Intermediate	316	
Forest Service Timber Harvest 2000 to Present	Regeneration	236	
	Intermediate	2,558	

Ongoing Activities

Ongoing activities that have effects to pileated woodpecker habitat are summarized in table 197.

Table 197. Ongoing activities that may impact pileated woodpecker habitat in the combination boundary

Activity	Effects to Pileated Woodpecker Habitat
Firewood Cutting and Post and Pole Permits	Ongoing firewood cutting and post/pole permits result in removal of snags along roadsides and reduces snag availability for pileated woodpeckers in those locations.
Timber Harvest on Private Land	Private land logging will continue to remove snags and impact pileated woodpecker habitat.

Reasonably Foreseeable Activities

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next five decades. Private lands within the combination boundary but outside of the project area are a mix of lodgepole pine-dominated stands with a similar history and lower elevation stands dominated by Douglas-fir. Much of the lower elevation component has also been subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain. Timber harvest, especially at lower elevations, could impact pileated woodpecker habitat. Implementation of the Divide Travel Plan, pending a decision, would result in several miles of road closures that would preclude firewood retrieval in most cases (exceptions include opening some of these areas to firewood gathering on a limited basis as needed to address fuel loading concerns). Conversely, the roads that would remain open under the Divide Travel Plan would continue to be used for firewood gathering; however, since this is already ongoing the impacts to snags, and potential pileated woodpecker habitat, would remain the same as the current situation along these open roads.

Cumulative Effects Conclusions

Implementation of alternative 1 would not result in the removal of any pileated woodpecker habitat. It would, however, maintain the status quo in terms of snag recruitment associated with the mountain pine beetle.

Implementation of alternative 2 or 3 would result in effects similar to those associated with past timber harvest and fuels activities that have shaped the existing condition by both removing pileated woodpecker habitat through timber harvest and potentially adding habitat through prescribed fire. Alternatives 2 and 3 would contribute to the effects associated with the following ongoing and reasonably foreseeable projects by removing snags: Divide Travel Plan, private land timber harvest, and firewood retrieval. However, adequate snags will remain in the project area due to the mortality associated with the mountain pine beetle and because Forest Plan standards would be met under both action alternatives. Therefore, pileated woodpecker foraging habitat would remain abundant. Nesting habitat per the availability of large snags would not be impacted necessarily by the action alternatives since any large snags would be retained in treatment units where they do not pose a safety hazard.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

Implementation of either of the action alternatives should have a minimal impact on pileated woodpecker nesting habitat since the project area is already generally unsuitable as nesting due to a lack of large snags. Any large live trees 20 inches or more dbh (or snags should they be encountered rare as they appear to be) would be retained.

In the short term, alternative 1 retains the highest levels of snags needed by pileated woodpeckers for foraging. Alternative 2 would result in fewer remaining snags compared to alternative 3 because more acres overall would be treated in alternative 2, which could affect pileated woodpecker nesting and foraging habitat. Given that the project area's post-treatment snag density would remain relatively high and the largest snags would be retained in treatment units unless they pose a safety risk, the actual impact of the action alternatives on pileated woodpeckers is likely to be minimal.

In the long term under alternative 1, pileated woodpecker habitat, especially the large tree component essential for nesting, would be provided by mature stands of Douglas-fir. According to the Forest Vegetation Simulator (FVS), under alternative 1 productivity in Douglas-fir stands would be low. The density and presence of larger diameter trees along with smaller trees would increase susceptibility of Douglas-fir stands to the Douglas-fir beetle and Western spruce budworm. These agents of mortality would create snags that could be used for nesting by pileated woodpeckers. Conversely, adverse effects of wildfire would be greater under those conditions and pileated woodpecker habitat could be lost from the project area if a severe fire were to occur. The action alternatives would promote resiliency in Douglas-fir stands resulting in late-seral habitat with large live trees. Depending on the prevalence of mortality agents in these stands, nesting habitat may or may not be created. The action alternatives also include treatments adjacent to existing old growth which could affect fire behavior in the old growth stands. Fire entering old growth from adjacent treated areas is more likely to be a surface fire and less likely to be stand replacing.

Losses of large diameter trees from logging (Bull 1987; McClelland 1977), or high severity wildfire, are the major threats to pileated woodpeckers. From Bull (1987) we can infer that removing accumulations of down woody debris may reduce foraging habitat. From Samson *et al*. (2005), we can conclude that fire suppression that results in higher than normal wildfire severities precludes the long-term recruitment of suitable nesting snags.

Late-seral forest conditions are needed to produce large diameter snags. Alternative 2, and to a lesser extent alternative 3, are designed to take an aggressive approach to enhancing large tree growth with a short-term tradeoff of reduced snag densities for pileated woodpeckers. Post-treatment snag densities would meet Forest Plan standards and snag densities project area-wide would remain elevated over natural levels as described in the Eastside Snag Assessment (Bollenbacher *et al*. 2008).

The desired condition for pileated woodpeckers includes large trees for nesting, dead and down wood for foraging, and at least 35 percent canopy cover. Minimum nest tree diameter is 20 inches. Habitat surrounding nest trees generally includes stands of 50 to 100 contiguous acres with basal areas of 100 to 125 square feet per acre (McClelland 1977, McClelland and McClelland 1999, and Bull 1987).

Table 198. Changes in basal area (square feet per acre) estimates for sample stands of douglas-fir between alternative 1 and alternative 2 for two time periods

Year	Alternative 1	Alternative 2 (Intermediate Harvest)
2018	149 ft^2/acre	68 ft^2/acre
2063	176 ft^2/acre	84 ft^2/acre

Implementation of alternative 2, and to a lesser extent alternative 3, would result in stand characteristics more conducive to pileated woodpecker habitat requirements sooner than if the project area is left untreated (table 198). In the absence of wildfire, selection of alternative 1 would result in basal areas greater than those preferred for pileated woodpecker habitat.

As described in the Affected Environment, the project area currently comprises enough pileated woodpecker habitat to support up to 7 pairs of woodpeckers (7,643 acres). The removal of 859 acres in alternative 2 and 543 acres in alternative 3 of pileated woodpecker habitat would result in 6,784 acres of habitat remaining under alternative 2 and 7,100 acres under alternative 3. Post-treatment, under both action alternatives the project area would still support between 6 to 7 pairs based on the remaining acres of habitat. Intermediate harvest could still continue to provide structure necessary for woodpeckers.

Regulatory Framework and Forest Plan Consistency

The pileated woodpecker is a management indicator for old growth dependent species; as such it's intended to be a bellwether of the effects of management activities on representative wildlife habitats with the objective of ensuring that viable populations of existing native and desirable non-native animal species are maintained.

Federal laws and direction applicable to management indicator species include the National Forest Management Act (NFMA), the Forest Service Manual, and the Helena National Forest Plan. The NFMA requires the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" [16 U.S.C. 1604(g)(3)(B)]. All alternatives are consistent with this requirement. Pileated woodpecker habitat would continue to be abundant and well-distributed and species' viability would be maintained across the Forest. See also the Viability Analysis Section.

Forest Plan Standards applicable to pileated woodpeckers are those that provide thresholds for snags. See the Forest Plan Consistency section for Snags and Down Woody Debris Habitat.

Monitoring

The Forest Plan requires that monitoring of pileated woodpecker habitat take place in order to "measure the effect of management activities on representative wildlife habitats with the objective of ensuring that viable populations of existing native…species are maintained" (Forest Plan p. II/17). Monitoring allows us to determine if the forestwide goal – maintain and improve the habitat over time to support big game and other wildlife species (Forest Plan p. II/1) – is being achieved. The emphasis of the goals and objectives is habitat.

Monitoring element C7 focuses on pileated woodpeckers, among other species. Pileated woodpeckers were chosen as a management indicator species (MIS) because they were the largest primary excavator on the HNF – and still are. At the time of Forest Plan development, they were limited to the Lincoln District. Pileated woodpeckers were also chosen as an MIS species because they have the most restrictive requirements in terms of snag size of any cavity nester on the Forest. Therefore, pileated woodpeckers were expected to be a 'good old-growth indicator' because of their feeding requirements for large snags and down logs. The emphasis is on these structural components that tend to be more common in late-successional forests although certainly not limited to those sites.

Old growth on the Helena Forest has been reported in the *Forested Habitats of Special Concern Background Report*. Currently, there is 8.4 percent old growth forestwide, 9.8 percent in the Divide Landscape, 11.1 percent in the combination boundary, and 12.5 percent in the project area. Snags are abundant in the smaller size classes with very few large snags present on the Forest. This is primarily

due to a lack of large trees across the Forest. Snags will continue to be abundant due to the mountain pine beetle; however, large snags will continue to be rare. For now, the habitat requirements for pileated woodpeckers as prescribed by the Forest Plan are being met and as summarized in the Viability Section pileated woodpecker viability is being maintained forestwide.

Monitoring has occurred in stands identified as old growth within and outside of the project area (See Affected Environment). Outyear monitoring will occur in the project as part of Forest Plan monitoring specific to element C7.

Hairy Woodpecker

Affected Environment

Habitat Use

The hairy woodpecker (*Picoides villosus*) is a *Forest Plan* management indicator for species dependent on snags [standing dead trees at least 20 feet tall and 6 inches in diameter (dbh)](*HFP*, p. V1/15). Hairy woodpeckers inhabit a wide spectrum of habitats ranging from open snag fields created by stand-replacing fire to interior forests with a smattering of snags and other insect-prone trees (Hutto and Young 1999). Hairy woodpeckers are year-round residents in the northern Rockies and primary cavity nesters. The cavities that they excavate are eventually available to a myriad of other small birds and mammals.

The woodpeckers require dead or decaying trees at least 10 inches in diameter for nesting (Thomas 1979, p. 68), but they often forage on smaller trees. They feed on insects—wood borers, bark beetles, ants, and grubs—as well as on fruits, berries, and sometimes, seeds. These resources are gleaned from a variety of substrates: dead and dying trees, live trees, logs, stumps, shrubs, the ground—anything with a supply of appropriate insects or other suitable food. The primary habitat component on which hairy woodpeckers depend is ephemeral—more so than key habitat features required by most non cavity-dependent species. While some fire-killed trees may remain standing for several decades and continue to supply a potential base for nest cavities, their ability to support the insects on which the woodpeckers depend for food deteriorates quickly (typically, within 5 to 8 years). Trees killed by insects or disease may remain upright for only 2 to 5 years after becoming suitable for cavity excavation. As the supply of dead trees waxes and wanes in a given area, the woodpecker population follows.

Hairy woodpeckers reach their highest population densities in new burns and in stands beset with disease or insect irruptions (such as the current pine beetle outbreak in the Divide landscape). This is primarily a response to the elevated food supply, and as the abundance of wood-boring insects in a recently afflicted area begins to decline, the woodpecker population recedes as well. Covert-Bratland and others (2006) measured a six-fold decrease in population density and more than a ten-fold increase in home range size between the 2nd and 9th year following a stand replacing fire in Arizona. Decreasing food supply, rather than the loss of potential nesting sites, appears to be the principal factor that drives down populations and causes home range size to expand (Welsh and Capen 1992).

Hairy woodpeckers are also capable of inhabiting healthy mature forests as long as a few snags or living trees with a ready supply of insects are scattered through the stand. In these circumstances—with live trees providing up to 50 percent of their food (Sousa 1987)—woodpeckers maintain relatively low population densities. Given the range of habitats and food supplies that hairy woodpeckers are capable of exploiting, their population densities and their home range sizes can vary dramatically. Home ranges run from around 2.5 mi² (in recent burns) to more than 37 mi² (in healthy forest or areas with few trees). Population density in suitable habitat can range from around 1

to 2 pairs per mi² to 33 to 35 pairs per mi², depending on the availability of snags and other insect-prone trees and, ultimately, the abundance of food provided by those habitat components (Covert-Bratland et al. 2006, 2007).

Population Status

The Montana Natural Heritage database lists the global status of the hairy woodpecker as *G5*: "*Common, widespread, and abundant (although it may be rare in parts of its range), not vulnerable in most of its range.*" In Montana, the hairy woodpecker's status is *S5*—the state version of *G5* (http://fieldguide.mt.gov/displayClasses.aspx?Kingdom=Animalia).

The North American Breeding Bird Survey indicates that while hairy woodpecker populations are declining slightly in parts of North America—notably, in the South, Midwest, and Pacific Northwest—populations have been increasing in most of the Rocky Mountain Region at an average yearly rate of 0.76 percent between 1966 and 2013 (see figure 68 and http://www.mbr-pwrc.usgs.gov/bbs/bbs.html). In Montana, the rate of increase is at 2.76 percent. Populations in many areas have been trending upward more sharply since the mid-1980s coincident with the upsurge in large stand-replacing fires and, more recently, with the advent of widespread mountain pine beetle infestation across parts of the state.

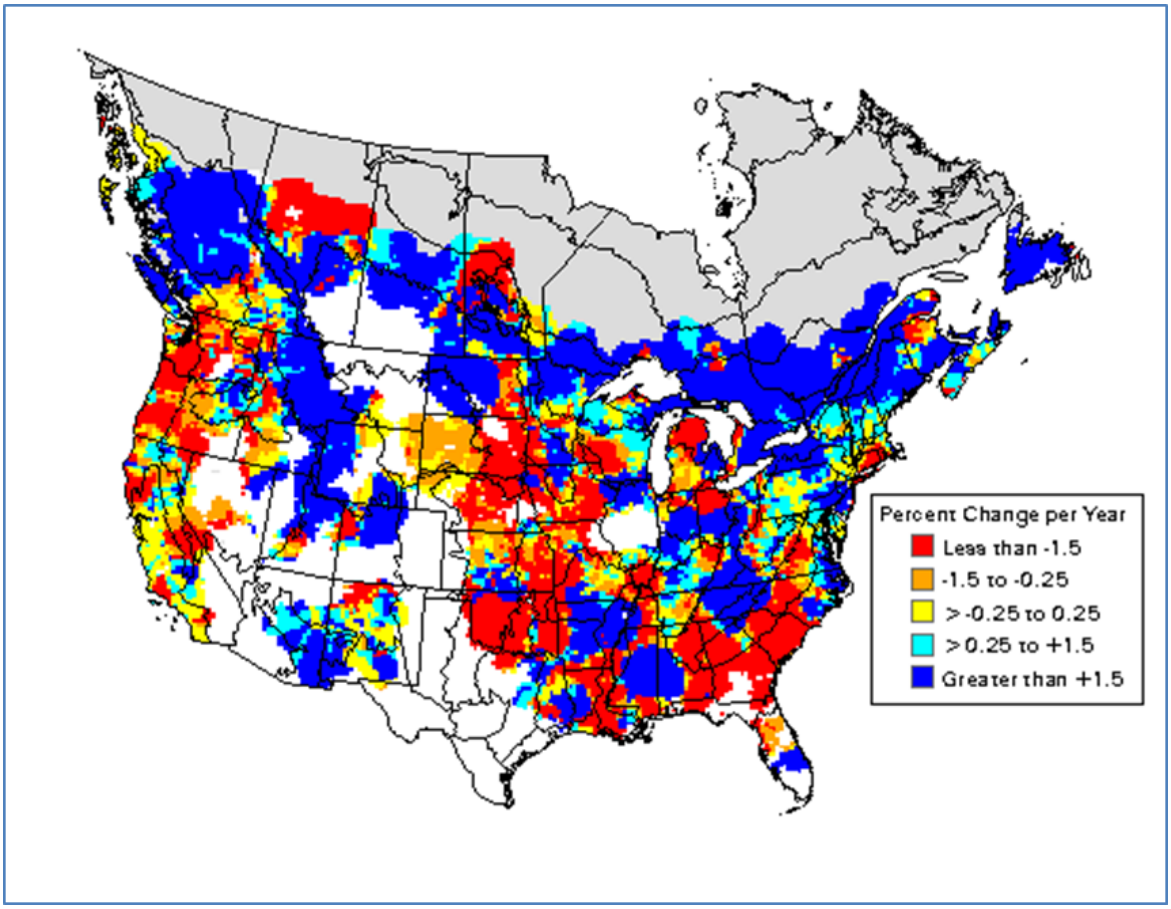


Figure 68. Average percent change per year in population trend for hairy woodpeckers, 1966 to 2013, across the 48 contiguous states and the Canadian provinces (Sauer et al. 2014)

Habitat and Population in the Project Area

Habitat

Hairy woodpeckers can be found with regularity in any forest habitat with a modicum of dead trees for nesting and enough insect-prone trees to provide feeding substrate (Hutto and Young 1999, p. 22). In the Telegraph Project area, hairy woodpeckers have been observed in mature lodgepole pine, spruce/subalpine fir, Douglas-fir, ponderosa pine, mixed conifer, and aspen stands; in young forest and cutting units (including clearcuts) with residual snags and older trees; in wetland and riparian shrub associations; and, with great frequency, in the new snag dominated environments created by the mountain pine beetles.

Hairy woodpecker habitat has been estimated via a model developed by Region 1 (R-1) and described in the *Criteria for Wildlife Models Helena National Forest* (USDA 2009a). This model employs a broad definition of suitable hairy woodpecker habitat that focuses on stands dominated by trees with dbh 10 inches or larger and canopy cover 10 percent or more. However, the model does not include lodgepole pine—and as a result, it assigns only 7,647 acres of suitable habitat to the project area (32 percent of the area) and 24,793 acres to the combination boundary (21 percent of that area) (figure 69). Based on the overwhelming dominance of forest habitats in the project area (*Vegetation Introduction Report*), the proliferation of snag-dominated habitats, and the regular observation of hairy woodpeckers in most forest types across the area, it is likely that the woodpeckers nest and forage over more than 50 percent of the project area.

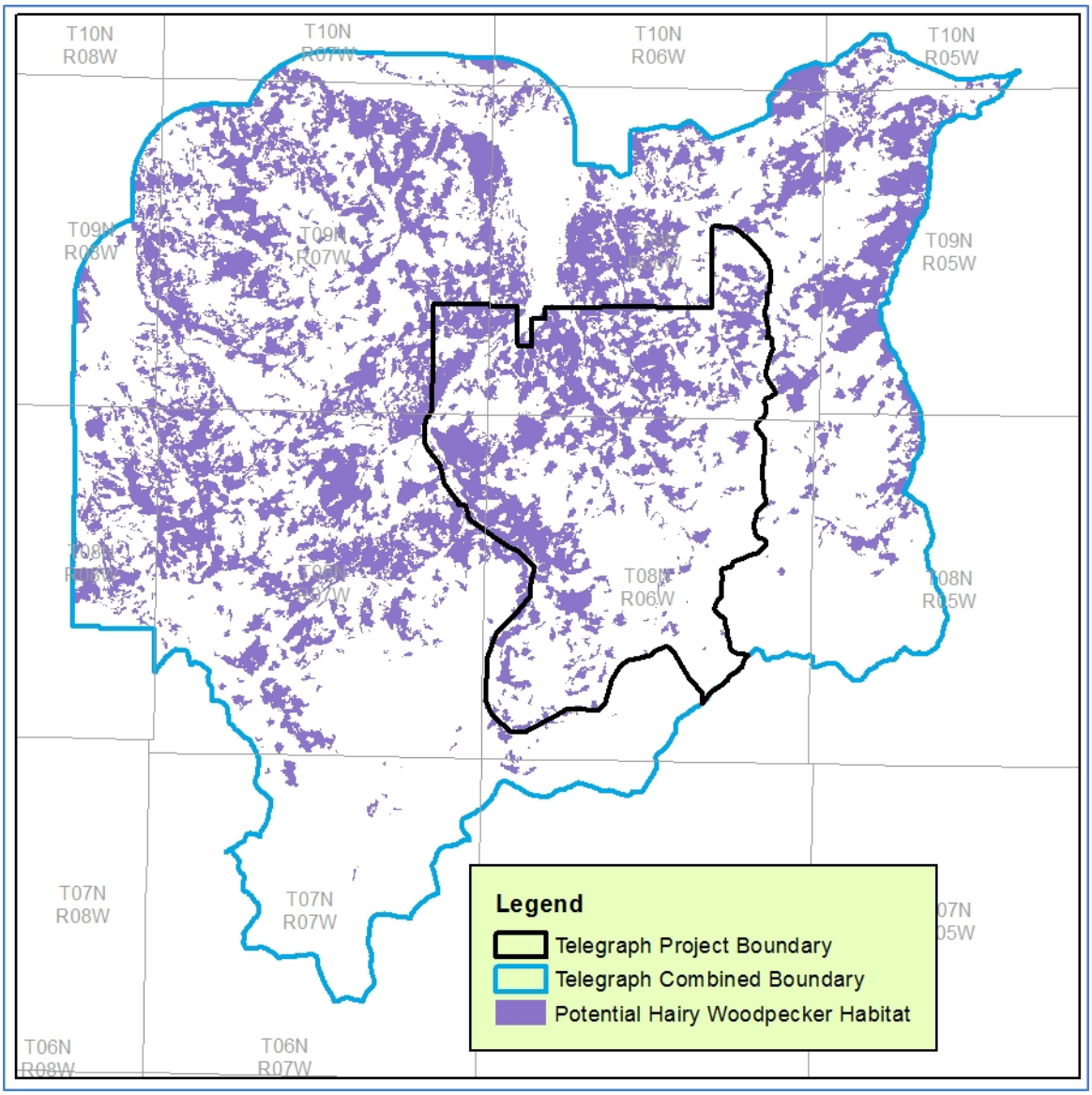


Figure 69. Modeled hairy woodpecker habitat in the Telegraph project area

Local Populations

There are no population density estimates for hairy woodpeckers in the project area. But, extensive wildlife surveys by HNF biologists (1992–2013) and point-count surveys by the Northern Region Landbird Survey Program (1994–2006) indicate that the hairy woodpecker was regularly present in the Telegraph project area (and the combination boundary) prior to the mountain pine beetle outbreak in 2006 and that it is now common in the beetle-impacted forests. It is a rare session in the field that does not produce hairy woodpecker observations. The Birds and Burns study (2002–2014) in the northern Elkhorn Range just east of the Divide landscape found that in healthy mature ponderosa pine dominated stands, the hairy woodpecker was the 17th most common of 44 bird species detected on regular point-count surveys (Russell and Saab 2004, 2005). The bulk of the nesting sites, however, were in aspen groves scattered throughout the pine forest (Saab et al. 2007). Forests in the North Elkhorns have since been heavily impacted by the mountain pine beetle, and while the hairy woodpecker population has not increased appreciably, nest survival rate has gone up

and a majority of nest sites have switched from aspen to dead pine trees (Dresser *et al*. 2013; Mosher and Saab 2009).

In the Telegraph Project area, the hairy woodpecker population has responded somewhat differently to the beetle outbreak. Prior to 2006, the woodpeckers, while consistently present throughout the area, were not as abundant as in the North Elkhorns. This appears to have been a function of the relative scarcity of aspen stands and the poor dispersion of snags across most of the area. Now that dead trees are the predominant feature of project area forests, hairy woodpeckers are much more in evidence—responding to the increased food supply and the plethora of potential nesting sites. A recent study in British Columbia found that after a mountain pine beetle outbreak there, the average number of hairy woodpecker nests detected each year rose by a factor of about 3.5 (3½ times). The increase was not due to a rise in fecundity (clutch size) but, rather, to ***immigration*** from other less suitable areas and improved survival of young (Edworthy et al. 2011). It is likely that the same phenomenon is occurring now in much of the Telegraph project area and combination boundary.

Most recent field studies of hairy woodpeckers have avoided expressing population abundance or density in absolute terms. Rather, they provide descriptors of relative abundance—the numbers of birds detected per transect, per sample point, and so on [Edworthy et al. 2011; Ripper et al. 2007; Covert-Bratland et al. 2006; Welsh and Cappen 1992]. These measures do indicate consistently that hairy woodpecker populations increase significantly during the first 2 to 3 years after a fire or a lethal insect outbreak—by as much as 18 times after a severe fire (Covert-Bratland et al. 2006)—and then decline back to pre-event levels after 7 to 9 years. As population density increases in the first 2 to 3 years, individual home range size contracts—only to expand back to pre-event level as population density declines. Covert-Bratland et al. (2006) found home ranges of hairy woodpecker pairs shrinking from around 360 acres to an average of 19 acres 2 years after a stand-replacing fire and then expanding back to pre-fire levels after 7 years. In a heterogeneous matrix of different aged forest stands in Washington, Ripper et al. (2007) found home ranges ranging from 40 acres to 438 acres (averaging 143 acres).

Assuming that (1) home range size in post-beetle-kill environments is similar to that in post-fire environments and that (2) most Telegraph area stands are at the 4 to 5 years post-kill stage, hairy woodpecker home ranges in these habitats are probably in the neighborhood of 75 to 120 acres (using data from Covert-Bratland et al. 2006). While the woodpeckers defend core territories around nest sites, there may be considerable home range overlap between neighboring pairs. The literature, however, provides no good estimate as to how extensive this overlap might be and, consequently, of how to convert home range size to population density. Sousa (1987) reports defended territory sizes of 6 to 20 acres for a variety of habitats across the western U.S. This could allow population densities as high as 5 to 16 pairs per 100 acres. Field observation in the Telegraph project area, however, does not suggest woodpecker densities of this magnitude. On the other hand, a conservative estimate that assumes no home range overlap—thus producing densities of 1 pair per 120 acres in beetle-impacted forest and 1 pair per 360 acres in non-impacted habitats—is certainly too low. Current hairy woodpecker abundance in the Telegraph project area and combination boundary undoubtedly lies somewhere between these two extremes.

Environmental Consequences

Effects to hairy woodpeckers are evaluated according to the following measures:

- Effects to snags and down wood habitat
- Acres of hairy woodpecker habitat treated

Desirable Hairy Woodpecker Habitat Conditions
√ Dead and dying trees for foraging and nesting habitat

Effects Common to All Alternatives

Under all alternatives, insect infestations will continue to create snags and provide hairy woodpecker habitat. Public firewood cutting is permitted and could reduce snags adjacent to roads. Large areas of untreated stands would remain on the landscape where natural snag creation and attrition processes would proceed unabated.

Effects Common to All Action Alternatives

Hairy woodpeckers utilize a variety of habitats and are generally associated with snags and down wood habitat. Snags provide nesting habitat; snags and down wood provide foraging habitat. Hairy woodpeckers forage on a variety of prey items including insects and woodpeckers tend to concentrate in areas of insect outbreaks. Hairy woodpeckers forage on a variety of substrates including snags and down wood.

Timber harvest could result in the removal of hairy woodpecker habitat depending on the treatment type. Commercial thinning will generally retain stand structure suitable as hairy woodpecker habitat while other treatments such as group shelterwood, shelterwood, and seedtree will generally remove hairy woodpecker habitat but will retain some structural components in the form of legacy trees left on site as part of the tree retention guidelines. Regeneration treatments with reserve trees generally will not retain habitat. Snags would be managed according to Forest Plan Standards.

Timber harvest may reduce future foraging opportunities for hairy woodpeckers since treatment objectives are to reduce future stand susceptibility to insects and disease. However, since a large portion of the project area will remain untreated, stands that have high levels of insect infestations will remain in the project area. Prescribed fire could promote nesting habitat due incidental mortality of trees associated with burning.

Alternative 1

Direct and Indirect Effects

There are no direct effects to hairy woodpecker habitat associated with this alternative. Under this alternative, no snags would be removed except through firewood retrieval and where they pose safety hazards in areas frequented by the public. Dead trees, while standing, will provide ample foraging and nesting habitat until such time as these trees fall.

Alternatives 2 and 3

Direct and Indirect Effects

Alternative 2 would affect approximately 1,611 acres of hairy woodpecker habitat (table 199); alternative 3 would impact 1,182 acres. Impacts to hairy woodpecker habitat depend on the type of

proposed treatment. Bunnell et al. (2002) found that partial harvest did not affect the abundance of primary nesters in most cases. In some cases, abundance increased perhaps due to small openings and creation of edges. Of those acres of hairy woodpecker habitat treated, approximately 352 acres will be treated with intermediate harvest in alternatives 2 and 3. Regeneration habitat is proposed on 817 acres in alternative 2, and 508 acres in alternative 3. Prescribed fire is proposed on 128 acres in alternative 2, and 86 acres in alternative 3. Hairy woodpecker habitat will be retained to some extent in both the intermediate harvest and prescribed fire treatments since habitat will remain within units post-treatment albeit to a lesser extent than is currently present. Regeneration harvest will remove hairy woodpecker habitat with the exception of some snags remaining within units. Precommercial thinning should have negligible effects to hairy woodpecker habitat.

Table 199. Acres of Potential Hairy Woodpecker Habitat Treated by Treatment Type and Alternative

Alternative	Regeneration Harvest	Intermediate Harvest	Prescribed Fire	Precommercial Thinning
Alternative 2	817	352	128	313
Alternative 3	508	352	86	236

Snags and down wood habitat will continue to be abundant in the project area. Most of the project area would remain untreated with no removal of snags and live trees retained for recruitment. Untreated areas are well distributed and connected. Many snags (primarily lodgepole pine) in proposed treatment areas would be removed especially lodgepole pine snags since these snags are generally of small diameter and not wind firm (See *Forested Habitats of Special Concern Background Report*). Snag densities would remain at or above the Forest Plan Standard of two snags per acre. Hairy woodpeckers would continue to nest and forage in the project at least for the next 10–20 years while snags are still standing. Snags at Forest Plan Standard densities should be sufficient to provide suitable hairy woodpecker habitat (Jackson et al. 2002).

Under alternative 2, 8.5 miles of temporary roads would be constructed for the project and obliterated post-implementation. Alternative 3 includes 3.4 miles of temporary roads. These roads would be closed to the public so snag attrition associated with firewood retrieval should not be an issue.

Cumulative Effects

Cumulative effects are the incremental impacts that the direct and indirect effects associated with the action alternatives have on hairy woodpecker habitat in the context of the myriad of other past, present, and future effects on this habitat from unrelated activities. The cumulative effects analysis considers spatial and temporal boundaries, how past activities have contributed to the existing condition, and whether the ecosystem can accommodate additional effects. Table 200 summarizes the key items that are taken into consideration for the cumulative effects analysis for hairy woodpecker habitat.

Table 200. Cumulative effects considerations for hairy woodpecker habitat

Parameter	Discussion
Spatial Boundary	The spatial boundary is expanded to the point at which hairy woodpecker habitat is longer measurably affected. The combination boundary area satisfies this requirement because this is the scale at which the effects to this habitat can be examined at the stand or treatment unit. The combination boundary also provides a sufficient landscape to assess pattern and structure in the context of larger processes.
Temporal Boundary	The temporal boundary ranges from the 1950s (due to a lack of earlier records in the FACTS database) to those future projects that are either listed in our SOPA or are planned or implemented on private land within the Project boundary.
Past Activities and Existing Condition	The effects of past activities are reflected in the existing condition. Past activities shaped the age class, density, and species composition of hairy woodpecker habitat that comprises the Project area today. The existing condition, which incorporates the changes due to past activities, has been measured by remote sensing and field validation.
Activities Considered in Cumulative Effects	Past activities that are included in the cumulative effects analysis include timber harvest, fuels activities, and private land timber harvest.
	Ongoing and future activities include personal fire wood cutting, post and pole permits, and private land timber harvest.
Measurement Indicators	Measurements include effects to hairy woodpecker habitat.
Thresholds	Forest Plan Standards of a minimum of 2 snags per acre by 3rd order drainage.
Methods	Past, ongoing, and reasonably foreseeable activities are described quantitatively based on acres of hairy woodpecker habitat affected. Impacts of past activities are based on the FACTS database and summarized according to the types of treatments recorded in the database. The effects on hairy woodpecker habitat are based on observed changes to stand structure.
Assumptions	The assumptions for describing past and foreseeable treatments are made based on terminology described in FACTS since these definitions are standardized.

Past Activities

Past timber harvest most likely removed many of the snags need for hairy woodpecker habitat that were in the area at that time. Today, snag numbers are well above Forest Plan standards because of the mountain pine beetle outbreak. Table 201 summarizes the effects of timber harvest during three time periods on hairy woodpecker habitat currently existing in the Project area.

Fuels activities that occurred in the past mainly focused on reducing surface fuels. These activities most likely have resulted in the creation of snags and subsequent hairy woodpecker habitat.

Table 201. Past Forest Service timber harvest activities and their impacts on the availability of existing hairy woodpecker habitat in the combination boundary

Decade	Harvest Type	Acres	Effect
Forest Service Timber Harvest Pre-1960s through 1970s	Regeneration	3,079	Although no pre-harvest data exist on snag levels, it's probable that most snags that were present at the time were removed during timber harvest. However, the Forest Plan established snag standards in 1986 which most likely resulted in greater snag retention than prior to Forest Plan development.
	Intermediate	264	
Forest Service Timber Harvest 1980s through 1990s	Regeneration	2,684	
	Intermediate	316	
Forest Service Timber Harvest 2000 to Present	Regeneration	236	
	Intermediate	2,558	

Ongoing Activities

Ongoing activities that have effects to hairy woodpecker habitat are summarized in table 202.

Table 202. Ongoing activities that may impact hairy woodpecker habitat in the combination boundary

Activity	Effects to Hairy Woodpecker Habitat
Firewood Cutting and Post and Pole Permits	Ongoing firewood cutting and post/pole permits result in removal of snags along roadsides and reduces snag availability for hairy woodpeckers in those locations.
Timber Harvest on Private Land	Private land logging will continue to remove snags and impact hairy woodpecker habitat.

Reasonably Foreseeable Activities

The private lands within the project area that are capable of supporting forests are dominated by lodgepole pine, either mature trees or seedling/sapling stands that are the result of regeneration harvest in recent decades. Nearly all of the mature trees have succumbed to mountain pine beetle, much of which has been salvage logged. Because the sawtimber component that is economical to remove has been removed and because the balance of the lands are at least 50 years from again producing saw logs, it is likely that there will be very little if any harvest on the private lands within the project area for the next five decades. Private lands within the combination boundary but outside of the project area are a mix of lodgepole pine-dominated stands with a similar history and lower elevation stands dominated by Douglas-fir. Much of the lower elevation component has also been subject to past timber harvest, but there is the potential for reasonably foreseeable harvest. However, the level and timing of this harvest is uncertain. Timber harvest, especially at lower elevations, could impact hairy woodpecker habitat. Implementation of the Divide Travel Plan, pending a decision, would result in several miles of road closures that would preclude firewood retrieval in most cases (exceptions include opening some of these areas to firewood gathering on a limited basis as needed to address fuel loading concerns). Conversely, the roads that would remain open under the Divide Travel Plan would continue to be used for firewood gathering; however, since this is already ongoing the impacts to snags, and potential hairy woodpecker habitat, would remain the same as the current situation along these open roads.

Cumulative Effects Conclusions

Implementation of alternative 1 would not result in the removal of any hairy woodpecker habitat. It would, however, maintain the status quo in terms of snag recruitment associated with the mountain pine beetle.

Implementation of alternative 2 or 3 would result in effects similar to those associated with past timber harvest and fuels activities that have shaped the existing condition by both removing hairy woodpecker habitat through timber harvest and potentially adding habitat through prescribed fire. Alternatives 2 and 3 would contribute to the effects associated with the following ongoing and reasonably foreseeable projects by removing snags: Divide Travel Plan, private land timber harvest, and firewood retrieval. However, adequate snags will remain in the project area due to the mortality associated with the mountain pine beetle and because Forest Plan standards would be met under both action alternatives. Therefore, hairy woodpecker nesting and foraging habitat would remain abundant.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitments of resources.

Conclusions

Implementation of any of the action alternatives should have a minimal impact on hairy woodpeckers. Implementation of alternative 3 would result in the least impact to hairy woodpeckers since fewer acres of habitat are being treated and more snags will remain in the project area post-implementation, although snags certainly aren't limited in the project area. However, the reduced risk of wildfire associated with alternative 2 provides some assurance that forested stands are more likely to persist into the future. While hairy woodpeckers may be generalists and adapted to a wide range of stand conditions, they generally prefer forested stands with at least 25 percent canopy cover.

The desired condition for hairy woodpeckers includes dead and dying trees for forage and nesting habitat. Suitable hairy woodpecker habitat comprises at least two snags per acre greater than 10 inches in diameter (Sousa 1987). There are three 3rd order drainages associated with the project area (1106B, 1107, and 1108-1); based on aerial detection surveys there have been at least 33 'new' snags per acre in all 3rd order drainages in the project area in all alternatives (not yet tallied as part of the existing condition). This is in addition to the existing condition in the project area of 49.64 snags per acre that are 7 to 11.9 inches in size and the 9.03 snags per acre greater between 12 and 19.9 inches dbh. Clearly, plenty of snags will be retained in the project area to provide adequate forage and nesting habitat regardless of the alternative selected.

Regulatory Framework and Forest Plan Consistency

The hairy woodpecker is a management indicator for snag dependent species; as such it's intended to be a bellwether of the effects of management activities on representative wildlife habitats with the objective of ensuring that viable populations of existing native and desirable non-native animal species are maintained.

Federal laws and direction applicable to management indicator species include the National Forest Management Act (NFMA), the Forest Service Manual, and the Helena National Forest Plan. The NFMA requires the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" [16 U.S.C. 1604(g)(3)(B)]. All alternatives are consistent with this requirement. While the extent of mountain pine beetle may not have been anticipated at the time the Forest Plan was crafted, today, in the project area and forestwide, snags are abundant and well-distributed and the detections of hairy woodpeckers, particularly in the project area, indicate that snag habitat is abundant and well distributed for a variety of snag-dependent wildlife. See also the Viability Analysis Section.

Forest Plan Standards applicable to hairy woodpeckers are those that provide thresholds for snags. See the Forest Plan Consistency section for Snags and Down Woody Debris Habitat.

Monitoring

The Forest Plan requires that monitoring of hairy woodpecker habitat take place in order to "measure the effect of management activities on representative wildlife habitats with the objective of ensuring that viable populations of existing native…species are maintained" (Forest Plan p. II/17). Monitoring allows us to determine if the forestwide goal—maintain and improve the habitat over time to support big game and other wildlife species (Forest Plan p. II/1)—is being achieved. The emphasis of the goals and objectives is habitat.

Monitoring element C7 focuses on hairy woodpeckers, among other species. Hairy woodpeckers have wide ecological amplitude in terms of nesting and foraging. They are not tied to old growth structural characteristics to the extent that pileated woodpeckers or northern goshawks may be. However, they are included in this element because at the time the Forest Plan was developed, hairy woodpeckers represented snag-dependent species on the Helena and Townsend Ranger Districts where pileated woodpeckers were rare or absent (Helena National Forest Plan EIS p. III/26). Hairy woodpeckers are abundant across the Forest and their viability is being maintained (See Viability Analysis Section and Forest Plan Evaluation and Monitoring Report Fiscal Years 2005–2009, 2010 in prep).

Monitoring has occurred in the project area (see Affected Environment). Outyear monitoring will occur in the project as part of Forest Plan monitoring specific to element C7.

Migratory Landbirds and Shorebirds

Considerations Pertinent to Management

In 1988, an amendment to the Fish and Wildlife Conservation Act mandated that the U.S. Fish and Wildlife Service (USFWS) "identify species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973." A subsequent report, *Birds of Conservation Concern 2002*, identified migratory and non-migratory bird species (in addition to those already designated as federally threatened or endangered) that represented the highest conservation priority. In that report (and in a 2008 update), North America is broken down into 66 Bird Conservation Regions (BCRs), with "bird species of concern" identified for each region. The HNF is situated at the boundary of BCR 10 (northern Rockies) and BCR 17 (badlands and prairies) but supports bird populations more characteristic of BCR 10. The migratory bird list for that BCR and the accounting in MFWP's *Montana Field Guide* (http://fieldguide.mt.gov/) have been used to determine which birds may be of particular management concern in the Divide landscape. This grouping takes in all migratory and yearlong resident landbirds and shorebirds identified as "species of concern." It does not include waterfowl or upland gamebirds.

More specific management direction for dealing with landbirds and shorebirds in project planning (including NEPA documents) comes from the Forest Service's Landbird Conservation Strategic Plan (2000) and Executive Order 13186 (2001) [Fed Reg. Vol 66, No. 11, p. 3853-3856]. More recently (2008), the Forest Service and the U.S. Fish and Wildlife Service (USFWS) signed a memorandum of understanding (MOU) that directs the Forest Service to approach management of migratory birds in the following way: (1) focus on bird *populations*; (2) focus on habitat restoration and enhancement where actions can benefit specific ecosystems and migratory birds dependent on them; (3) recognize that actions taken to benefit some migratory bird populations may adversely affect other migratory bird populations; and (4) recognize that actions that may provide long-term benefits to migratory birds may have short-term impacts on individual birds. The parties agreed that through the NEPA process, the Forest Service would evaluate the effects of agency actions on migratory birds, focusing

first on species of management concern along with their priority habitats and key risk factors. The MOU expired in December 2013, but discussions are underway to issue a new Memorandum in the near future. This report deals with priority bird species as if the Memorandum were in effect.

Population Status in the Project Area

Over a period of 14 years (1994–2008), the HNF participated in the USFS Northern Region Landbird Monitoring Program (LBMP) in partnership with the Avian Science Center (ASC) at the University of Montana (Hutto and Young 2002). Each year, from late spring through mid-summer, the ASC conducted standardized surveys along a series of pre-determined transects across the Forest. The program has provided data on population trends, habitat relationships, and effects from past management activities for birds breeding throughout western Montana and northern Idaho. According to Hutto, "There are not nearly enough years of data to make meaningful use of our population trend data yet, but the preliminary data suggest that most populations have remained fairly stable during the 12-year period from 1994–2006" Results from the first half of the program's fieldwork are summarized in Hutto and Young (1999).

The Divide landscape includes 19 point-count transects (3 in the Telegraph project area, 6 in the combination boundary) that were monitored in different combinations from 1994–2006. In monitoring a transect, surveyors identified and counted birds for 10 minutes at each of 10 points—with transects being worked once a year in late spring or early summer. Surveyors identified birds primarily by songs and calls and, to a lesser extent, by sight. So, they did not always pick up birds that were particularly secretive (American bitterns), uncommon (Brewer's sparrows), or attached to habitat that lacked transects (bobolinks) during their relatively short sessions at each transect point. Some of these species, however, have been identified fortuitously over the past two decades during general wildlife fieldwork or by special survey efforts that targeted particular species (goshawks, flammulated owls, boreals owls, and black-backed woodpeckers, for example).

Over the 12-year period, 60 species of birds were identified along established LBMP survey transects in the Divide landscape and an additional 36 species were picked up during general and targeted wildlife survey work. These enumerations do not include waterfowl, upland gamebirds, or obvious transients (peregrine falcons, ferruginous hawks, and Baird's sparrows, among others). Of the 96 species, 19 are classified as "species of concern" and/or "birds of conservation concern" in the Montana portion of BCR 10 and are displayed in table 203 as species whose populations could be compromised by certain land management activities.

The Telegraph project area provides habitat opportunity for most of these species—some much more than others. Some are open-country species found in prairies and valley lands on the fringes of the combination boundary (Swainson's hawks, prairie falcons). Some of the species found in and around the project area are affected negatively by certain land management practices, others positively, and some little at all. Hejl and others (1995) recommend a bird conservation strategy composed of three parts: (1) maintain, mimic, and restore natural vegetation patterns and processes; (2) ensure that the specific habitat components required by focus species are created and/or maintained; and (3) monitor the habitats and individual species. Table 203 also indicates which birds are carried forward in analysis and the respective section.

Table 203. Resident Bird Species in the Divide Landscape that have been identified as (1) "Birds of Conservation Concern" in Bird Conservation Region 10 by the U.S. Fish and Wildlife Service (USFWS)[1] or (2) "Species of Concern" in the State of Montana by the Montana Natural Heritage Program (MNHP).

Species	List	Relative Abundance[2]	Habitat Preferences and Limiting Factors	Analysis Section
Swainson's Hawk	USFWS	Uncommon—limited to the fringes of the project area and combination boundary	Swainson's hawks are similar in behavior and foraging patterns to red-tailed hawks, but their populations are much less robust, in part because of problems on their winter ranges in South America. They occur only on the fringes of the Telegraph combination boundary in grassland and agricultural fields, nesting in isolated trees and hunting for small mammals, reptiles, and large insects.	Not carried forward in additional analyses since the project would have no effect to the habitat.
Golden Eagle	MNHP	Rare	Golden eagles nest on cliffs and large trees. They forage most often over upland grasslands and open woodlands, where prey is visible. Numbers are limited by territorial competition with other eagles (and other raptors) and by mortality from shooting, poisoning, and electrocution on powerlines.	Not carried forward in additional analyses since the project would have no effect to the habitat.
Prairie Falcon	MNHP	Rare—limited to the fringes of the combination boundary	Prairie falcons establish eyries on high cliffs, preying on birds that can be knocked out of the air wherever they occur. They are less dependent on aquatic habitat than peregrine falcons and appear more versatile in their choice of nest sites. Nonetheless, numbers are limited by the availability of nesting cliffs, as well as by the logistics of ongoing recovery from decimated populations in the 20th century.	Not carried forward in additional analyses since the project would have no effect to the habitat.
Northern Goshawk	MNHP	Uncommon but regularly distributed	Goshawks nest and fledge young in mature closed-canopied forest stands but hunt in a variety of forest formations, as well as in open habitats near forest edges. Availability of nesting/ post-fledging habitat and the density of prey are primary limiting factors. Low population density is driven by the need for large home ranges.	Analyzed in the Northern Goshawk section
Great Gray Owl	MNHP	Uncommon but often observed	Great gray owls nest in the upper reaches of large broken-topped trees in mature/ old-growth forest (usually fairly dense). They forage in a variety of habitats, including wet meadows, fields, and bogs, as well as coniferous forest. In some areas, great gray owl populations are limited by periodic shortages of prey; in others, a paucity of suitable nest trees is the primary factor.	Not carried forward in additional analyses since the project would have no effect to the habitat.

Species	List	Relative Abundance[2]	Habitat Preferences and Limiting Factors	Analysis Section
Boreal Owl	MNHP	Relatively uncommon overall, but usually well distributed in suitable habitat	Boreal owls nest in tree cavities and hunt at night in higher elevation conifer forests—usually Engelmann spruce, subalpine fir, and lodgepole pine. These diminutive owls are more common than once thought, but they are secretive and difficult to census. Numbers are limited by territoriality and the availability of suitable habitat.	Not carried forward in additional analyses since the project would have no effect to the habitat.
Flammulated Owl	USFWS MNHP	Rare with fragmented distribution	The flammulated owl is a small cavity nesting raptor, preferring open-grown mature or old-growth ponderosa pine forest for nesting and foraging. Inclusions of denser conifers provide roosting enclaves. They are sometimes found in Douglas-fir or aspen when suitable ponderosa pine stands are unavailable. The scarcity of open-grown stands of large ponderosa pine is the main limiting factor.	Discussed in the Flammulated Owl section
Great Blue Heron	MNHP	Relatively uncommon but widespread	Great blue herons usually feed in shallow wetlands wherever they occur, including many near human development. Less often they forage for amphibians and small mammals in wet meadows or fields. They establish nesting colonies in the canopies of deciduous trees (typically cottonwoods) not far from wetland feeding areas. Populations are limited by the fragmented distribution of suitable nesting and foraging sites.	Not carried forward in additional analyses since the project would have no effect to the habitat.
Lewis's Woodpecker	USFWS MNHP	Currently rare, but becoming less so with increasing habitat opportunity	Lewis's woodpeckers are cavity nesters most strongly associated with burned or open gown ponderosa pine forest with a sufficient supply of snags. They usually move into burned forests several years after fire has occurred. Pine forests decimated by insect and disease may also provide suitable habitat. Lewis's woodpecker populations are limited primarily by a shortage of older, dead trees in a given area.	Not carried forward in additional analyses since the project would have no effect to the habitat.
Black-backed Woodpecker	MNHP	Currently rare because of the absence of wildfire	Black-backed woodpeckers are tightly tied to large concentrations of dead trees created by stand replacing fires. Post-fire insect populations can sustain woodpecker populations for only 3 to 5 years. The proliferation of dead trees created by mountain pine beetle infestation in the Divide landscape does not appear to be drawing in black-backed woodpeckers. The primary limiting factor is the erratic availability of suitable post-fire environments for these highly specialized birds.	Discussed in the Black-backed Woodpecker section

Species	List	Relative Abundance[2]	Habitat Preferences and Limiting Factors	Analysis Section
Willow Flycatcher	USFWS	Rare	Willow flycatchers are highly restricted to riparian shrub communities. Landscape-wide populations are suppressed by the fragmented and limited distribution of the key habitat association and by processes that reduce the quality of that habitat—stream channelization, livestock grazing, etc.	Discussed in the Wetlands and Riparian Habitats section
Olive-sided Flycatcher	USFWS	Relatively uncommon	These birds generally nest and perch in dead trees in open habitats—historically, those created by fire, but also in post-insect infestation areas, logged sites with residual snags, or other open areas with tall dead trees. They are most common in spruce, lodgepole pine, and aspen habitat types. Populations are limited by the availability of snags in suitable configurations.	Discussed in the Mature and Early Conifer Forests section
Clark's Nutcracker	MNHP	Relatively common in suitable habitat	Clark's nutcrackers are conspicuous residents of higher elevation whitebark pine-dominated forests in summer and lower elevation ponderosa pine and limber pine forests in winter. They are highly dependent on the large seeds of these trees. Populations are limited primarily by the abundance and distribution of whitebark pine, which has decreased substantially with ongoing insect and disease infestation.	Discussed in the Whitebark Pine section
Rufous Hummingbird	MNHP	uncommon	Rufous hummingbirds are most common west of the Continental Divide in open habitats with an abundance of shrubs: burns, riparian shrub associations, open-grown forest, and timber harvest units. The proliferation of cutting units that provide shrubs but lack other key resources may be depressing populations. East of the Divide, populations are limited by fragmentation and overall scarcity of suitable habitat.	Not carried forward in additional analyses since the project would have no effect to the habitat.
Brown Creeper	MNHP	Uncommon overall, but usually well represented in suitable habitat	Brown creepers are small insectivorous birds than nest under the loose bark of large dead or dying trees. They are most common in mature and old-growth conifer stands with relatively dense canopy closure and a good supply of large trees and snags. The primary limiting factor for brown creepers is the decline in abundance of these dense older forest habitats.	Discussed in Snag and Woody Debris section, Habitat Fragmentation, Travel Corridors and Linkage Zones, Mature and Early Conifer Forests, and Old Growth sections
Veery	MNHP	Rare	Veerys are small birds strongly associated with riparian willow communities—particularly those with open forest overstory—and with cottonwoods. Their population distribution is limited by the fragmented dispersion of the riparian communities on which they depend.	Not carried forward in additional analyses since the project would have no effect to the habitat.

Species	List	Relative Abundance[2]	Habitat Preferences and Limiting Factors	Analysis Section
Green-tailed Towhee	MNHP	Uncommon	Towhees are most often observed on or near the ground in drier shrub communities—especially those with a rich diversity of shrubs. They are most common in sagebrush communities but also do well in some riparian shrub habitats. Primary limiting factors are those that threaten the health of shrub-dominated habitats, often livestock grazing in this case.	Not carried forward in additional analyses since the project would have no effect to the habitat.
Evening Grosbeak	MNHP	Relatively common in suitable habitat	Evening grosbeaks are often observed in small flocks in mixed conifer and spruce/fir forests; but they also make use of aspen, cottonwoods, and ponderosa pine. Their populations generally increase in years of insect irruptions—particularly, spruce budworm. Limiting factors include the unpredictable presence of preferred insect prey and the distribution of mature forest.	Discussed in the whitebark pine section
Cassin's Finch	USFWS MNHP	Relatively common	Cassin's finches are most often found in open-grown coniferous forest—typically, ponderosa pine; but they occur across a broad array of forest types, including post-fire stands and riparian habitats. Variable conifer seed production (particularly in ponderosa pine) may be a destabilizing factor for populations.	Discussed in the whitebark pine section

[1] Not all of the bird species of concern in BCR 10 occur in the Project area. Those not found in the project area or Divide Landscape(or that are only transient) include: Swainson's and ferruginous hawk, Williamson's sapsucker, peregrine falcon, bald eagles, upland sandpiper, long-billed curlew, yellow-billed cuckoo, black swift, Lewis's and white-headed woodpeckers, loggerhead shrike, sage thrasher, sage and McCown's longspur, and the black-rosy finch, among others.

[2] "Relative abundance" is derived from field observation in the Divide landscape.

Topics not Analyzed in Detail

This section summarizes the status of the following resource issues:

- Aspen
- Whitebark Pine
- Mature and Early Seral Conifer Forest
- Old-Growth
- Edges and Ecotones
- Grassland-Shrubland Habitats
- Livestock Grazing
- Noxious Weeds
- White-tailed Deer
- Moose
- Black Bear

- Mountain Lion
- Gray Wolf
- Boreal Toad
- Fisher
- Flammulated Owl
- Black-backed Woodpecker

Aspen

Aspen in the Northern Rockies

In the conifer dominated forests of the northern Rockies, broad-leaved, deciduous aspen stands represent a primary source of wildlife habitat diversity. In addition to the distinctive overstory, aspen stands provide soft cavity-prone tree trunks with chlorophyll-rich bark and a diverse array of robust understory vegetation (Thomas 1977). As well, they often lie at the interface of conifer forest and open grassland. This ecotone-like locale combined with their productivity and contrast to the dominant conifer regime make them magnets for a whole confederacy of wildlife species (Newlon 2005).

Small mammals, amphibians, and ground nesting birds take advantage of cover provided by the typically thick growth of grasses, forbs, and low shrubs. The ground vegetation is also a source of invertebrate prey for these species as well as forage for grazers ranging from meadow voles to snowshoe hares to elk. The rapidly-regenerating aspen shoots in the understory are a prized source of browse for deer, moose, elk, and hares (though often to the detriment of stand development). The soft trunks of aspen trees provide a ready substrate for cavity dependent species, such as red-naped sapsuckers, downy woodpeckers, and northern flickers (Thomas 1977). In summer, aspen, as an "edge" environment, often provides lush, shaded resting enclaves for elk calves and deer fawns next to open country where adults are able to forage.

Fire is a primary factor in perpetuating aspen. Aspen are able to regenerate from suckers in underground root systems following fire. With the other dominant vegetation temporarily eliminated by fire, young aspen shoots are able to grow quickly. For the first 10-15 years after a stand replacing fire, aspen may be the dominant tree species on many sites [personal observation, Elkhorn and Big Belt Mountains]. But before long, it is often overtaken by conifer species that have grown from seed—sometimes by shade-tolerant species such as Douglas-fir for which the aspen has been providing cover (Stam et al. 2008). Periodic fire will set back this conifer succession and maintain aspen on the site. But in the absence of fire, remaining aspen trees eventually lose vigor, fail to sucker and are eliminated from the community. Effective fire suppression beginning the 1930s has resulted in a notable decrease in the abundance of aspen stands in the northern Rockies compared to historical conditions (Arno 2000).

Another factor repressing aspen regeneration has been the recovery of elk, deer, and moose populations through the 20th century. The native ungulates seek out aspen as an "ice cream plant," browsing on any young trees within the vertical browse zone year after year, thus inhibiting the ability of the stands to develop as multi-storied forest environments (Hollenbeck and Ripple 2008). Domestic livestock also impact aspen stands by browsing and bedding down on young shoots, but in most cases they are less an impediment to aspen restoration than native browsers [personal observation, 1987–2013]. Cattle browse on young aspen shoots if the aspen stands are within their normal grazing sites, and this can exacerbate big game impacts [see Durham and Marlow 2010]. Mature aspen is susceptible to heart-rot, and the older overstory can deteriorate quickly. While the

underground root/sucker systems may linger for several decades, the regenerating shoots will come to naught if heavily browsed, and the above-ground space will inevitably come to be filled with young conifers.

Area Characterization

Historically, aspen stands were widely dispersed in the project area as evidenced by scattered remnants and historic range maps [see project file]. A majority of stands were associated with seeps, springs, and riparian areas, but a number occurred on drier upland sites, including grasslands, shrublands, and talus slopes. Stands had a diversity of structure and age classes, which limited decadence. Currently, most stands are declining due to conifer colonization and overbrowsing by native herbivores and, to a lesser extent, by cattle. Many former stands have disappeared beneath the canopies of lodgepole pine and Douglas-fir forest.

Viable, multi-aged aspen stands are present in lower Telegraph Creek, around Negro Mountain, in Hahn Creek, along the Little Blackfoot River, and in a few other locations. But much of the aspen resource is confined to small clones, besieged by encroaching conifers or impoverished by overbrowsing of the regenerating understory trees. Other *potential* stands are present underground beneath the canopies of conifer stands—many of which are now in the process of being released by the demise of the lodgepole pine overstory in the wake of the mountain pine beetle outbreak. This process is somewhat different than what follows stand replacing fire, so the results are difficult to predict. Fire not only removes competing conifers, allowing more light to reach regenerating aspen, but it also stimulates suckering by removing the apical dominance of mature aspen trees (Shepperd 2001). In those instances where a mature aspen canopy is in place, the loss of lodgepole pine may result in only minor improvement of aspen regeneration. Where an aspen overstory is no longer present, but the underground root system is still intact, regeneration is likely to be more vigorous.

The locations of potential aspen break-out sites have not been mapped but they are numerous and widespread. With the death of most of the lodgepole pine overstory, it is likely that young aspen will increase and, in some cases, proliferate on a number of sites throughout the Project area. These incipient stands will not reach maturity, however, if they are eventually overtaken by conifers as in recent decades or if they are overshelmed by ungulate browsing. The status of aspen in the Project area is discussed in more detail in the *Forested Habitats of Special Concern Background Report* [Project Record].

Whitebark Pine

General Status of Whitebark Pine Habitat

Whitebark pine is a high elevation 5-needle pine species that, while much less common than other mountain conifers, contributes to forest diversity and is an important habitat component for a number of wildlife species. Whitebark pine has been in decline since the turn of the 20th century (Keane 1995). Prior to the early 1900s, it was more abundant in subalpine forests largely as a result of natural fires, which removed less fire resistant trees (subalpine fir, lodgepole pine, Engelmann spruce) that are often able to outcompete the whitebark (Arno and Hoff 1989). Mature whitebark pine trees are relatively resistant to low intensity fire and young seedlings do best in open, sunny post-fire conditions (Weaver 2001). As a result of fire suppression during the 20th century, natural fire cycles in seral whitebark pine communities were disrupted, resulting in this species being replaced by competitors (Keane and Parsons 2010). The competing trees crowd in around the mature whitebark pines and suppress the ability of their seedlings to regenerate in the understory. The frequent low intensity fires that occurred under the natural fire regimes in whitebark communities prevented or slowed the replacement of the pine by the more shade tolerant species, thereby aiding

the regeneration and long-term maintenance of seral whitebark pine forests (Morgan and Bunting 1990).

Fire suppression has also led to an abundance of older forests, which, in turn, has resulted in greater frequency and extent of mountain pine beetle infestations. Whitebark pine, already under stress from competition with subalpine fir and lodgepole pine, is particularly susceptible to the beetle attacks. Since the early 20th century, the pines have also been at risk from white pine blister rust, native to Eurasia, which grows into the branches and stems, killing the branches, ending cone production, and ultimately killing the trees (Tomback et al. 2001, p. 3-21).

The effects of whitebark pine decline ripple throughout the ecosystem. Whitebark pine seeds represent a high energy food source of a sort not provided by the other conifers that dominate the subalpine forest. They are particularly important for grizzly bears and Clark's nutcrackers. The nutcrackers are key to widespread dispersal of the seeds, storing them in multiple caches across the forest, and leaving many of them to germinate to seedlings. Grizzly bears exert considerable effort in late summer and fall, ferreting out the caches, and in some areas, relying heavily on them as a pre-hibernation food source. The seeds are also consumed by a number of other seed-eating birds, rodents, and larger mammals—red crossbills, evening grosbeaks, mountain chickadees, Cassin's finches, red-breasted nuthatches, red squirrels, deer mice, yellow pine chipmunks, bushy-tailed woodrats, and black bears, among others (Tomback 2001, p. 89-104, Tomback and Kendall 2001, p. 243-262).

Local Whitebark Pine

In the Divide landscape, whitebark pine generally occupies sites above 6,000 feet in elevation. Five-needle pines found below this elevation usually turn out to be *limber pine*, a similar species that can be difficult to differentiate from whitebark pine in the field in the absence of cones. While whitebark pine may occur as a dominant tree type, field surveys indicate that it almost always shows up as a minor component in stands dominated by lodgepole pine, subalpine fir, and Engelmann spruce [see the *Forested Habitats of Special Concern Background Report* for a more detailed discussion]. Whitebark pine on the HNF has been under attack from white pine blister rust for many decades and over the last 8 to 9 years, it has also suffered from mountain pine beetle infestation. Recent field studies (2006) of whitebark pine mortality in stands in the southern Divide landscape showed mortality rates from blister rust of 5 to 25 percent and mortality from mountain pine beetle of 5 to 50 percent [*Forested Habitats of Special Concern Background Report*]. Beetle-generated mortality in trees larger than 4 to 5 inches dbh has increased since these surveys were completed 8 years ago.

Whitebark pine is a relatively minor component of forest stands in the Telegraph Project area and combination boundary. As noted in the *Forested Habitats of Special Concern Background Report*, this part of the Divide landscape does not contain the elevations and types of sites where whitebark pine would be dominant. As a result, it is found almost entirely as a minor component—scattered seedlings, saplings, and mature trees—in stands dominated by other species, particularly lodgepole pine. Field surveys have found that most whitebark pine in the Project area are concentrated around Treasure Mountain, Bison Mountain, and on the Continental Divide between upper Ontario and Tenmile Creeks. This latter whitebark area extends eastward, in a sporadic pattern across the head of the Tenmile drainage in the southeast corner of the combination boundary. With the exception of a few small local sites, none of these areas has supported whitebark pine as a dominant species.

Over the last few years, with a majority of the larger trees succumbing to the mountain pine beetles, most remaining whitebark pine now occurs as understory seedlings and saplings. At the same time, however, most of the lodgepole pine overstory has also been killed by the beetles, providing an

opportunity for the young whitebark pine to attain more rapid growth in the new "open" environment and temporarily free from most competiton from other conifers.

Because whitebark pine has not been a prominent feature of subalpine forests in the project area, wildlife species that would normally depend on the pine either maintain lower populations than they would in whitebark pine dominated areas or they have adpated to using other seed and food sources. Clark's nutrackers are often observed in the project area, and while they undoubtedly focus on the whitebark pine seed source wherever it occurs, they have been obliged to diversify their diet. The same is true of red squirrels and other seed-eaters. Likewise, grizzly bears that can be highly dependent on whitebark pine seeds cached by the nutcrackers, have adapted to foraging in habitats other than whitebark pine stands in the Project area [as has been shown to be the case in declining whitebark pine systems in the Greater Yellowstone Ecosystem]. The status of whitebark pine in the project area is discussed in more detail in the *Forested Habitats of Special Concern Background Report* [Project Record].

Mature and Early Conifer Forests

Mature Conifer Forest

Conifer forests in various stages of succession dominate most of the Divide landscape: they account for about 77 percent of the Telegraph combination boundary and 93 percent of the Telegraph Project area [data are from the Telegraph *Vegetation Introduction* and the *Forested Vegetation Background Report*]. Historically—prior to to settlement from the eastern U.S. and fire suppression in the 20th century—these forests experienced fire as a normal landscape process (Arno 1980). In dry forest types (ponderosa pine, dry Douglas-fir), most fires would have been low-severity underburns. In moist forest types, such as those that cover most of the Telegraph project area (lodgepole pine, subalpine fir, moist Douglas-fir), they would have been, most often, stand replacing events. Recent estimates are that the 202,460-acre Divide landscape averaged 39,000 to 170,240 acres burned each decade (Hollingsworth 2004). This produced a much more diverse mosaic of forest structure across the landscape than has been in place since the early 20th century. [See also the discussion in the previous section on "*Habitat Fragmentation"*].

Prior to the mountain pine beetle epidemic, which began in 2005, lodgepole pine dominated roughly 56 percent of Project area forests, Douglas-fir 35 percent, subalpine fir 1 percent, and other species less than 1 percent. These forests were a mix of successional stages, but 71 percent of them were in "mature" forest formations (with overstory trees greater than 10 inches dbh). These forests, for several decades, had been relatively "healthy" and supported a typical assemblage of interior forest wildlife species, but only a modest array of cavity dependent species (given the relative scarcity of dead trees). Because of the paucity of ground vegetation and understory layering in the lodgepole pine dominated forests, ***wildlife diversity*** has been low. But conditions have been favorable for species such as brown creepers, white-breasted nuthatches, red-backed voles, red squirrels, and northern goshawks. The forests also provided hiding and summer thermal cover for elk, deer, bears, and other species.

The condition of these forests is now in rapid transition. Mature forest formations have declined from more than 70 percent of the Project area to just over 40 percent. Most of the remaining mature forest overstory is provided by Douglas-fir, which has been unaffected by the pine beetles. Some of the Douglas-fir is in relatively pure stands, some in stands mixed with now-dead lodgepole pine. The stands dominated by Douglas-fir are now the primary refuge for species needing mature interior forest as a habitat base. Field surveys indicate that this is where goshawks—some of which may have previously nested in lodgepole pine forest—are now staking out all of their nest sites. As well, red squirrels that had previously inhabited the lodgepole pine forests are now shifting to the Douglas-fir

as the lodgepole canopy cover and seed supply fade away. Other interior forest species are following suit wherever the transition is possible.

In the future, given the dramatic erosion of mature lodgepole pine forest in the project area, wildlife associations dependent on these forests could also decline. Most species will be able to adapt to the new Douglas-fir dominated mature forests, but population abundances will inevitably decline because of the loss of suitable habitat. On the other hand, generalist species and those favored by open-grown forest, uncanopied habitats, and extensive accumulations of coarse woody debris could increase (e.g., olive-sided flycatchers). See the *Forested Vegetation Background Report* for more information.

Early-Seral Conifer Forest

Unlike the other three landscapes on the HNF (the Big Belts, Elkhorns, and Blackfoot), the Divide landscape has not experienced any major stand replacing fires in the last century. Fires in the Beartrap Gulch and Sweeney Creek areas in mid 20th century burned several hundred acres in the northern half of the landscape—areas now occupied by grasses, forbs, shrubs, and scattered conifers. In the northern end of the combination boundary, the MacDonald Pass fire in 2009 burned 170 acres of mature forest that is now in the very early stages of forest succession. Aside from these burns and a few areas impacted by winter-kill in the early 1990s, most early seral forest habitats of any note have been produced by timber harvest. Between 1960 and 2014, approximately 16 percent of the Telegraph Project area was logged by regeneration harvest methods, creating 3,779 acres of new openings. Almost 95 percent of the cutting units are less than 40 acres in size and 50 percent of them are less than 15 acres. Because all but about 50 acres were harvested prior to the mid-1990s, regenerating conifers in most sites have now progressed to sapling size trees (1 to 5 inches dbh). These sapling dominated units, while often clustered in certain drainages, are fairly well distributed across the project area, resulting in a landscape dominated by mature forest but punctuated by early-seral forest openings. [See also the earlier section on "*Habitat Fragmentation.*"]

Conifer species that dominate the early seral habitats vary from one unit to the next, and some of the sites have diverse mixtures of tree species. Lodgepole pine is predominant in a majority of the units, but some are occupied mostly by Douglas-fir or Engelmann spruce. Subalpine fir often occurs as a component in these stands but seldom dominates the species mix. Whitebark pine is rare; aspen a bit less so. The tree species compositon of early successional stands is of importance to some of the tree-nesting birds and small mammal species; but most often, wildlife use of the stands is less dependent on the tree species present and more dependent on the nature of the ground vegetation, abundance of edge, presence of water, the topography, and the density and size of the young conifers.

Sapling densities in most of the old cutting units are sufficient to provide good hiding cover for big game species. But, tree density within the stands is variable and most of them are peppered with small openings that serve as foraging areas for elk and deer within the cover matrix. Some of the sapling thickets are dense enough to serve as winter habitat for snowshoe hares, thus providing winter foraging opportunities for lynx. Many other species take advantage of the combination of abundant ground vegetation and widespread cover offered by the young conifer stands.

Because most of the trees in early seral stands are too small to have been attacked by mountain pine beetles, these sites are a key part of the remaining green forest in the project area. In addition to their dominance of old harvest units, conifer seedlings and saplings are now the dominant green tree formation in some of the lodgepole stands decimated by the beetle epidemic—although their density is usually much thinner and their distribution more erratic than in the old clearcuts. Within the next 5 to 10 years these young trees will be emerging through a tumble of woody debris as the beetle-killed

snags fall. Eventually, even stands that currently support little or no understory regeneration will see it develop once the overstory trees are down and seeds take hold. Habitat configuration of these regenerating beetle-killed stands will be different than what is present in the regenerating harvest units, which have mostly uncluttered understories. Each of these formations has advantages for different species of wildlife—the unharvested sites with more structural diversity, the harvested sites with more robust understory vegetation and more favorable growing conditions. And, as a result, wildlife associations, while similar overall, will be somewhat different between the two. See the *Forested Vegetation Background Report* for more information.

Old-Growth Conifer Forest

General Considerations

Old-growth forests are defined by the predominance of large, old-aged trees [see the *Forested Habitats of Special Concern Background Report* for more detail on old-growth]. The structure of old-growth stands is variable, but in general, they are unique for their diversity and for the variety of niches that they offer. Old-growth is not a static end-point condition: old-growth stands are constantly evolving under the influence of insects, disease, fire, weather conditons, and inexorable aging processes. Particularly at higher elevations, old-growth stands are often eliminated by crown fire. While no local wildlife species are absolutely dependent on old-growth for their survival, a number of them find optimal conditions in these old forest environments. This includes the two *Helena Forest Plan* management indicator species for old-growth—the pileated woodpecker and northern goshawk.

In the Divide landscape, some old-growth occurs at lower elevation in warm/dry forest types (ponderosa pine and dry Douglas-fir). Historically, these old-growth stands were dominated by large, open-grown, fire-resistant trees with relatively “clean” grass/forb/shrub understories—a configuration maintained by frequent low intensity fires. With the advent of fire suppression in the 20th century, most of these stands became cluttered with dense understory trees and are now unlikely to survive fires of any magnitude. This old-growth configuration is rare in the Telegraph Project Area.

At higher elevation, most old-growth occurs in moist forest types or on sites that retain snow for a longer period through the spring (moist Douglas-fir, Engelmann spruce, subalpine fir, lodgepole pine). Old-growth stands most often show multi-layered canopies, abundant woody debris, and varying age classes of snags. They support varied understory vegetation and maintain light and climatic variables that offer a diversity of wildlife niches (Franklin et al. 1981). Because stand-replacing fire is the norm here, this type of old growth usually occurs in blocks or patches of limited size—sites that have escaped catastrophic fire. These sites often occur in drainage bottoms and on north and east slopes and are typically dominated by subalpine fir and Engelmann spruce. Lodgepole pine stands may survive to old-growth status wherever conditons allow escape from stand-replacing fire for 150 years or more (Green et al. 1992, p.36). This is sometimes a fortuitous circumstance but it often occurs in rolling, high elevation terrain with poor drainge where snow remains through the spring. In spite of patchy distribution, old-growth stands, are usually surrounded by younger closed-canopied conifer stands, which thus creates a wider interior forest condition. These are the kinds of stands found in the Telegraph project area.

The structural and vegetative diversity in these old-growth environments is notably greater than in most mature or pole-sized forest stands—particularly middle-aged lodgepole pine forests, which tend to be mostly single-storied with few snags and logs and with scant understory vegetation (or ground vegetation not particularly palatable as forage). As a result, old-growth forest tends to support a more complex wildlife community than the surrounding forest stands.

Project Area Old-Growth

Old-growth in the Telegraph project area has been identified by a combination of habitat modeling and field survey work that has specifically targeted old-growth habitat. The methodology used to define and identify these stands is discussed in detail in the *Forested Habitats of Special Concern Background Report.* The overarching conclusion is that fully-developed old-growth is uncommon in the project area. This is a result of much of the area having been burned or logged in the latter 19th and early 20th centuries, leaving too little time for old-growth to have redeveloped. More recently, lodgepole pine old-growth has been obliterated over most of the area by the mountain pine beetle epidemic. Only stands in which most of the lodgepole canopy had been replaced by climax subalpine fir, Engelmann spruce, or Douglas-fir remain as old-growth environments.

Altogether, only 222 acres have been identified as viable, established old-growth. These and a number of mature stands that are approaching, but have not yet attained old-growth status, provide a complexity of microsites that support numerous wildlife species, including those dependent on dead-tree cavities, coarse woody debris, shaded mesic environments, mutiple canopy layers, and diverse ground flora. Resident species include pileated woodpeckers, brown creepers, hermit thrushes, northern goshawks, western tanagers, white-breasted nuthatches, hairy woodpeckers, Stellar's jays, spruce grouse, red-backed voles, marten, red squirrels, golden-mantled ground squirrels, red-tailed chipmunks, and northern flying squirrels, among others. Native ungulates and black bears use these areas in summer for thermal cover to reduce heat stress. In winter these areas are important foraging and denning habitat for marten and also provide opportunities for snowshoe hares, wolverine, fisher, and lynx.

The *Helena Forest Plan* (*HFP*, p. II/20-21) directs that old-growth be assessed within 3rd order drainages, three of which are associated with the Project area: Mike Renig Gulch (#1106B), Telegraph Creek (#1107), and Ontario Creek (#1108-1). These three drainages account for 96 percent of the Project area. The remaining 4 percent occurs within a 2nd order drainage (the Little Blackfoot River) not tallied for purposes of *Forest Plan* compliance. A minimum of 5 percent of each drainage is designated to be managed as old-growth. Since existing old-growth (222 acres) adds up to an average of less than 1 percent of the Project area, the other 4 percent has to come from stands that will be managed for future old-growth. In the case of Douglas-fir and Engelmann spruce/subalpine fir, some of this potential old-growth consists of stands that should achieve old-growth age and structure in a relatively short time. In the case of lodgepole pine, where virtually all mature and old-growth stands have been eliminated by bark beetles, only young stands more than 80 to 100 years from old-growth classification are available for designation.

Table 204. Acres[1] of forest habitat to be managed for *Forest Plan* old-growth in the Telegraph Project area

Forest Type	Mike Renig Gulch	Ontario Creek	Telegraph Creek	Total Acres
Lodgepole Pine	-	174	158	332
Spruce/ Subalpine Fir	124	140	234	498
Douglas-fir	35	52	192	279
No designated type	-	-	48	48
Total Acres	159	366	632	1,157

[1] Acres include both existing old-growth and younger stands designated as future old-growth]

For each individual third order drainage, the habitat to be managed as old-growth forest totals slightly more than 5 percent (the total for the combination boundary is 5.1 percent). This is "*Forest Plan* old-growth." The portion of the project area that does not qualify as third order drainage (1,020 acres along the Little Blackfoot River) contains an additonal 50 acres of old-growth. When this is added into the mix for the entire Project area the old-growth contribution remains at 5.1 percent. See the *Forested Habitats of Special Concern Background* Report for more information.

Edges and Ecotones

An *edge* is an interface where forested country and open-country habitats meet. An *ecotone* is the zone on either side of the edge that is influenced by the transiton between contrasting vegetation types (Thomas 1979, p. 48). In some cases, edges are abrupt and the zone of influence—the ecotone—is very narrow, as where a clearcut meets dense interior forest. In other cases, ecotones consist of broad bands of habitat that are structural and vegetative hybrids of the two habitats on either side, as where relatively open-grown, younger forest forms a gradual transition from mature forest to open grassland. These zones often develop where forest is gradually colonizing the grassland.

Edges and ecotones are abundant and widespread throughout the Telegraph Project area. Some are *Induced* edges (human-created edges) such as those between mature forest and sapling-dominated clearcuts or between forested habitat and the margins of road corridors. Others are *inherent* edges (natural edges) such as at the meeting of forest and grassland, aquatic and shoreline habitats, riparian zones and uplands, talus and forest. Still others represent hybrid situations as where ecotones created by conifers moving out into meadows are cut back to preserve the open habitat, or trees in a riparian transition zone are thinned. Recently, edges and ecotone habitats have expanded dramatically with the mountain pine beetle epidemic. Slopes that were once covered with unbroken mature forest are now broken up into a patchwork of dead, open-canopied lodgepole pine and denser, green non-pine stands. In stands where lodgepole and other conifer species are mixed, broad ecotone-like forest formations have developed, eventually blending into totally dead lodgepole in some areas and green interior forest in others.

Edges and ecotones often support a more diverse assemblage of wildlife species than either of the adjacent habitats alone. Field surveys throughout the Divide landscape (1992 to 2013) reveal that species typically found along edges and in ecotones include chipping sparrows, dark-eyed juncos, northern flickers, brown-headed cowbirds, Townsend's solitaires, red-eyed vireos, pygmy nuthatches, robins, calliope hummingbirds, Hammond's flycatchers, blue grouse, yellow pine chipmunks, cottontails, and snowshoe hares, among others. Edges and ecotones provide a pairing of cover and forage for species wary of human activity or of predators. Elk, deer, moose, black bears, bobcats, and mountain lions, among other species, often frequent edges.

Some kinds of forest edges also provide ideal habitat for nest parasites (brown-headed cowbirds) and predators that are able to reduce local populations of susceptible grassland and forest songbirds to a greater extent than within the core areas of either adjacent habitats (Reese and Rati 1988, p. 128, 131). Wildlife species adapted to edges are widespread and common in the Telegraph project area and are becoming more so as edge and ecotone habitat proliferates in the aftermath of the mountain pine beetle outbreak.

Because edges add to both between-habitat structural diversity on the landscape and species diversity in the wildlife community, they are sometimes incorporated into an index used to gauge the overall diversity of a given landscape [see Thomas 1979, p. 53-58; Walker and Craighead 1997].

The treatment units in either action alternative would at first produce a considerable amount of new induced edge (Thomas 1979, p. 51), contrasting the open clearcut and partial cut units with adjacent stands, most of which would be dominated by standing dead trees. Over the next decade, as the dead trees topple, the edge condition would revert to one of “clean” ground cover in the cutting units vs. accumulated large woody debris in the untreated stands. Eventually, conifers would regenerate in both treated and untreated areas, but the stands of young lodgepole pine emerging through the woody debris would generally be thicker than those in the treatment units (which would be maintained at lower density through thinning). This future “edge” between thicker and thinner stands would not be particularly striking. As a general rule, wildlife density and diversity tend to be higher along forest edges than in the center of either adjoining habitat (Thomas 1979, p. 48-59), but in this case the adjoining habitats are unlikely to be different enough to generate a measurable edge effect.

Based on wildlife field observations throughout the Divide landscape over the past 20 years and the results of scientific research dealing with forest edges and ecotones, local wildlife species diversity and population density (particularly of birds) are expected to increase in the vicinity of treatment unit edges during the first several years after project completion. It is anticipated that the diversity would decline from this level once most of the dead trees on the untreated side of the edge have fallen, thus diminishing the structural contrast between the two habitats. There should be no meaningful negative impacts on any species of special concern that might be attributed to the presence of the edge.

Grassland and Shrub Habitats

Mountain grasslands (with and without shrubs) are widely distributed across the project area and the combination boundary, but they are highly fragmented. They account for 12 percent (14,019 acres) of the combination boundary, with most of the large contiguous grassland habitat concentrated in the northwestern one-third of the area [see the map in the *Vegetation Introduction Report*]. In the project area, mountain grasslands (as opposed to wetland and riparian grass/sedge/forb/shrub habitats) cover only 1,537 acres (6 percent of the area). These habitats occur at all elevations and on a variety of slopes and aspects. Most often, the grasslands are dominated by rough fescue, Idaho fescue, bluebunch wheatgrass, oatgrass, junegrass, sedges, and tufted hairgrass intermingled with a variety of forbs and low shrubs. Larger shrubs (big sagebrush, bitterbrush, chokecherry, shrubby cinquefoil) sometimes occur within the grasslands—in patches of various sizes or as scattered individuals—but they seldom dominate these grassland breaks in the forest continuum.

The grasslands, in spite of their relatively small contribution to the overall acreage of the project area and their fragmented dispersion, add an important element of diversity to the forest-dominated landscape. They are a primary source of inherent edge/ecotone habitat and they provide the primary grazing resource for elk and a number of other native grazers, large and small. Mountain grasslands serve as the base habitat for a number small mammals and birds—montane voles, pocket gophers, ground squirrels, badgers, long-tailed weasels, vesper sparrows, lark sparrows, mountain blue birds, kestrels, harriers, rough-winged swallows, nighthawks, chipping sparrows, horned larks, and white-crowned sparrows, among others. Other species, such as chipping sparrows, juncos, robins, flickers, blue grouse, and snowshoe hares are common along the edges. A number of predators, while wide-ranging, focus the bulk of their hunting in the mountain grasslands—coyotes, red foxes, wolves, red-tailed hawks, Coopers hawks, sharp-shinned hawks, golden eagles, great gray owls.

While some of the montane grasslands in the project area are mesic environments (moderately well watered), most are relatively dry. Nonetheless, they serve as productive foraging areas for native grazers in spring, summer, and fall. Elk usually begin moving through grasslands in the northern part of the project area in late April or early May, feeding on cured grasses from the previous year and zeroing in on areas of early green-up as they develop. They continue to focus most of their foraging in the grasslands through early summer, gradually shifting to wetland and riparian environments as

the summer progresses. In fall, when much of the wetland vegetation succumbs to frost, the elk return to the drier grasslands, feeding on cured grasses and new fall green-up.

Beginning in the 19th century and continuing through much of the 20th century, the biggest threat to the integrity of mountain grasslands was overgrazing by domestic livestock (cattle, sheep, and horses). National Forest allotment management plans progressively reduced livestock numbers and employed rotation grazing systems in the latter decades of the 20th century to allow grassland recovery. With the exception of some sites where cattle still concentrate to the detriment of habitat (mostly in wetland and riparian areas), livestock grazing in most of the Divide landscape is now reduced to a point where forage available for native grazers is more than adequate and grassland vegetation is in reasonably good health (in terms of species compositon, diversity, and productivity). Livestock have relatively little influence on project area grasslands since only 14 percent of the area falls within active grazing allotments [see the following section on *"Livestock Grazing"* and the *Range Background Report* for more information].

Primary problems with montane grassland habitats today involve (1) the spread of noxious weeds and (2) colonization of grasslands by conifers from adjacent forest habitats.

Livestock Grazing

Livestock grazing in the Telegraph Project area is discussed in some detail in the *Range Background Report* [Project Record]. Only about 14 percent of the Project area falls within active grazing allotments. The western fringe of the project area extends slightly into the Hat Creek and Slate Lake allotments on the west side of the Little Blackfoot River. Livestock grazing in these allotments has no meaningful influence on wildlife habitat in the Project area. The Minnehaha pasture of the Tenmile allotment, however, occupies 1,730 acres in the eastern half of the upper Mike Renig Gulch drainage in the northeast corner of the Project area.

Most of the upper Mike Renig drainage within the allotment is continuously forested. The understories of mature forest stands are generally depauperate and provide little in the way of livestock forage, although cattle regularly trail through some of them. A majority of these forest stands are now dominated by beetle-killed lodgepole pine trees, some of which are beginning to fall. While this process is opening up the understory and allowing more ground vegetation to develop, it is also beginning to block cattle trails and is complicating access for livestock.

Numerous regenerating clearcuts on the east side of the drainage, though dominated by sapling conifers, remain open enough to support robust ground cover of grasses and forbs. Cattle use of these sites is limited by the absence of preferred forage—the ground cover being dominated by pinegrass. Most livestock use focuses on areas with more palatable forage: wet sites along Mike Renig Gulch and its tributaries, open grasslands in the far northeastern corner of the area, and old roads now vegetated with Kentucky bluegrass, Timothy, orchard grass, Dutch clover, dandelions, and other palatable introduced species.

These are sites that also draw in native grazers. Deer and elk forage through these sites in spring and early summer, moving off to more remote locations when cattle come into the country and returning in the fall when the cattle have left. The falling beetle-killed trees that are making access to forest stands difficult for cattle are less likely to deter native species, which are usually more adept at finding ways into suitable habitat by one route or another. See the *Range Background Report* for more information.

Noxious Weeds

Noxious (or *invasive*) weeds are plants that have been imported into Montana from other areas (most often, Eurasia) over the last 200 years—and as a result, local ecosystems have not had the time to develop natural biological controls for them. Wherever suitable habitat conditions are available, noxious weeds are usually able to outcompete and displace many of the native plants that have evolved within a system that allows a variety of species to coexist (see Montana Noxious Weeds at montana.plant-life.org/page_weeds.htm). Many of these invasive weed species, if allowed to increase unchecked, are capable of developing veritable monocultures. Noxious weeds in the Divide landscape are associated primarily with unforested and open-forested sites or with breaks within the forest. Areas most at risk are those disturbed by humans (roadsides, motorized trails, harvest units, mining operations, camp sites), overgrazed grassland/shrubland, burned areas, and riparian areas.

The HNF has documented the presence of nine State of Montana noxious weed species in the combination boundary, seven of which also occur in the project area. The two most common are Canada thistle (1,557 acres) and spotted knapweed (1,429 acres). Also relatively widespread in the Project area are gypsyflower (917 acres), yellow toadflax (807 acres), and oxeye daisy (719 acres). Orange hawkweed and Dalmatian toadflax are also present, but much less common [data are from the *Noxious Weeds Background Report*]. All of these species are currently being treated via the ongoing Forest Weed Management Program, which is using both on-ground herbicide spraying and and release of insects that prey upon specific weed species.

From a wildlife standpoint, invasive weeds are a problem in that they outcompete native forage plants, replacing them with unpalatable (and sometimes poisonous) species; they lower plant species diversity; and they create a new microclimate in which many small mammals and birds are less fit or in which they are unable to survive at all. Studies have shown that where Eurasian weeds supplant much of the native plant community, significant changes in bird species composition and abundance result (Scheiman *et al*. 2003; Wilson and Belcher 1989). While these impacts are most striking in plains ecosystems, they can also occur in mountain grasslands such as those in the Telegraph project area. In Montana, invasive weeds have been a particular problem on big game winter ranges. A number of studies have documented a decline in the amount of forage available to elk where invasive species such as spotted knapweed have moved into native bunchgrass communities—in some cases, forcing elk and deer to abandon such ranges entirely (Bedunah 1992).

While there is little in the way of winter range in the Telegraph project area, some upland parks, riparian areas, old clearcuts, and roadsides where native grazers forage in summer have been hit by noxious weeds. To this point, the impact has not been severe enough to measurably alter the way that elk, deer, and other species use traditional habitat; and given the aggressive weed control program adopted by the HNF in recent years, it is most likely that the potential for such impacts will decline rather than increase in the future. See the *Noxious Weed Background Report* for more information.

Big Game Species

White-tailed Deer

The white-tailed deer (*Odocoileus virginianus*) is the most widely distributed and abundant big game animal in North America. Whitetails are highly adaptable and make use of a variety of habitats, depending on what is available locally. In northwestern Montana they are closely associated with subclimax coniferous forest (Mundinger 1984); in the eastern and central parts of the state, they are dependent upon riparian forest (Foresman 2012, p. 390). On the HNF and in surrounding areas, they tend to concentrate in the valleys, river bottoms, agricultural fields, and in towns and subdivisions, leaving much of the upland habitat in the foothills and mountains to the mule deer. As a result, white-tailed deer are much less common in the Telegraph Project area than mule deer. They are most

often seen in the major stream bottoms in the northern part of the Project area (the Little Blackfoot, Telegraph Creek).

Like mule deer, whitetails are broadly adapted to forest edge habitats, but because they focus on more succulent, higher quality foods, they tend to seek out moist habitats to a greater degree than mule deer (Mackie et al. 1998, p. 32-34). White-tailed deer deal well with a variety of habitat disturbances (fire, forest insect outbreaks, timber harvest, agricultural clearing)—a function of their preference for foraging in second-growth forest, shrubfields, edge, and cultivated crops. Whitetails spend much of the day in forest cover and move out into open habitats at dawn and dusk, sometimes foraging into the night (Foresman 2012, p. 390-391). Among other things, this behavior pattern allows them to minimize contact with humans. White-tailed deer make more use of forest cover than mule deer in all seasons. Populations are highest when forested riparian areas are available, and in winter they retreat to forested thermal cover considerably more often than mule deer.

As with mule deer, white-tailed deer populations have recently declined across much of the state—although not entirely for the same reasons. Primary problems for white-tailed deer populations have been deep-snow winters in 2010–2011 and recent outbreaks of epizootic hemorrhagic disease (for which there is no effective treatment or control) (Halls 1978, p. 54). While the Fish and Game Commission has eliminated B-licenses for white-tailed deer in some parts of the state, the restrictions have not been as all-encompassing as with mule deer. In the two hunting districts connected to the Telegraph Project area—HD 215 and HD 335—the number and types of licenses for white-tailed deer have remained essentially unchanged [see Montana 2014 Hunting Regulations: http://fwp.mt.gov/hunting/regulations]. Whitetail populations are capable of recovering from shortfalls very rapidly, particularly in response to an increase in foraging habitat as occurs with timber harvest or fire or with an increase in food availability after a mild winter (Foresman 2012, p. 390).

Despite the differences between the two species, they are similar enough that habitat management strategies on the HNF and population management (hunting regulation) by MFWP are similar for both mule deer and white-tailed deer. Much of the previous discussion of “Mule Deer” is thus valid for whitetails as well.

Moose

The Shiras moose (*Alces alces shirasi*) is widely, but erratically distributed across the Rocky Mountains of southern Canada and the northern United States. During the 20th century, Shiras moose dispersed southward into areas where they had not been observed by explorers and settlers in the 1800s (Kay 1997); but lately, populations have been declining in several parts of the West. In Montana, moose are becoming less common in some areas (the Big Hole), more so in others (the Centennial Valley and lower Missouri River) (Foresman 2012, p. 374-375). Hypotheses as to why some populations are shrinking include climate change-driven increases in parasites, decline in the quality of foraging habitat, and rising predator populations. Hunting pressure on moose has fallen significantly since 2006, and is not seen as a driving factor.

Moose are generally solitary animals and their numbers in and around the HNF are inherently low compared to those of elk and deer (MFWP observation records; personal observation). With the exception of cow/calf pairs, moose social groupings are temporary and usually an artifact of animals migrating into the same preferred habitat sites and tolerating one another. Most key habitat is defined by the availability of forage: palatable deciduous shrubs, tall forbs, and, periodically, aquatic vegetation.

In the Telegraph project area (and across the Divide landscape as a whole) this habitat is naturally fragmented because of its association with wetlands, riparian areas, drainage-head basins, productive

north- and east-slope forest, and other habitat features with disjunct distribution on the landscape. In spring, summer, and fall, moose frequently move from one site to another, spending a few days at a given locale before moving on (Costain 1989, p. 138-143; Costain and Matchett 1992, p. 27-31). On a landscape scale, moose prefer a mosaic of densely-forested, open-forested, and unforested habitats. This provides the balance of forage, thermal relief, and calving sites they require (Costain 1989; Costain and Matchett 1992). Moose do not do well in continuously forested country.

While moose may spend part of the winter in stands of mature timber at mid elevation, most winter range is concentrated in lower elevation riparian areas where browse is plentiful and snow depths are more moderate (Costain 1989, p. 89-90, 34-36). So, with the exception of riparian bottoms along the Little Blackfoot River and lower Telegraph and Ontario Creeks, the Telegraph project area holds little moose winter range.

Since 2007, only five moose licenses have been issued each year for the area covered by hunting districts in the vicinity of the Telegraph project area (HDs 215 and 335, which extend from Highway 12 in the north to Butte in the south). Nonetheless, because many moose choose to feed and rest in key habitat sites near roads, putting up with nearby human activity, they are susceptible to poaching or accidental shooting. As a result, human-induced mortality inevitably exceeds the hunting quotas set by MFWP (Matchett 1985, p. 132; G. Joslin, comments in MFWP 2007 Elk Survey, HD 335; personal observation).

The Helena Forest Plan addresses the needs of moose by specifying that moose habitat “will be managed to provide adequate browse species diversity and quantity to support current moose populations” (HFP, p. II/19). Moose are also covered, to an extent, by Forest Plan management guidelines for elk that limit road density, maintain certain levels of forest cover, and protect key habitat components—particularly riparian areas and other productive wet habitats.

To the extent that the more open habitat created by the action alternatives promote growth of deciduous shrubs and tall forbs, the project is likely to improve local foraging conditions for moose. Removal of dead trees and most woody debris in treatment units would reduce local hiding cover (useful during the hunting season and for concealment of young calves in spring) but would have little effect on summer use since the thermal value of the overstory (the key summer component) has already been removed by the mountain pine beetles. Given the small number of hunting licenses issued for moose in the local hunting district (3 permits for antlered bulls in HD 335 in 2013), hunting pressure is low.

Black Bear

The black bear (Ursus americanus) occurs in all forested regions of Montana and is more dependent on interior forest environments than are elk, deer, moose, or grizzly bears (Foresman 2012, p. 340-343). While black bears forage in forest habitats to a certain extent, they more often make use of them as sites for day beds, escape cover, screened travel routes, shade, and secure den sites (Jonkel 1978, p. 236-238). Like grizzlies, black bears are opportunistic omnivores, constantly on the move, switching from one food to another as availability dictates. They eat whatever animal matter they can kill or scavenge (rodents, elk calves, insects, carrion) but they rely most heavily on vegetation (green plant matter, roots, seeds, berries). The fact that they possess a short carnivore digestive tract means that they need to consume tremendous amounts of plant material to compensate for digestive inefficiency (Foresman 2012, p. 341). Because the foods they consume occur in a variety of habitat formations (forest, meadows, edges, riparian areas), black bears are particularly drawn to mixed forest environments with a variety of tree sizes, shrub species, small productive openings, and wet sites (Kolenosky and Strathearn 1987). While they tend to avoid new clearcuts and burns (except

when on the move), they frequently forage in those areas once new vegetation and a modicum of cover develop (Jonkel and Cowan 1971, p. 20-21).

Black bears range through most parts of the project area on a regular basis from April into November, foraging in the more productive sites and making use of forest cover for day-beds, thermal relief, and general concealment. Bears usually begin denning/hibernating sometime in November, depending on the availability of autumn foods (Linnell et al. 2000). They can den in a variety of habitats but most often choose forest or dense shrub formations, taking advantage of large tree roots, logs, boulders, and caves. Bears are not true hibernators and they can be roused from winter lethargy by human activity such as winter recreation, hunting, and logging operations. As a result, they typically select hibernating sites that are secluded from predictable human activity (Linnell et al. 2000).

MFWP does not conduct population censuses for black bears, but HNF wildlife surveys over the last several years have regularly encountered bear sign (scat, tracks, diggings, rub trees), as well as the bears themselves on occasion, suggesting that black bears are well represented throughout the project area. A 7-year study involving nearly 200 bears in northwest Montana (Jonkel and Cowan 1971) found that while reproductive rates were relatively low (less than 2 cubs per adult female every 2 years), mortality rates were also low, resulting in a fairly dense, stable population. Hunting mortality was also very low. While habitat in the Telegraph project area is less productive than in northwest Montana—and population density is thus probably lower—the same balance of productivity and mortality factors is likely to be in play here as well, resulting in a stable population.

The action alternatives present a mixed bag for black bears. If the surrounding forest were dominated by live trees, the bears would typically exploit the enhanced forage supply in the treatment units near the forest edge; but with the forest now dominated by dead trees, their use patterns may be different. Within another 5 to 10 years the “forest edge” would be reduced to a juxtaposition of open grass/forb or open forest habitat in the treatment units and accumulated woody debris in the surrounding “forest”—and the contrast between habitats created by the action alternatives and untreated areas would be considerably less meaningful (until new forest regenerated). The degree to which black bears would use any of this habitat under these circumstances is uncertain. The project would generate local shifts in habitat use by black bears but it would not measurably affect population size or structure. Loss of forest cover would be partially offset by gains in foraging opportunity and mitigated by the abundance of cover in surrounding untreated forest.

Mountain Lion

The mountain lion (*Puma concolor*) is the largest felid (cat) in North America. While mountain lions are highly adaptable animals, capable of exploiting a broad spectrum of environmental conditions (Russell 1978), they tend to frequent forested habitats where they can move in on prey undetected and avoid humans (Foresman 2012, p. 282). Widespread distribution of tracks, scat, and other sign observed during wildlife field surveys indicates that lions are present throughout the Telegraph project area. However, because of their low numbers, secretive and often nocturnal lifestyle, frequent use of hiding cover, and aversion to most human activity, they are seldom observed. Mountain lions range over large areas. A recent study in the Garnet Range, roughly 20 miles northwest of the Telegraph project area, found average home ranges of 106 mi^2 for females and 265 square miles for males (Robinson and Desimone 2011, p. 22-24). There is considerable variation in home range size from one area to another, however, with smaller ranges reported in areas where prey is more plentiful (Lindzey 2003). Because lions are territorial and home range overlap is relatively small [33 percent for female ranges, 22 percent for male ranges in the Garnet study], population density remains low (Foresman 2012, p. 283-284).

Primary prey (mule deer and, to a lesser extent, white-tailed deer and elk) are relatively common throughout the project area, as are a number of small and mid-sized mammals that can serve as alternate prey in summer and fall (squirrels, hares, porcupines, foxes, mice, etc.). Stalking cover (shrubs, regenerating conifers, tree trunks, large deadfall, boulders), which helps the lions approach prey unseen, is widespread but erratically dispersed at present. Mountain lions will cross large openings (especially at night) and will go after prey in these habitats if opportunities present themselves (Williams et al. 1995; personal observation).

Hiding cover during the hunting season is less an issue for lions (in terms of their survival) than for other hunted species since virtually all lion hunters use hounds to locate and chase lions, ferreting them out of hiding places. Recent research in the nearby Garnet Range indicates that the primary factor influencing the health of mountain lion populations is hunting and how it is regulated. Forest cover or other aspects of habitat were not raised as significant factors (Robinson and DeSimone 2011). In recent years, the quota in combined hunting districts 318/335, which includes the project area, has been 8 lions—a quota which hunters have been able to meet consistently.

The action alternatives would eliminate ‘stalking cover’ in treatment units, particularly within regeneration harvest treatments, making it more difficult for lions to approach ungulates foraging in those initially open habitats. But, it would also open up opportunities for prey, both primary and alternate, that prefer the more open habitat and more robust ground vegetation. The size and configuration of new openings and open forest under the action alternatives are well within the range of open habitats normally tolerated by and often used by mountain lions. Increased forage in these units would attract deer and elk, as well as some smaller prey, which, under certain circumstances, would draw lions to the sites. Given the abundance of untreated forest habitat in surrounding areas, these new treatment units would have no significant effect on the ability of lions to continue to successfully inhabit the area.

Sensitive Species

Overview

Rationale for Assessment

Evaluation of “sensitive species” is a requirement of the National Forest Management Act (NFMA) of 1976. Sensitive species are native species whose populations may be vulnerable to viability problems trending toward their being listed under the Endangered Species Act. A current list of sensitive species in this area is maintained by USFS Region 1 (Northern Region) in Missoula—the most recent version having been issued in August 2013. The status of all threatened, endangered, and sensitive (TES) species and potential effects of the Telegraph project are compiled in the *Biological Evaluation* section toward the end of this report.

Sensitive Species Present

The discussion in the sections that follow address *sensitive species* that inhabit the Divide landscape, focusing on the area south of U.S. Highway 12, where the Telegraph project area is located. Also taken into consideration are the foothills and valley sites adjacent to the Forest boundary that may provide habitat for species within range of the project area. Six sensitive species that are present in the Divide landscape could be directly or indirectly affected by the Telegraph project alternatives—although the potential is quite low in some cases. The six species are the northern Rocky Mountain gray wolf, the boreal toad, the fisher, the flammulated owl, the black-backed woodpecker, and the wolverine (discussed above).

Sensitive Species Not Present

Sensitive species that are resident elsewhere on the HNF but have been identified only as transients or not at all in the Divide landscape are the bighorn sheep, Townsend's big-eared bat, bald eagle, peregrine falcon, and plains spadefoot toad. The northern bog lemming and harlequin duck are suspected to occur on the Forest, but have not been positively identified as present.

Bighorn sheep inhabited the Divide landscape historically, but have not been present since the late 19th or early 20th century. The landscape harbors a certain amount of suitable habitat, but so far, MFWP has chosen not to reintroduce the sheep and none have migrated in from neighboring regions. Bighorn populations are at risk primarily from disease. Vegetation management issues for the sheep are similar to those for elk and deer—though on a more limited scale and in a different assortment of habitats.

The Townsend's big-eared bat has not been found in the Divide landscape. Bat surveys conducted on the HNF in recent years have found big-eared bats in the Big Belt Range to the east but not elsewhere on the Forest [Point Observation Database, Montana Natural Heritage Program (http://mtnhp.org/tracker/HNTMap.aspx)]. Removal of large decadent trees may reduce potential roosting sites, but the key habitat sites in caves and mine adits are essentially unaffected by vegetation management operations.

Northern bog lemming habitat is present, but highly fragmented and uncommon. Bog lemmings may be present on the HNF but they have not yet been reported. The best habitat—involving classic sphagnum moss bogland—is on the Lincoln Ranger District west of the Divide. Higher elevation wetland areas in the Telegraph project area that might provide marginal habitat are, as far as can be determined, unoccupied. All such sites have been exempted from impactive project activity because soils, hydrology, and general wildlife habitat concerns.

Bald eagles are occasionally reported in the Divide landscape, but so far, only as transients. For several years a pair nested west of the Forest boundary along Snowshoe Creek, but these birds spent virtually all of their time along the lower Little Blackfoot River on private and State land. This nest is no longer active, but bald eagles are still regularly reported along the lower Little Blackfoot River several miles west of the HNF boundary. Potential nesting, roosting, and foraging habitat is available on the Forest, in particular, along the upper Little Blackfoot River in the southern part of the landscape. But so far, no eagles have chosen to occupy it. The Montana Bald Eagle Management Plan contains guidelines for forest management and human access around nest sites that would guide management if eagles were to establish themselves in this part of the Forest.

Peregrine falcons have been reported occasionally in the Divide landscape over the past 25 years—mostly in the vicinity of Mount Helena and around Sheep Mountain just east of the HNF boundary near Clancy. Most observations have been during the spring and fall migration periods, and no eyries are known to have been established. Since 1989, when the falcons returned to the HNF, all known eyries have been in the Big Belt Mountain Range. Management of these birds focuses on keeping recreationists off the cliffs where the eyries are established. Vegetation management is seldom an issue.

Harlequin ducks are suspected to be present on the Lincoln District of the Helena Forest, but none have been reported in the Divide landscape. Only marginal habitat is present—mostly on the upper Little Blackfoot River. Harlequins have been reported on the lower Little Blackfoot during migration several miles west of the Forest boundary.

The plains spadefoot toad has been found only along the Missouri River below Meriwether Canyon in the Big Belt Mountains. Its range just barely edges onto the Helena Forest in an area of grassland, shrubland, and savannah.

The leopard frog, once relatively common in and around the HNF, including much of the Divide landscape, has not been reported in this part of Montana in over 20 years. It has almost certainly been extirpated, probably as a result of global factors (increased ultra-violet radiation, global warming, the spread of pathogenic chytrid fungus) in addition to local habitat change. Leopard frogs are still relatively common in parts of eastern Montana. Standard management for the common spotted frog and the boreal toad will take care of habitat needs for leopard frogs, if they are in fact still present.

Northern Rocky Mountain Gray Wolf

The northern Rocky Mountain gray wolf (*Canis lupus irremotus*) was listed as an "endangered" species in 1973. Since that time, populations in the northern Rockies have gradually increased via a combination of natural migration southward out of Canada and active reintroduction into Yellowstone National Park and central Idaho. Almost all of the wolves identified in and around the Divide landscape over the past 25 years have been migrants from Canada, although in the last few years a few Idaho and Yellowstone wolves have turned up in this general area.

Currently, the wolf is classified as a "sensitive" species in USFS Region 1, having been removed from the Endangered Species list in Montana and Idaho by an Act of Congress in March 2011. The State of Montana classifies the wolf as a "game" animal and has maintained a general wolf hunting season since 2011 and a trapping season since 2012. The effect of these policies has been to flatten the steadily increasing state-wide population trend of the last several years. Montana's wolf population was estimated to be 625 at the end of 2012; the estimate for 2013 was 627 (USDI et al. 2014, p. 1). The 2013 estimate for the northern Rockies as a whole (Montana, Idaho, Wyoming) was 1,691 wolves (78 breeding pairs). The USFWS region-wide minimum recovery goal of 300 wolves (30 breeding pairs) has been met every year since 2002 (USDI et al. 2014, p. 1).

The fact that wolf populations were continuing to increase prior to the initiation of shooting/hunting/ trapping programs indicates that habitat and population mechanisms had not yet kicked in as limiting factors. Wolves, for the most part, are habitat generalists that can successfully inhabit a broad range of environments as long as prey (mostly large herbivores), sufficient and secure denning and rendezvous sites are available for rearing young, and human-caused mortality is not too high (USDI 1987, p. 7-11). Observation of wolf packs in the Divide landscape and in areas north and south of there over the past 20 years indicates that a habitat matrix that supports healthy populations of elk, deer, or moose can sustain a local wolf pack. The particular mix of forested and non-forested habitat is of little concern. Access routes that allow humans to approach and interfere with wolf dens or that make it easier for hunters to kill wolves are of more importance.

Currently, there are no radio-collared or otherwise marked wolves in or near the project area or elsewhere in the Divide landscape south of U.S. Highway 12. However, wolf activity is regularly reported in the vicinity of the Project area as individuals continue to move southward through the Divide linkage zone and some of them group up to form local packs. The most consistent pack activity since 1995 has been in the Spotted Dog country along the west edge of the HNF and in the ranchland west of there. The Helmville-Avon Valley that runs north and south to the west of the Forest is a natural conduit for wolves, and they have been making use of it for the past 2 decades [see Sime 2010; Sime et al. 2007-2011; USDI et al. 1996, 1997, 2003, 2006, 2010]

The most recent wolf activity of note in or near the Project area was a possible pack of 4-6 wolves reported in the Telegraph Creek drainage in 2012-2013 (Bradley et al. 2013, p. 18). This is in the same general area where the "Boulder pack"—the first viable pack on the HNF since the 1920s—was reported in 1995. That pack remained in the Telegraph drainage for a few weeks before moving southward onto the Beaverhhead-Deerlodge NF. So, while the project area is known to provide suitable habitat for wolves, they typically range widely, taking advantage of opportunities over a much broader area [USDI et al. 1996, 1997].

The habitat shift from standing dead forest to openings bereft of dead trees would have no meaningful implications for wolves. Potential prey use of the sites would increase, if anything. The new openings would not provide any real opportunity for hunters or trappers to improve their chances of bagging a wolf. If any denning or rendezvous site were located in the project area, project operations would be modified so as to stay well clear of the site until after midsummer when pups began moving with the pack. The project would have ***"no impact"*** on wolves.

Boreal Toad

The boreal toad is the Montana subspecies of the western toad, which is widely distributed in the Rocky Mountains and the Pacific Northwest. As with many amphibians, population numbers have been dwindling over the past 2 decades, leading to its listing as a sensitive species Region 1. Boreal toads are found most often in mountainous terrain—up to 9,220 feet. They are capable of breeding in the shallower reaches of any clean standing water ranging from roadside ditches to lakes (Werner et al. 2004, p. 73-74), but they generally prefer larger bodies of water than are often used by other local amphibians (G. Hokit, personal communication). Eggs are laid in May or June, depending on elevation, and tadpoles and young toads are present in and around aquatic sites through the summer. Adults are largely terrestrial and, outside of breeding season, may wander considerable distances from their aquatic breeding sites (Werner *et al.* 2004). They occupy a variety of terrestrial habitats irrespective of overstory cover. The quality of ground-level microhabitat is more important than large-scale vegetation structure. When not feeding, toads seek cover in rodent burrows, under logs, in dense vegetation and litter, or within any habitat structure that provides concealment from predators and protection from temperature extremes.

Primary local risk factors for boreal toads are those that affect breeding habitat via reduction in size and quality of riparian areas. Activities that eliminate key vegetation and increase water turbidity reduce the quality of riparian areas as breeding habitat. Specific problems include draining and alteration of aquatic habitat, proliferation of cattle in breeding sites, pollution, introduction of predatory fish, and roads and motor trails in riparian areas (Maxell and Hokit 1999). While toad populations are highest near aquatic sites, adult toads travel through a variety of upland habitats in summer. Timber and fuels projects that severely reduce logs and other woody debris can make cross-country travel more precarious for them; and while dense vegetation, burrows, and other components offer opportunities for shelter, the absence of deadfall can reduce local habitat opportunity.

Biologists from Carroll College in Helena have conducted systematic surveys and tallied boreal toads at numerous locations in recent years—including parts of the southern Divide landscape (G. Hokit, personal communication). Surveys have occasionally picked up boreal toads in upland habitats, but their relatively low densities in these areas and their tendency to burrow under cover make them difficult to discover.

None of the riparian areas in the treatment units maintains sufficient season-long surface water to serve as aquatic breeding habitat for boreal toads and support developing tadpoles and young toads. However, these wet sites could provide key habitat for any adults moving away from breeding sites through this area. Mitigation measures and design elements intended to protect riparian areas would

preserve the integrity of these sites as boreal toad habitat. Elsewhere, a sufficient amount of woody debris would be left on the ground to provide for nutrient recycling and to provide enough cover, when combined with ground cavities and robust ground vegetation to accommodate boreal toads in upland habitats. Within the next decade, logs and other large woody debris will provide abundant cover for toads everywhere else in the project area. Implementation of either action alternative "***may impact individuals but would not likely result in a trend toward federal listing or threaten viability for the population or species".***

Fisher

The fisher (*Martes pennanti*) is an uncommon mid-sized forest carnivore tightly tied to mature forest habitats. It has been listed as a sensitive species in Forest Service Region 1 since the early 1990s. While reports of "fishers" in the Tenmile and adjacent drainages have come in on rare occasions over the past 20 years, none have been verified. Systematic hair snare and winter tracking surveys for fishers in the Divide landscape, 2007 to 2009, turned up no positive results. The Telegraph project area is beyond the fringe of what the USFWS has determined to be the historic range of the fisher in North America (Federal Register: June 30, 2011; vol. 76, no. 126, p. 38509, 38513).

Fishers are strongly associated with older, structurally complex forest stands at mid-low elevation. Old-growth and mature riparian forests with a variety of snags, broken-top trees, and logs provide particularly good habitat. This type of habitat is severely limited in Divide landscape because of wildfire and logging patterns that eliminated much of the older forest in the late 19th and early 20th centuries. Most of the available forest consists of "travel" habitat that, while not providing long-term habitat for resident animals, allows them to move between key habitat sites under cover.

The action alternatives would modify some areas that may be considered suitable "travel" habitat between what few key habitat sites are present in the project area. Whether the standing dead trees and, eventually, the open-canopied deadfall in untreated areas would still be useful as travel habitat for fishers is not known, but it is unlikely. What is lowering the value of the project area and combination boundary as potential fisher habitat is the aftermath of the pine beetle outbreak, rather than the action alternatives. Implementation of either action alternative would have ***"no impact"*** on fishers.

Flammulated Owl

The flammulated owl (*Otus flammeolus*) is a small insect-eating raptor with specialized habitat requirements. They are secondary cavity nesters in mature or old-growth ponderosa pine and Douglas-fir stands. Occasionally, they are found in mature aspen or cottonwood. They forage for large insects at twilight and after dark in open-grown forest formations with productive understories (tall grass, brush, young conifers) (McCallum 1994). This vegetation pattern is key to maintaining an adequate supply of insect prey while providing the owls with perches from which to forage and a substrate for nesting cavities. Patches of denser trees or multi-storied vegetation within or near the open stands are important for roosting (Morgan 1994). Because of the nature of their food base, flammulated owls migrate south in winter.

Flammulated owls are unevenly distributed because of the scarcity and spotty dispersion of suitable habitat. Primary threats are habitat loss to logging and settlement and the transformation of open-grown ponderosa pine stands into dense interior forest as a result of fire prevention (Morgan 1994). The scarcity of large open-grown ponderosa pine and Douglas-fir at mid-low elevation limits habitat opportunities throughout the Divide landscape, and there is very little suitable habitat in the Telegraph project area (which is dominated by mid-high elevation lodgepole pine forest). What little habitat there is occurs along the northeastern fringe of the area toward Telegraph Creek.

Management strategy involves maintaining open-grown old-growth ponderosa pine and Douglas-fir forest at low and middle elevation with lightly grazed grasses and shrubs in the understory. The stands should contain a number of large snags with cavities similar to those that will support pileated woodpeckers and northern flickers (Bull *et al.* 1990). These conditions will not evolve naturally in the short term, and management needs to eliminate dense second-growth in these stands and burn away needle accumulations so that native grasses and shrubs can flourish (Morgan 1994). The project would have ***"no impact"*** on flammulated owls.

Black-backed Woodpecker

The black-backed woodpecker (*Picoides arcticus*) is a primary cavity nester strongly associated with burned forests and associated wood-boring beetles. While it would seem that the bark beetle infested forests of the Divide landscape would provide an auspicious environment, black-backed woodpeckers do not appear to be taking advantage of it. Over the last 5 to 6 years, observations of other woodpeckers during field surveys have increased noticeably in these habitats—most obviously, hairy woodpeckers and northern flickers, but also some downy, pileated, and northern three-toed woodpeckers, as well as red-naped sapsuckers. In recent years, the only place in the Divide landscape where black-backed woodpeckers have been positively identified is the 170-acre MacDonald Pass burn, which originated in 2009. Elsewhere on the HNF, black-backed woodpeckers have been found in several burns in the Big Belt Mountains and on the Lincoln Ranger District, but they have not been detected during 8 years of intensive bird survey work in beetle-impacted stands of the north Elkhorn Range (Avian Science Center 2006; Bate 2003, 2004, 2005, 2007; Mosher and Saab 2009, 2010, Dresser et al. 2012). In other parts of the west, black-backed woodpeckers have been reported in pine beetle-killed forests, sometimes in substantial numbers (Bonnot et al. 2008; USDA 2007e, p. 6). So, black-backed woodpeckers could well be present (and simply unobtrusive) in parts of the Divide impacted by the bark beetles—including the Telegraph project area.

If the woodpeckers are in fact present, the action alternatives would promptly remove 3,484 acres in alternative 2 through regeneration harvest and 1,856 in alternative 3. In the absence of the action alternatives, this loss of habitat would occur more gradually. The loss would be mitigated in either case by the degree to which beetle populations decline after the trees have died. Burned trees generally dry out and lose their ability to support the wood-boring beetles on which the woodpeckers primarily feed in 4 to 8 years [see USDA 2007e, p. 3-4]. Bark beetles (such as mountain pine beetle) are generally present for only 1 to 2 years after they have attacked a tree: the dead trees may then support wood-boring beetles for another 2 to 3 years (Hagle et al. 2003). Implications for the Telegraph project are that since most of the trees in the project area will have been dead for roughly 4 to 7 years by the time they are harvested, they will be near or beyond their utility as feeding substrate for black-backed woodpeckers. Another factor that would come into play is the abundance of standing dead trees that would remain intact in surrounding untreated areas in the project area. These would be sufficient to provide for any black-backed woodpeckers present. The project would have ***"no impact"*** on black-backed woodpeckers.

Biological Evaluation

Biological Evaluations are documented Forest Service reviews of the potential effects of proposed actions on threatened, endangered, and sensitive (TES) species (FSM Ch. 2670, Amend. 2600-2005-1). These species groups are designated and managed under two different authorities. “Threatened” and “endangered” species (as well as those “proposed” as such) are listed under the Endangered Species Act (1973) and are overseen by the U.S. Fish and Wildlife Service (USFWS). “Sensitive” species are a matter of Forest Service policy: They are designated by Regional Foresters based on population viability concerns—which may be evidenced by significant downward trends in population numbers, population density, or habitat capability (FSM Ch. 2670, Amend. 2600-2005-1, p. 12).

The biological evaluation of terrestrial wildlife species for the Telegraph project occurs throughout the body of this report wherever the different species of concern are addressed. These include in detail two threatened species (lynx and grizzly bear) and one sensitive species (wolverine). The remaining species are either briefly discussed in the Topics not Analyzed in Detail section or are not present in the project area. Table 205 summarizes the key aspects of the evaluation.

Table 205. Threatened and sensitive species in the project area

Species	Category	Status
Grizzly Bear	Listed threatened	A small number of grizzlies range through and inhabit the project area. Observations of bears and encounters between bears and humans are uncommon. Enough back-country, non-motorized habitat is available to support a small sub-population of bears over the long term. All action alternatives would affect grizzly bears to one degree or another.
Canada Lynx	Listed threatened	Lynx are known to occur in the project area—having been systematically tracked both north and south of Highway 12. Numbers are very low and, to date, no evidence of breeding has been noted. The bulk of the foraging habitat used by these animals has been in early seral conifer stands rather than in older multi-storied forest. The action alternatives would result in the removal of key lynx habitat—stand initiation and multistory hare habitat within the wildland urban interface.
Wolverine	Sensitive	Wolverines are known to inhabit the project area in very low numbers. They range widely through a variety of habitats. In winter they often frequent the same mix of early seral and mature forest as lynx. No active natal denning sites have been identified and no breeding noted. All action alternatives would potentially displace wolverines at least while project activities are ongoing.
Gray Wolf	Sensitive	Wolves pass through the project area regularly. Since 1995, several packs have been active in and around the landscape—most having reduced or removed after preying on local livestock. Currently no packs are known to be active in the landscape. The action alternatives would not affect the ability of wolves to utilize the project area.
Fisher	Sensitive	Fishers have not been reported in the project area, and only one report has been verified in the last 20 years for the Divide landscape as a whole. Key habitat is limited and patchy. The action alternatives would not affect fisher since the project is considered at the fringe of the fisher’s historical range.
Townsend’s Big-eared Bat	Sensitive	Big-eared bats have not been identified in the project area. The action alternatives would have no effect on key habitat components for these bats or on the bats themselves should they be present.

Species	Category	Status
Northern Bog Lemming	Sensitive	Northern bog lemmings have not been identified in the project area. Primary habitat (sphagnum bog mat) is rare and highly fragmented. The action alternatives would have no effect on it.
Bighorn Sheep	Sensitive	Bighorn sheep are not present in the project area. Potential habitat is somewhat fragmented, but sufficient to support a small population should the sheep be reintroduced or migrate in naturally in the future. The action alternatives would do nothing to erode this potential.
Black-backed Woodpecker	Sensitive	Black-backed woodpeckers focus on aggregations of fire-killed trees. They have not been identified in stands impacted by mountain pine beetle, such as those that now dominate broad areas of the landscape. The action alternatives would have no direct or indirect effects on these woodpeckers.
Flammulated Owl	Sensitive	Flammulated owls nest and forage in open-grown stands of large ponderosa pine which are very rare in the project area. The action alternatives are designed to promote large tree growth in Douglas-fir stands and to promote ponderosa pine where it occurs. All large snags would be retained (except where they pose a safety hazard). It's unlikely the action alternatives would impact flammulated owl habitat.
Peregrine Falcon	Sensitive	Peregrine falcons have never been documented nesting in the project area. The action alternatives would have no impact on their ability to do so in the future.
Bald Eagle	Sensitive	Bald eagles fly over and occasionally stop off in the vicinity of the project area—perching in large trees, most often near aquatic habitats. No nests have been identified. The action alternatives would have no impact on bald eagles or their key habitat components.
Harlequin Duck	Sensitive	Harlequin ducks have never been identified in the project area. Marginal habitat exists in parts of the upper Little Blackfoot but, so far, it has been unoccupied. The action alternatives would have no impact on it.
Boreal Toad	Sensitive	Boreal toads breed in aquatic habitats across the Divide landscape although none have been observed in the project area. Adults range widely through the uplands. Although populations have declined from historic levels, they seem to be holding up well in this area. The action alternatives are designed to avoid wetlands and riparian habitats so the only anticipated impact to toads is the potential for mortality associated with equipment needed for project implementation. This would be rare though.
Leopard Frog	Sensitive	Leopard frogs have not been identified in the project area in nearly 25 years and it is highly unlikely that they are still present. The action alternatives would not impact leopard frogs.
Plains Spadefoot Toad	Sensitive	On the HNF, the plains spadefoot has identified only in a small pocket of the northern Big Belt Range. Given their habitat preferences, it is highly unlikely that they are present anywhere in the project area. The action alternatives would not impact the Plains Spadefoot toad.

Table 206 presents the determination of "effects" (for T&E species) and "impacts" (for sensitive species). For most species, the action alternatives would have no measurable impact—either because the species are basically not influenced by project activities or because they are not present in the project area (or present so fleetingly that any effects would be imperceptible).

Table 206. Effects determinations for sensitive species in the project area

Species	Alternative 1 Effects or Impacts	Alternative 2 Effects or Impacts	Alternative 3 Effects or Impacts
Grizzly Bear	No effect	May affect not likely to adversely affect	May affect not likely to adversely affect
Canada Lynx	No effect	May affect likely to adversely affect	May affect likely to adversely affect
Wolverine	No effect	May impact individuals but won't cause a trend towards listing or threaten species viability	May impact individuals but won't cause a trend towards listing or threaten species viability
Gray Wolf	No impact	No impact	No impact
Fisher	No impact	No impact	No impact
Townsend's Big-eared Bat	No impact	No impact	No impact
Northern Bog Lemming	No impact	No impact	No impact
Bighorn Sheep	No impact	No impact	No impact
Black-backed Woodpecker	No impact	No impact	No impact
Flammulated Owl	No impact	No impact	No impact
Peregrine Falcon	No impact	No impact	No impact
Bald Eagle	No impact	No impact	No impact
Harlequin Duck	No impact	No impact	No impact
Boreal Toad	No impact	May impact individuals but won't cause a trend towards listing or threaten species viability	May impact individuals but won't cause a trend towards listing or threaten species viability
Leopard Frog	No impact	No impact	No impact
Plains Spadefoot Toad	No impact	No impact	No impact

Mitigation Measures/Design Elements

1. If any listed species are detected in the project area during implementation, activities will be examined to determine if activity modification is necessary.
2. All prescribed fire and underburning would be implemented prior to May 1 or after July in order to protect nesting birds, unless surveys indicate birds are not present.
3. Recommendations from the Final Report of the Montana Cooperative Elk-Logging Study, 1970-1985 for Coordinating Elk and Timber Management would be implemented during timber harvest. Applicable design elements include:
    a. Logging activity will be confined to a single drainage at a time with all work completed in the shortest time frame possible.
    b. Logging operations will be prohibited during the first two weeks of the general rifle season in order to maintain big game habitat capability and hunting opportunity.
    c. All temporary roads will be closed to the public.
    d. Recreational use of firearms will be prohibited for anyone working within an area closed to the general public.
    e. Slash clean-up inside clearcuts will be reduced below 1.5 feet.
    f. Timbered areas adjacent to winter foraging areas will be retained.
4. If elk calving and nursery areas are identified prior to or during project implementation, these areas will be protected. This would be from late May through July unless surveys indicate areas are no longer being used.
5. If a great gray owl nest is located in the project area, activities will be restricted within a half mile of the nest during the nesting season between March 1 and August 1.
6. A buffer zone of uncut forest would be established around any active goshawk nest near treatment units. The size and configuration of this zone would depend on the location of the nest, the distribution of green overstory trees, and other local factors to be assessed by the wildlife biologist at the site. If possible, the buffer around an active nest tree should be at least 40 acres.
7. At least 180 acres of nesting habitat per home range will be retained in the project area with an emphasis on stands that have been used by goshawks for nesting.
8. No ground disturbing activities would occur inside known post fledging areas from 15 April through 15 August to protect the goshawk pair and young from disturbance during the breeding season until fledglings are capable of sustained flight. Site-specific data will continue to be used and if needed, timing restrictions will be designed to reflect variations in fledging dates.
9. Retain deformed trees for use by goshawks as nest trees.
10. Implementation of post treatment weed mitigation measures would occur in treatment units. Following weed treatments, monitoring of affected areas would occur.
11. In addition to guidelines outlined in the Aquatics, Hydrology, and Soils reports, riparian and wetland sites in the treatments units will be further protected as viable wildlife habitat by retention of most healthy live trees and as many snags and as much coarse woody debris as practicable in and around the fringes of these sites.

12. All temporary roads would be decommissioned after project. Decommissioning of roads would ensure no future loss of elk security or sediment movement to streams.
13. All temporary roads would have locked gates and be closed to the public at all times.
14. A retention of 5 tons per acre of down woody debris (greater than 3 inches diameter) following treatments in warm, dry forest habitat types and a minimum of 10 tons per acre in all other forest types would ensure adequate habitat for down woody debris-dependent species (i.e., marten).
15. Whitebark pine is an important wildlife resource, and it would be protected/ enhanced wherever it occurs within treatment units.
16. Within treatment units, viable aspen of all ages would be protected from damage by cutting and burning operations as much as possible. Treatment patterns would favor aspen over green conifers in the vicinity: conifers that appeared likely to suppress the development of promising aspen clones would be removed.
17. If post-treatment range/wildlife surveys indicated that cattle use in the new treatment units were proving detrimental to riparian sites, retarding development of aspen, or displacing native grazers from the area in summer, temporary exclosures may be needed so as to block off cattle access to the new treatment units.
18. Proper food storage would be required of all personnel working in the project area.
19. Aspen would be favored in all harvest treatments; if post-treatment monitoring indicates that livestock are impeding the ability of aspen to regenerate, then appropriate measures would be taken to protect aspen regeneration (e.g., fencing).
20. Forest Plan Standards regarding snags will be met as described in the *Forested Habitats of Special Concern Background Report*. While OSHA requires the felling of trees deemed to be safety hazards, site-specific silvicultural prescriptions will include snag retention and coarse woody debris goals (See also *Habitats of Special Concern)*.
    - In regeneration harvest units, roughly 20 snags per 10 acres from a mixture of diameter classes available, with seral species preferred, would be retained where they do not pose a safety or feasibility concern. All snags greater than 20 inches dbh would be retained. There would be a few reserve trees/patches and inoperable areas to provide snags and/or replacement trees.
    - In intermediate harvest units, snag retention goals would be to retain all snags greater than 20 inches dbh; AND 7 ponderosa pine or Douglas-fir snags greater than 10 inches dbh, or as many are available less than that amount, where they do not pose a safety or feasibility concern. There would also be abundant live trees in various size classes retained for snag replacement (75 to 300 per acre).