Chapter 1

Purpose and Need

Introduction

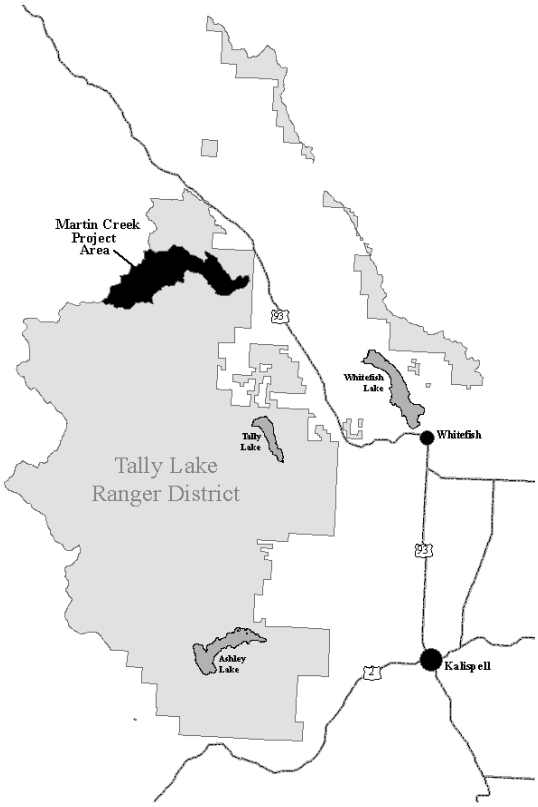
The Tally Lake Ranger District employees are proposing to improve forest stand conditions, reduce hazardous fuel loads, and improve water quality on National Forest System (NFS) lands located in the Martin Creek drainage located northwest of Whitefish, Montana. This Environmental Assessment (EA) discusses the findings of analysis conducted for the Martin Creek Resource Management Project, hereafter referred to as the Martin Creek Project. This EA describes the project in detail and analyzes the effects on forest and community resources. Additional documentation, including more detailed analyses of project area resources, can be found in the Project File located at the Tally Lake Ranger District Office in Kalispell, Montana. These records are available for public review. References to project file exhibits in this EA are referred to as simply "Exhibit H-3," as an example.

The analysis for this EA is being conducted in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. The Martin Creek Project planning will be conducted under the guidance of the Flathead National Forest Land and Resource Management Plan, hereafter referred to as the Forest Plan (USDA Forest Service 1986).

Three alternatives have been developed for this project; Alternative A is the "No Action" alternative, Alternative B is the "Proposed Action," and Alternative C responds to issues identified during the public scoping of the Proposed Action.

Some terms used in this document may be of a technical nature and unfamiliar to the reader. A glossary of definitions is provided in Appendix A. The analysis presented in this document was conducted using the best and most recent science available to Forest Service personnel.

Figure 1-1. Martin Creek Analysis Area & Vicinity.



Project Area Description

The Martin Creek Project Area includes the area drained by Martin Creek. The area is located in the Salish Mountains on the northern end of the Tally Lake Ranger District (see Figure 1-1). Whitefish is the closest incorporated community, but some rural residential development is located in the Martin Creek area in the southeast portion of the project area. While the northern and eastern boundaries of the Flathead Valley are defined by steep mountain ranges, the Salish Mountains on the western boundary are more gradual and rolling, with few peaks above 5000 feet. This less dramatic terrain has in large part determined the historical and current use and development of the area. Whereas relatively little private land exists in the more precipitous mountains around the Valley, there are numerous private land holdings in the Salish Mountains, including 147 acres of private land in the Martin Creek area.

The Martin Creek Project is approximately 10,800 acres in size and is located entirely in Flathead County. The National Forest portion of this area is managed by the Tally Lake Ranger District, headquartered in Kalispell. The analysis area is located entirely or partially in the following townships and sections: T32N, R25W, Sections 1-2,10-16, and 21-24; T32N, R25W, Sections 3-6, 7-15, and 17-18; T33N, R25W, Sections 33 and 34. A map of the analysis area with prominent landscape features, such as roads and streams, is shown in Figure 2-1 in Chapter 2. **Activities proposed in this EA are only for implementation on NFS land.**

The overriding disturbance that initiated the forests on the Martin Creek landscape is wildland fire. Many sites show evidence of recurring stand-replacing fires; others experienced low intensity, mixed severity fires. Wildland fires were often preceded by tree mortality from insect outbreaks. These fires created large openings until vegetation recovered, unlike the smaller openings created by humans in the latter half of the twentieth century. Wildland fire suppression has changed the natural burning cycle on this landscape. Increasingly dense multi-storied stand structure and high fuel levels put these stands at risk for disturbance, particularly from wildland fire. No large wildland fires have occurred in the Martin Creek area since 1926 (see Exhibit O-9). Approximately one-quarter of the analysis area burned between 1889 and 1926 (see Exhibit O-4); thick stands of lodgepole pine regenerated in many parts of these burned areas.

Structural development has occurred on private land in and around the project area, raising concerns about the risk to human life and property when wildland fire occurs. Following the 2000 fire season, Congress directed the Forest Service to identify high-risk areas, using the 2000 National Fire Plan Guidelines (U.S. Department of the Interior and U.S. Department of Agriculture 2000 and 2001, Interagency Federal Wildland Fire Policy Review Working Group 1995 and 2001). The communities of the Flathead Valley have been identified as “communities at risk” from wildland fire. Flathead County, in cooperation with area fire districts, land management agencies, and corporate timber land owners, responded with a county-wide fire protection plan. This plan, known as the *Flathead County Community Wildfire Protection Plan* (CWPP) (Exhibit O-2), defines areas where communities and other enclaves of residential development are at greatest risk from wildland fire, known as the Wildland Urban Interface (WUI). The WUI in the Martin Creek area affects a small portion within the project area but does affect a larger area east of the project boundary. The WUI is shown on Figures 2-1 and 2-3.

A large portion of the project area experienced regrowth following timber harvest activities conducted in the 1950s. These stands are composed primarily of western larch and/or Douglas-fir with smaller amounts of lodgepole pine and Engelmann spruce in some stands. Understory trees are scarce due to closed or nearly closed canopies. These stands are generally in a healthy condition, although growth is beginning to slow due to overstocking.

The majority of the project area has mixed species stands. This is a complex group with high variation in species and structure. Typically, Douglas-fir and western larch are the primary species in these stands, but no species is clearly dominant. Species composition includes varying amounts of Douglas-fir, western larch, Engelmann spruce, lodgepole pine, subalpine fir, western red cedar, and grand fir. In the absence of disturbance, Douglas-fir, subalpine fir, and spruce dominate the understory forming multi-layered stands.

Insects and diseases are always present to some degree in any forest, and the Martin Creek area is no exception. Mountain pine beetles are not currently at epidemic levels in the project area, but remain active in lodgepole pine stands, along with dwarf mistletoe. Douglas-fir bark beetles and fungal root diseases are active in some stands where Douglas-fir is the dominant species. Spruce budworm and needle blight have also been prevalent in recent years.

The project area provides a diversity of habitats for numerous wildlife species. However, vegetation patterns and wildlife habitats have been altered, primarily by forest management activities and wildland fire suppression. Most of the old growth habitat areas are fragmented and include a substantial amount of abrupt edge. Forested connections between many patches have been narrowed or severed. Numerous ponds, seeps, and streams provide a diversity of habitat for a wide variety of wildlife species. Snags and large downed-wood habitat are lacking in most previously logged areas and many are vulnerable to loss to firewood cutting. Fire suppression may have altered the availability of open-understory forested habitat for species such as the goshawk. The Martin Creek drainage has no designated deer or elk winter range, although there is ample habitat for ungulates within the project area. Secure habitat for elk during hunting season is limited. Grizzly bears are most often traveling visitors, although their use of this area is increasing. Potential habitats for lynx are abundant and well distributed. The area also appears to provide all of the elements for a wolf pack's territory and reports of wolf presence have increased in recent years.

The project area is within the Flathead River basin. Martin Creek drains directly into Stillwater River which flows into Flathead River eventually making it to Flathead Lake. The Martin Creek drainage was formed by glaciers that left numerous hummocky deposits with interspersed depressions, some of which contain water all year. Martin Lakes is a good example of this type of formation. This area also has a number of rock outcrops and cliffs, one of which contains Martin Falls, a destination with Forest visitors.

The entire Martin Creek drainage is believed to be historically fishless due to a waterfall at its confluence with the Stillwater River. However, due to fish stocking operations over the past several decades, the area provides habitat for both brook and Westslope cutthroat trout. The main recreational fishery is in Martin Lakes located entirely on National Forest System lands.

Most of the recreation in the Martin Creek area would be described as dispersed. Two popular points of interest in the project area are Martin Falls and a dispersed camping site

located on Upper Martin Lake. Other common uses in the Martin Creek project area include firewood gathering, hunting, dispersed camping, sightseeing, and fishing.

Purpose and Need

The Martin Creek project is proposed to respond to the goals and objectives of the Flathead National Forest Land and Resource Management Plan and direction found in the Forest Service Manual. The Forest Plan provides the basis for managing the Flathead National Forest. A variety of current conditions as described above, and guidance from the Forest Plan, provide the purpose and need for management action in the Martin Creek area. The purpose of the proposed management actions are:

- Improve forest stand conditions related to Forest Plan objectives for vegetative structure and species composition.
- Reduce hazardous fuel to varying degrees across the landscape. Create and expand fuels treatments to enhance fire suppression control efforts by reducing fire intensity.
- Provide quality outdoor recreation opportunities.
- Reduce sediment and improve water quality and aquatic species habitat in project area streams and lakes.
- Provide commercial and personal-use wood products for the local economy.

Proposed Action

A “Proposed Action” is defined early in the project-level planning process. This serves as a starting point for the Interdisciplinary (ID) Team of Forest Service resource specialists and gives the public and other agencies specific information on which to focus comments. Using these comments and information from preliminary analysis, the ID Team then develops alternatives to the Proposed Action. The Proposed Action and alternatives are discussed in detail in Chapter 2 of this EA; a brief description of the Proposed Action is below.

The Proposed Action for the Martin Creek Project includes a variety of vegetation treatments on a total of 1432 acres of NFS land. The total includes 868 acres of fuel reduction and timber stand health improvement accomplished through commercial timber harvest and 564 acres of non-commercial thinning in sapling-sized stands using primarily hand tools. The proposal also calls for the construction of approximately 0.9 miles of temporary road and 3.1 miles of permanent road. Other improvements include the closure of approximately 3.0 miles of road for big game security; 150 feet of new trail construction to access Upper Martin Lake; the replacement of four culverts; 482 acres of tree planting; and up to 500 acres of shrub planting and 100 acres of shrub slashing.

Decisions to Be Made

The Flathead National Forest Supervisor will decide whether and how to meet the purpose and need in the Martin Creek Project area using the environmental analysis in this EA. The decision will be based upon Forest Plan goals, objectives, and the desired future condition for the project area. The decision will include:

- The location, design, and scheduling of the proposed activities, temporary and permanent road construction and reconstruction, and silvicultural practices.
- Design criteria and monitoring requirements.
- A Finding of No Significant Impact.

Relationship to the Forest Plan

National Forest planning takes place at several levels: national, regional, forest, and project. This Martin Creek Project EA is a project-level analysis; its scope is confined to addressing the significant issues and possible environmental consequences of the project. It does not attempt to address decisions made at higher levels. It does, however, implement direction provided at those higher levels.

The Forest Plan embodies the provisions of the National Forest Management Act, its implementing regulations, and other guiding documents. The Forest Plan sets forth in detail the direction for managing the land and resources of the Flathead National Forest. Where appropriate, the Martin Creek Project EA tiers to the Forest Plan, as encouraged by 40 CFR 1502.20.

The Forest Plan uses management areas (MA) to guide management of the NFS lands within the Flathead National Forest. Each management area provides for a unique combination of activities, practices, and uses. The Martin Creek Project area includes four management areas. The goals and primary objective for each management area are summarized in Appendix B and displays the management area distribution within the project area.

Public Participation, Scoping, and Collaboration

The Council on Environmental Quality (CEQ) defines scoping as "…an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). Among other things, the scoping process is used to invite public participation, to help identify public issues, and to obtain public comment at various stages of the NEPA process.

After an assessment of the area prepared by the ID Team recommended several management actions, a public involvement strategy was developed to ensure that potentially interested members of the public and other government agencies received timely information about the upcoming analysis so they may participate and collaborate in the process (Exhibit B-1).

In addition to the following public participation processes, the Martin Creek Project has been listed on the Flathead National Forest Schedule of Proposed Actions since April, 2012 (Exhibit B-2). To date, the public has been invited to participate in designing the project in the following ways:

***Community Wildfire Protection Plan Development*:** The Flathead National Forest has undertaken collaborative efforts beginning in 2001 with various state and Federal agencies (e.g. Montana DNRC, National Park Service) as well as other partners to implement the National Fire Plan. The focus of these efforts was how to best collaborate on reducing risk to communities through fire prevention, staffing, preparedness, fuels treatments/wildland urban

interface projects, and grant opportunities. These partners helped to review criteria (e.g. condition class, fire starts, crown cover) that have been used to determine priority setting for various fuels reduction projects on the Flathead National Forest.

Beginning in the summer of 2004, the Flathead National Forest participated in the development of the *Flathead County Community Wildfire Fuels Reduction/Mitigation Plan* (FCWP) (Exhibit O-2), a Community Wildfire Protection Plan (CWPP). Emphasis in this plan was given to the following goals:

- Community-based involvement in defining at-risk priority areas;
- Emphasis on involving local fire district chiefs responsible for community fire protection across the county;
- Collaboration and information exchange with responsible stakeholders interested in furthering the planning process;
- Use of GIS technology for data aggregation, analysis, and the public involvement process itself;
- Utilization of the best available GIS data for the study area;
- Utilization of existing homeowner fire protection programs such as FIREWISE and;
- The compilation of the planning results in a dynamic, digital document that would serve the community as it moves toward continued and meaningful fuel mitigation projects across Flathead County.

The plan is an adaptive document, one that would continue to be updated annually or as needed to reflect accomplishments and newly emerging needs, issues, and opportunities surrounding wildland fire management in Flathead County. The FCWP wildland urban interface boundary was updated in 2011 to show recent refinements.

The units identified for possible treatment in the Martin Creek project area are within proximity to the communities at risk as shown in the CWPP. See Exhibit O-3 for a map showing the communities at risk. A map of the FCWP WUI boundary in relation to the Martin Creek project area boundary can be found on each of the alternative maps in Chapter 2.

Public Mailings*:* On April 6, 2012, a letter announcing the beginning of the public involvement process and detailing the Proposed Action was sent to approximately 55 individuals and organizations that had expressed interest in this type of project before or live adjacent to NFS land in the project area. This letter invited comments on the Proposed Action. Comments were received from 10 members of the public. A mailing on February 19, 2014, to the entire mailing list, was made to announce the upcoming availability of the EA and gave information on how to receive a copy of the EA on hardcopy, CD, or notification of its availability on our web page. On June 17, 23 copies of the EA were sent to those that requested an EA or previously commented on the project.

Public Meeting: On April 16, 2012, Tally Lake Ranger District personnel hosted a public meeting at the Stillwater State office in Olney to present the proposed actions and answer questions. The meeting was attended by four members of the public. District Ranger Lisa Timchak, Project Leader Tami MacKenzie, and other members of the ID Team were available at the meeting.

Local Media*:* A legal notice was published in The Daily Inter Lake newspaper on April 6, 2012, announcing the project and seeking public comment. The public meeting on April 16

was also announced in the same legal notice. An article was also published by the Whitefish Pilot on April 18, 2012 describing the project proposal (Exhibit C-1). On July 18, a legal notice announcing the availability and comment period for the Environmental Assessment was published in The Daily Interlake.

***Content Analysis**:* Comments generated from the Forest Service's request for comments on the Proposed Action and the EA dated July 2014, were analyzed using the content analysis process. Content analysis is a systematic process to compile, categorize, and capture the full range of public viewpoints and concerns regarding a plan or project. Content analysis helps the ID Team clarify, adjust, or use technical information to prepare and update the EA. Information from public meetings, letters, emails, faxes, phone calls, and other sources are all included in this analysis. This process makes no attempt to treat comments as votes. Content analysis ensures that every comment is considered at some point in the decision process. The content analysis is presented in Exhibit E of the Project Record.

To analyze the input, a list of comments was created. This list identifies specific requests expressed by individuals and groups who responded to the proposed action or EA comment period. To develop the list, each letter was read and representative quotations were selected that best capture the respondent's sentiments in the form of an action the Flathead National Forest should consider pursuing. A response from the ID Team follows each concern. The list of comments to the Proposed Action from the public and the responses from the ID Team are in Chapter 4 of the EA dated July 2014. The list of comments on the EA dated July 2014, and the responses from the ID Team, are available in Chapter 4 of this EA (dated March 2015).

Using the comments received on the Proposed Action, the ID Team developed a list of issues to address. These issues are discussed in Chapter 2.

A list of collaborating agencies, groups, and individuals consulted throughout the entire public participation process is in Chapter 4 of this EA. Participation with the Salish and Kootenai Tribe was conducted during quarterly meetings between tribal representatives and the Flathead National Forest Heritage Resource specialists.

Copies of this EA will be sent to those individuals or groups that commented on the project or who responded to our recent invitation to receive a copy. A legal notice will appear in the Daily Inter Lake informing the public of the availability of the EA and where they may acquire a copy.

The complete documentation of public participation, collaboration, and media coverage is contained in Exhibits B, C, and E.

Applicable Laws and Executive Orders

Shown below is a partial list of federal laws and executive orders pertaining to project-specific planning and environmental analysis on federal lands. While most pertain to all federal lands, some of the laws are specific to Montana. Disclosures and findings required by these laws and orders are contained in the applicable resource areas of Chapter 3 of this EA.

- National Historic Preservation Act of 1966 (as amended)

- National Environmental Policy Act (NEPA) of 1969 (as amended)
- Clean Air Act of 1970 (as amended)
- Endangered Species Act (ESA) of 1969 (as amended)
- Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (as amended)
- National Forest Management Act (NFMA) of 1976 (as amended)
- Clean Water Act of 1977 (as amended)
- American Indian Religious Freedom Act of 1978
- Archeological Resource Protection Act of 1980
- Executive Order 11593 (cultural resources)
- Executive Order 11988 (floodplains)
- Roadless Area Conservation Rule of 2001
- Americans with Disabilities Act (ADA) of 1994
- Architectural Barriers Act (ABA) of 1968
- Section 504 of the Rehabilitation Act of 1973

Decision Framework

This project was originally scoped under the provisions of 36 CFR 215. This project now falls under the 36 CFR 218 regulations and is subject to Subparts A and B.

Chapter 2

Alternatives

Introduction

This chapter describes and compares the alternatives considered by the Forest Service for the Martin Creek Resource Management Project. It includes discussion of how alternatives were developed; the primary issues raised; a description and map of each alternative considered in detail; an overview of features common to all alternatives; a monitoring plan; and a comparison of the features of these alternatives. Chapter 2 is intended to present the alternatives in comparative form, sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public (40 CFR 1502.14). Alternative A is the "No Action" alternative, under which no management actions would occur for the Martin Creek Project. Alternative B is the "Proposed Action" that was developed by the ID Team. Alternative C was developed following public scoping on the Proposed Action.

Alternative Development Process

The ID Team used information from field-derived resource information to identify treatment areas and formulate potential treatment prescriptions to different land units to create the proposed action. Alternative C applies the primary issues and subsequent field information to the activities presented in the Proposed Action. The primary issues are presented below. Each action alternative is also designed to meet the stated purpose and need for the project and the project-specific desired future conditions.

Each action alternative represents a site-specific proposal developed through intensive interdisciplinary evaluation of current and desired conditions, based on field verification. Unit identification and design also made use of high resolution topographic maps, aerial photos, satellite imagery, and a large quantity of resource data available in a geographic information system (GIS) database and hardcopy formats.

Issues

An issue is defined as a point of discussion, debate, or dispute concerning environmental effects of an action. Issues are identified through the public involvement process and by review from other agencies and Forest Service personnel. The scoping process is used not only to identify important environmental issues, but also to identify and eliminate issues that do not pertain to the action, narrowing the scope of the environmental documentation process accordingly. Therefore, impacts are discussed in proportion to their importance.

To identify issues specific to the Martin Creek Project, the ID Team studied public comments and information about historic and current conditions within the analysis area. They also reviewed the Forest Plan and other site-specific planning documents relevant to the Martin Creek area to further develop a list of issues. The Forest Service separated the issues into two

groups: "primary" and "other." Primary issues were defined as those directly or indirectly caused by implementing the proposed action. Similar issues were combined into one statement where appropriate. Other issues were identified as important and were considered in the analysis and design of the alternatives; however, they were determined not to be primary issues that would require additional alternatives.

The ID Team also determined quantifiable "issue indicators" to measure how each alternative responded to the primary issues. Comparison of these indicators is presented in Table 2-11 at the end of this chapter.

Primary Issues:

The following issues were determined to be significant and within the scope of the project decision. These issues are addressed through the Proposed Action and its alternative.

Issue 1: **Old Growth Forest:** There is concern the amount of total old growth habitat in the project area is near the low point of the historic range. Some stands of timber in a late-seral condition but not meeting old growth definitions may provide old growth habitat in the near future. New temporary and permanent road construction may also affect the quality of some existing old growth habitat. In addition, there is concern that proposed stand-regeneration treatments adjacent to old growth timber stands would create an "edge effect" that would reduce the value of old growth habitat to wildlife.

Issue Indicators: Acres of late-seral forests, that appear to be moving toward old growth conditions, with proposed stand-regeneration treatments; miles of road construction through old growth habitat areas; and acres of old growth habitat affected by new abrupt edge.

Issue 2: **Forested Wildlife Habitat:** There is concern that several units would negatively impact wildlife species using mature forests, such as Canada lynx and northern goshawks.

Issue Indicators: Acres of potential lynx understory and sapling feeding habitats proposed for treatment, acres of potential goshawk nesting habitat proposed for regeneration harvest.

Issue 3: **Forested Wildlife Connectivity:** There is concern that the proposed action would sever or constrict forested connections in numerous places that serve as wildlife travel corridors.

Issue Indicators: Number of timber harvest units affecting forested connections between old growth habitat areas, Number of timber harvest units narrowing forested riparian connectivity to 300 feet or less, number of connections between fisher habitat severed.

Issue 4: **Forested Wildlife Security:** There is concern that the various types, amounts, and distribution of timber harvest in the Proposed Action would reduce the area's ability to provide wildlife security over the next 15 years, particularly secure hunting season elk habitat.

Issue Indicators: Percent of analysis area in elk hunting season security area.

Other Issues:

The following public concerns and resource areas are important and were considered in the analysis of issues; however, they were determined not to be primary issues that would require additional alternatives. Some are already addressed through other processes or in the Forest Plan (see *Features Common to All Action Alternatives* in this chapter and *Response to Comments* in Chapter 4).

- There is concern that vegetation treatment and fuel reduction actions would lead to the spread of noxious weeds.
- There is concern that proposed changes for motorized access on existing roads would restrict recreation and firewood gathering opportunities.
- There is concern that not enough is being done to conserve populations of cutthroat trout.
- There is concern that the existing road system is adequate and no new permanent roads should be considered.
- There is concern that new permanent and temporary road construction and timber harvest could affect water quality in streams and lakes.

Alternative Descriptions - Alternatives Considered in Detail

Alternative A - No Action Alternative

This alternative proposes no vegetation or fuels treatments, recreation improvements, fisheries or watershed improvements, wildlife habitat improvements, or transportation upgrades within the Martin Creek project area. Selection of this alternative does not preclude approved activities in other areas of the National Forest at this time or from the Martin Creek project area at some time in the future. The Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14d) requires that a no action alternative be analyzed in every EA or Environmental Impact Statement (EIS). This alternative represents the existing condition against which the other alternatives are compared. This alternative does not improve existing forest stand conditions, maintain and improve terrestrial wildlife species habitat, develop outdoor recreation opportunities, or improve water quality; and provide wood products for the local economy; therefore, it would not meet the purpose and need of the project as stated in Chapter 1.

Alternative B - Proposed Action

The Proposed Action is a series of activities developed to respond to the purpose and need for the project as described in Chapter 1. This alternative proposes to modify vegetation and fuels; address site specific needs for reducing sedimentation and improving water quality, terrestrial wildlife habitat and security, and recreational opportunities; and provide wood products for the local economy. Please refer to Figures 2-1 and 2-2 for locations of the proposed actions.

Vegetation and Fuels Treatments

Several types of prescriptions or treatment types are proposed to meet the vegetation and fuels objectives that were described in the purpose and need statements in Chapter 1. The proposed treatment for each unit was determined from the current structure and species composition of trees and the desired future conditions for the stand. Treatments would be accomplished using mechanical equipment in areas containing commercial-sized trees and in some areas with trees smaller than commercial size. Hand treatments would be used in areas with non-commercial material and where slopes or soils preclude using equipment. In most treatment units, the prescriptions would emphasize retaining the most fire, insect, and disease tolerant trees, typically the larger western larch and Douglas-fir.

Table 2-1 below provides descriptions of the treatment types proposed in the action alternatives. The treatment types are described in detail in Chapter 3, *Vegetation* section. The estimated trees per acre and canopy cover to be retained are expressed in ranges for each treatment type. Canopy cover is an estimate of the percent of the ground surface that would remain beneath the tree branches after treatment. The retention column indicates the relative number of trees that would be left scattered or dispersed throughout the unit following treatment.

Vegetation and fuels treatments proposed by Alternative B include 29 units totaling 868 acres of commercial harvest and 16 units with 564 acres of non-commercial thinning in sapling-sized stands. The sapling thinning, also referred to as precommercial thinning, would be accomplished using primarily hand tools. Tree planting would be prescribed on 482 acres. Tables 2-2 through 2-3 display the proposed acreage and retention levels for each unit. The Proposed Action was designed with no timber harvest in areas of old growth habitat or within riparian landtypes.

Table 2-1. Key to Treatment Categories in the Unit Tables.

Stand Level Vegetation/Fuel Treatment Type	Retention Description	
	Trees per acre	Canopy Cover
Commercial Thin (CT)	50 to 150 pole to large trees per acre	30-70% (avg 40%)
Shelterwood (SW)	10-40 medium to large trees per acre	10-30%
Seed Tree (ST)	5-20 medium to large trees per acre.	5-10%
Clearcut (CC)	0 to 10 medium to large trees per acre	<5%
Precommercial Thin	200 to 400 saplings per acre (some units also have scattered pole to large trees)	5-40%

Transportation Management

Two new permanent system road segments would be constructed under this alternative for an estimated total of 3.1 miles (Table 2-5). Construction of these permanent roads would allow vehicle access to areas of the national forest for this proposed action as well as potential projects in the future. These roads would not be open to public wheeled motorized use.

Four temporary road segments totaling 0.9 miles would be required to access some of the units; these temporary roads would be reclaimed following their use. See Table 2-4 and Figure 2-1 for details of each road segment.

An estimated 44.0 miles of existing roads potentially used for timber hauling would be evaluated and if necessary have drainage features improved to meet Best Management Practices (BMPs). Please see Exhibit G-12 for a description of BMPs and a determination of their effectiveness.

Table 2-2. Alternative B Commercial Harvest Units.

Unit Number	Acres	Treatment[1] Method	Logging[2] System	Site Prep / Slash Treatment Method[3]	Reforestation[4] Method
1	9	ST	Tractor	WTY	Plant
6	18	SW	Skyline	WTY	Natural
7	26	SW	Tractor	Excavator	Natural
9	103	CT	Tractor	WTY	N/A
10	69	SW	Tractor	Excavator	Plant
11	24	SW	Skyline	WTY	Plant
13	28	ST	Tractor	Excavator	Plant
14	40	ST	Tractor	WTY	Plant
16	49	ST	Skyline	WTY	Plant
17	42	ST	Tractor	Excavator	Plant
18	55	CC	Tractor	WTY	Natural
21	23	ST	Skyline	WTY	Natural
22	47	SW	Skyline	WTY	Plant
23	12	SW	Tractor	Excavator	Plant
24	48	SW	Tractor	Excavator	Plant
25	6	SW	Skyline	WTY	Plant
27	6	ST	Skyline	WTY	Plant
28	20	ST	Tractor	WTY	Plant
30	7	SW	Skyline	Excavator	Plant
31	6	SW	Tractor	Excavator	Plant
33	9	SW	Skyline	Excavator	Plant
37	14	ST	Tractor	Excavator	Plant
38	12	ST	Tractor	Excavator	Plant
39	34	ST	Tractor	WTY	Plant
43	60	CT	Tractor	WTY	N/A
49	36	CT	Tractor	WTY	N/A
55	14	CT	Tractor	WTY	N/A
59	34	CT	Tractor	WTY	N/A
60	17	CT	Tractor	WTY	N/A
Total	868				

[1] Treatment Method – ST = Seed Tree, SW = Shelterwood, CT = Commercial Thin, CC = Clear Cut.
[2] Logging System—Tractor = ground-based equipment, Skyline = cable equipment.
[3] Slash Treatment—Excavator = slash would be piled using mechanical equipment such as an excavator; WTY = Whole Tree Yarding and pile at landing.
[4] Reforestation—Natural = allow natural regeneration; Plant = plant larch, Douglas-fir, ponderosa pine, and/or white pine; NA = no additional stocking needed.

Table 2-3. Alternative B Precommercial Thinning with Fuel Reduction.

Unit Number	Acres	Treatment[1] Category	Thinning Method	Slash Treatment[2] Method
100	48	WUI	Hand	Hand Pile
101	114	WUI	Hand	Hand Pile
103	28	WUI	Hand	Hand Pile
104	24	WUI	Hand	Hand Pile
105	36	WUI	Hand	Hand Pile
108	47	Research	Hand	Lop and Scatter
114	64	Research	Hand	Lop and Scatter
124	58	Research	Hand	Lop and Scatter
129	57	Research	Hand	Lop and Scatter
134	17	WUI	Hand	Lop and Scatter
135	12	WP	Hand	Lop and Scatter
136	16	WP	Hand	Lop and Scatter
137	2	WP	Hand	Lop and Scatter
138	26	WP	Hand	Lop and Scatter
139	7	WP	Hand	Lop and Scatter
140	8	WP	Hand	Lop and Scatter
Total	564			

[1] Treatment Category: WUI = Thinning proposed in the Wildland Urban Interface. Research = thinning proposed outside the WUI for the purpose of researching the habitat needs and requirements of Canada lynx and snowshoe hare. This thinning would not occur unless the District Ranger approves Forest Service financed research studies. WP = thinning proposed outside the WUI for the purpose of promoting western white pine regeneration. No more than 20 percent of the area of competing vegetation in these stands would be treated.
[2] Slash Treatment: Hand Pile = hand pile entire unit, Lop and Scatter = cut thinned trees in to small pieces and scatter evenly on the ground.

Table 2-4. Alternative B Temporary Road Construction.

Temporary Road Segment Number	Temporary Road Type	Approximate Miles of Temporary Road	Units Accessed by Temporary Road
A*	New	0.3	7
B	New	0.1	60
C	New	0.3	6
F	New	0.2	30, 31
		Total: 0.9	

*Road Segment A is partially located in the Ketowke Creek drainage (approximately 0.3 miles) outside of the Martin Creek analysis area. This segment would only be constructed after environmental effects analysis at some future time in the Ketowke Creek drainage determines the construction of this segment would have acceptable environmental effects.

Table 2-5. Alternative B Permanent Road Construction.

Permanent Road Segment Number	Approximate Miles of Permanent Road	Units Accessed by Permanent Road
H	1.2	9, 10, 11
I	1.9	9, 13, 14, 16, 17, 18
	Total: 3.1	

Figure 2-1

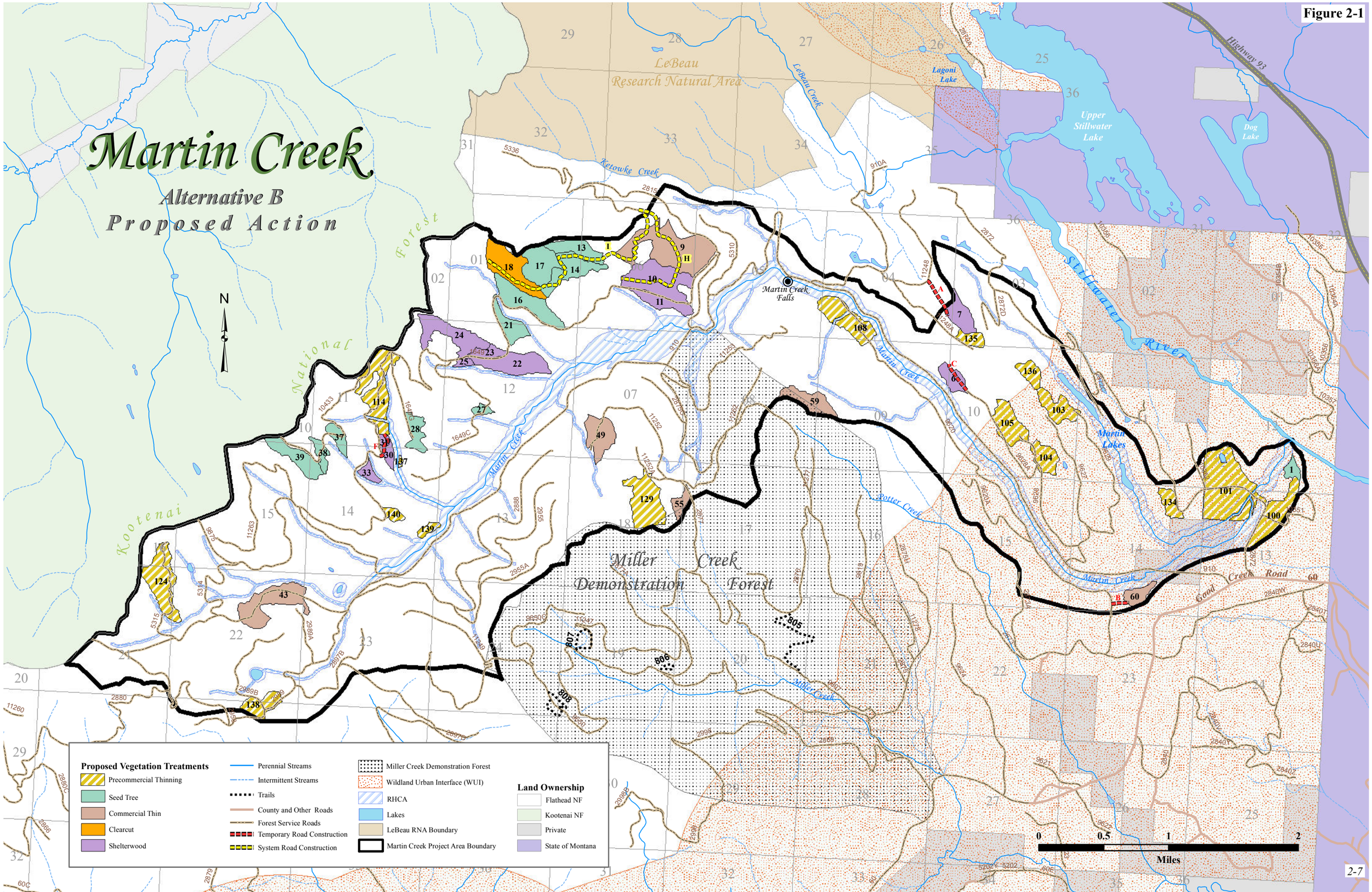
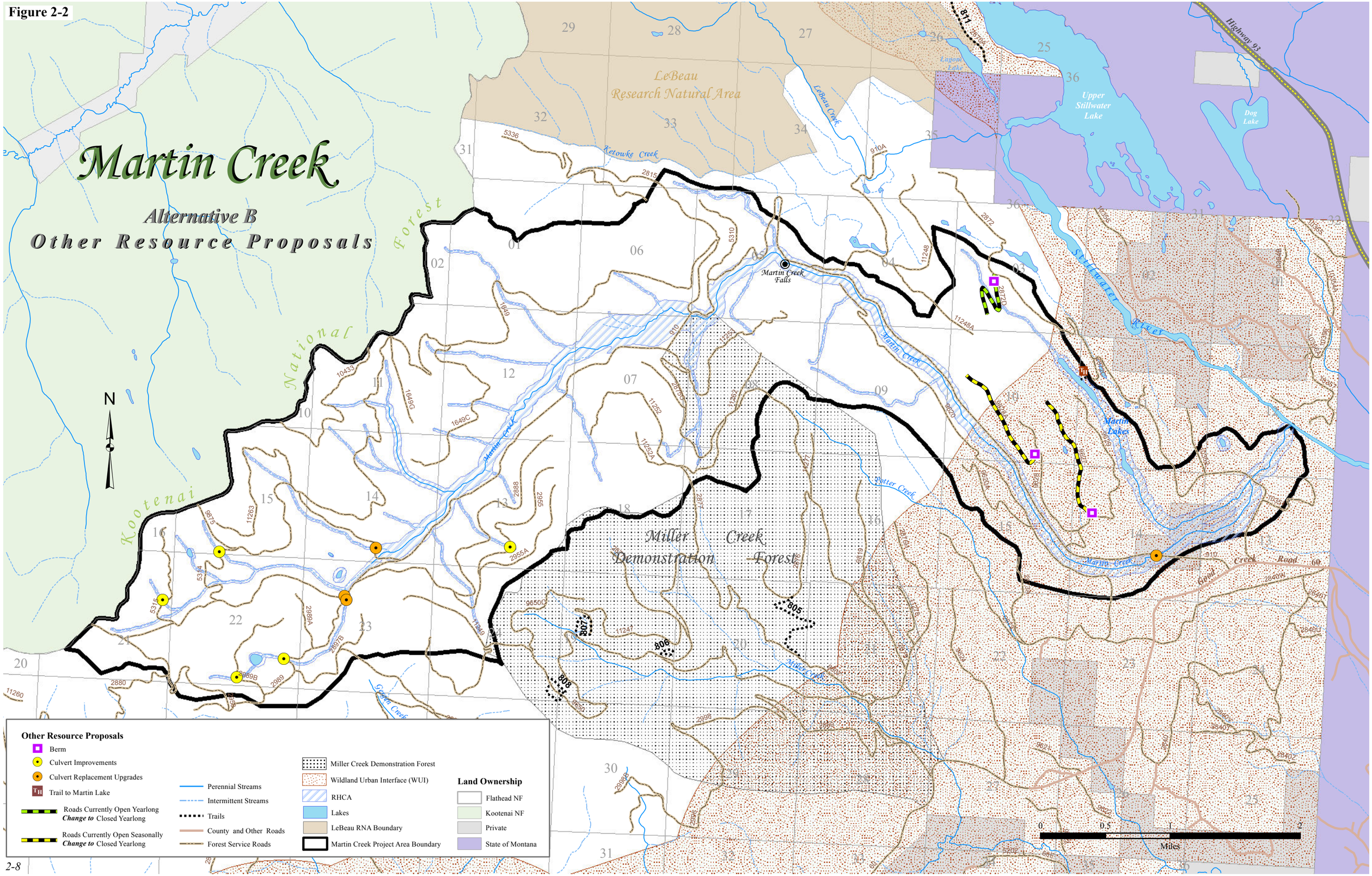

Martin Creek
Alternative B
Proposed Action
N
LeBeau Research Natural Area
Lagoni Lake
Upper Stillwater Lake
Dog Lake
Highway 93
Stillwater River
Martin Creek Falls
Martin Lakes
Miller Creek Demonstration Forest
Kootenai National Forest
Good Creek Road
Proposed Vegetation Treatments
Precommercial Thinning
Seed Tree
Commercial Thin
Clearcut
Shelterwood
Perennial Streams
Intermittent Streams
Trails
County and Other Roads
Forest Service Roads
Temporary Road Construction
System Road Construction
Miller Creek Demonstration Forest
Wildland Urban Interface (WUI)
RHCA
Lakes
LeBeau RNA Boundary
Martin Creek Project Area Boundary
Land Ownership
Flathead NF
Kootenai NF
Private
State of Montana
0
0.5
1
2
Miles

Figure 2-2


Martin Creek
Alternative B
Other Resource Proposals
Kootenai National Forest
LeBeau Research Natural Area
Upper Stillwater Lake
Dog Lake
Highway 93
Stillwater River
Martin Creek Falls
Martin Lakes
Miller Creek Demonstration Forest
Good Creek Road
N
0 0.5 1 2
Miles
Other Resource Proposals
Berm
Culvert Improvements
Culvert Replacement Upgrades
Trail to Martin Lake
Roads Currently Open Yearlong Change to Closed Yearlong
Roads Currently Open Seasonally Change to Closed Yearlong
Perennial Streams
Intermittent Streams
Trails
County and Other Roads
Forest Service Roads
Miller Creek Demonstration Forest
Wildland Urban Interface (WUI)
RHCA
Lakes
LeBeau RNA Boundary
Martin Creek Project Area Boundary
Land Ownership
Flathead NF
Kootenai NF
Private
State of Montana

Recreation Improvement Proposals

A user created trail at Upper Martin Lake currently connects the dispersed recreation site to the lake. This user created trail is steep and causing erosion into the lake. Rehabilitation of the user created trail and construction of approximately 150 feet of system trail is proposed to reduce erosion and vegetation loss.

Aquatic Habitat and Water Quality Improvement Proposals

Currently, there are several locations on National Forest System (NFS) Road 910 between the Good Creek Road (60) and Road 910A where Martin Creek has meandered and is running up against the road. These locations would be evaluated and improved to prevent road fill material from being deposited into Martin Creek as well as protect the road from washing out in the future. Riprap and/or erosion prevention materials would be used to stabilize these areas, preventing the stream from cutting into the road fill.

Four sites have been identified for culvert replacement or upgrade. One site is located where the Martin Creek Road (910) first crosses Martin Creek. Currently, there are two 48" pipes that are undersized. These pipes would be replaced with one new pipe that is designed to pass the 100 year storm event as required by the Forest Plan. While the pipes are not currently fish barriers, fish habitat and aquatic passage would be greatly improved. The remaining three are located in the upper reaches of Martin Creek and its tributaries (see Figure 2-2). These streams do not have fish but the culverts are too small and at risk for failure in a big runoff year. These culverts would be replaced with larger culverts designed to pass the 100 year storm event. The four culvert replacements would take place when the streams are at their low water point, typically during August or September. Please refer to Exhibit G-5 for a list of these culverts.

BMPs would be implemented on haul routes to minimize any potential impact the road has to water quality. There are five stream crossings causing some impact to aquatic habitat that are not on haul routes for any action alternative. These five stream crossings would receive culvert improvements anyway. Activities would include clearing the inlet of the culvert, blading ditches and installing drive-through drain dips. Please refer to Exhibit G-5 for a list and location of these five stream crossings.

Wildlife Habitat Enhancement Proposals

Shrub planting on up to 500 acres that are proposed for timber harvest would improve forage for deer and elk while providing nesting sites for songbirds. These areas would generally be near water sources and would not conflict with reforestation objectives. Up to 100 acres in other locations would benefit from selective shrub slashing to invigorate decadent shrubs to grow more browse at levels reachable by big game while retaining nesting sites for song-birds. Wildlife security would be improved by closing three road segments yearlong to wheeled, motorized vehicles. These three segments total approximately three miles in length. Roads 9627 and 9628A are currently open seasonally. Road 2872D is currently open year-long. These proposed access changes are displayed in Figure 2-2.

Alternative C

This alternative was developed to respond to the primary issues identified following the scoping of the Proposed Action (Alternative B). In particular, Alternative C modifies the proposed action in response to concerns with the effects on old growth and wildlife habitat. Most changes from Alternative B involved whole or partial units being eliminated because of multiple issues such as old growth recruitment, forested connectivity, lynx feeding habitat, and/or goshawk nesting habitat. The prescription in four units (24, 25, 30, and 31) was changed from regeneration harvest to commercial thinning for forested connectivity concerns. The prescription in one unit (7) was changed from regeneration harvest to commercial thinning for recruitment old growth concerns. In two instances, unit boundaries were modified to be further away from old growth stands to reduce edge effects to this habitat. Please refer to Figure 2-3 and Figure 2-4 for locations of the proposed treatments.

Vegetation and Fuels Treatments

Vegetation and fuels treatment types for Alternative C would be similar to those proposed for Alternative B. Please see Table 2-2 and the description of vegetation treatments under Alternative B above. Vegetation and fuels treatments proposed by Alternative C include 19 units totaling 460 acres of commercial harvest and ten units with 297 acres of non-commercial thinning in sapling-sized stands. However, there would be no sapling thinning in the WUI under this alternative. Tree planting would be prescribed on 103 acres. Tables 2-6 through 2-7 display the proposed acreage and retention levels for each unit.

Transportation Management

One permanent system road segment would be constructed under this alternative for and estimated total 0.3 miles. Construction of this permanent road would allow vehicle access to areas of the national forest for this alternative as well as potential projects in the future. This road would not be open to public wheeled motorized use.

Three temporary road segments totaling 0.6 miles would be required to access some of the units; these temporary roads would be reclaimed following their use. See Tables 2-8, 2-9, and Figure 2-3 for details of each road segment.

An estimated 41.0 miles of existing roads used for timber hauling would be evaluated and if necessary have drainage features improved to meet BMPs. Please see Exhibit G-12 for a description of BMPs and a determination of their effectiveness.

Recreation Improvement Proposals

The recreation site improvement proposal for Alternative C is the same as described for Alternative B (please refer to the description above).

Table 2-6. Alternative C Commercial Harvest Units.

Unit Number	Acres	Treatment[1] Method	Logging[2] System	Site Prep / Slash Treatment Method[3]	Reforestation[4] Method
7	26	CT	Tractor	Excavator	N/A
9	103	CT	Tractor	WTY	N/A
11	24	SW	Skyline	WTY	Plant
23	12	SW	Tractor	Excavator	Plant
24	48	CT	Tractor	Excavator	N/A
25	6	CT	Skyline	WTY	N/A
27	6	ST	Skyline	WTY	Plant
28	8	ST	Tractor	WTY	Plant
30	7	CT	Skyline	Excavator	N/A
31	6	CT	Tractor	Excavator	N/A
33	4	SW	Skyline	Excavator	Plant
37	14	ST	Tractor	Excavator	Plant
38	12	ST	Tractor	Excavator	Plant
39	23	ST	Tractor	WTY	Plant
43	60	CT	Tractor	WTY	N/A
49	36	CT	Tractor	WTY	N/A
55	14	CT	Tractor	WTY	N/A
59	34	CT	Tractor	WTY	N/A
60	17	CT	Tractor	WTY	N/A
Total	460				

[1] Treatment Method - ST=Seed Tree, SW=Shelterwood, CT=Commercial Thin, CC=Clear Cut.
[2] Logging System—Tractor=ground-based equipment, Skyline=cable equipment.
[3] Slash Treatment—Excavator=slash would be piled using mechanical equipment such as an excavator; WTY=Whole Tree Yarding and pile at landing.
[4] Reforestation—Natural=allow natural regeneration; Plant=plant larch, Douglas-fir, ponderosa pine, and/or white pine; NA=no additional stocking needed.

Table 2-7. Alternative C Precommercial Thinning with Fuel Reduction.

Unit Number	Acres	Treatment[1] Category	Thinning Method	Slash Treatment[2] Method
108	47	Research	Hand	Lop and Scatter
114	64	Research	Hand	Lop and Scatter
124	58	Research	Hand	Lop and Scatter
129	57	Research	Hand	Lop and Scatter
135	12	WP	Hand	Lop and Scatter
136	16	WP	Hand	Lop and Scatter
137	2	WP	Hand	Lop and Scatter
138	26	WP	Hand	Lop and Scatter
139	7	WP	Hand	Lop and Scatter
140	8	WP	Hand	Lop and Scatter
Total	297			

[1] Treatment Category: WUI = Thinning proposed in the Wildland/Urban Interface. Research = thinning proposed outside the WUI for the purpose of researching the habitat needs and requirements of Canada lynx and snowshoe hare. This thinning would not occur unless the District Ranger approves Forest Service financed research studies. WP = thinning proposed outside the WUI for the purpose of promoting western white pine regeneration. No more than 20% of the area of competing vegetation in these stands would be treated.
[2] Slash Treatment: Hand Pile = hand pile entire unit, Lop and Scatter = cut thinned trees in to small pieces and scatter evenly on the ground

Table 2-8. Alternative C Temporary Road Construction.

Temporary Road Segment Number	Temporary Road Type	Approximate Miles of Temporary Road	Units Accessed by Temporary Road
A*	New	0.3	7
B	New	0.1	60
F	New	0.2	30, 31
		Total: 0.6	

*Road Segment A is partially located in the Ketowke Creek drainage (approximately 0.3 miles) outside of the Martin Creek analysis area. This segment would only be constructed after environmental effects analysis at some future time in the Ketowke Creek drainage determines the construction of this segment would have acceptable environmental effects.

Table 2-9. Alternative C Permanent Road Construction

Permanent Road Segment Number	Approximate Miles of Permanent Road	Units Accessed by Permanent Road
H	0.3	9
	Total: 0.3	

Wildlife Habitat Enhancement Proposal

Shrub planting and shrub slashing would be the same as described above for Alternative B. The roads bermed for wildlife security were changed slightly. These are Roads 9628A, 9629, 2872D, and 2872 at its junction with Road 2872D. Miles of road closure is approximately five miles. Proposals are displayed on Figure 2-4.

Aquatic Habitat and Water Quality Improvement Proposals

The aquatic habitat and water quality improvement proposals for Alternative C are the same as those described for Alternative B (please refer to the description above).

Alternatives Considered But Eliminated From Detailed Study

Federal agencies are required by the NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action did not provide suggestions for alternative methods for achieving the purpose and need. No further discussion of alternatives dismissed from detailed consideration is necessary.

Figure 2-3

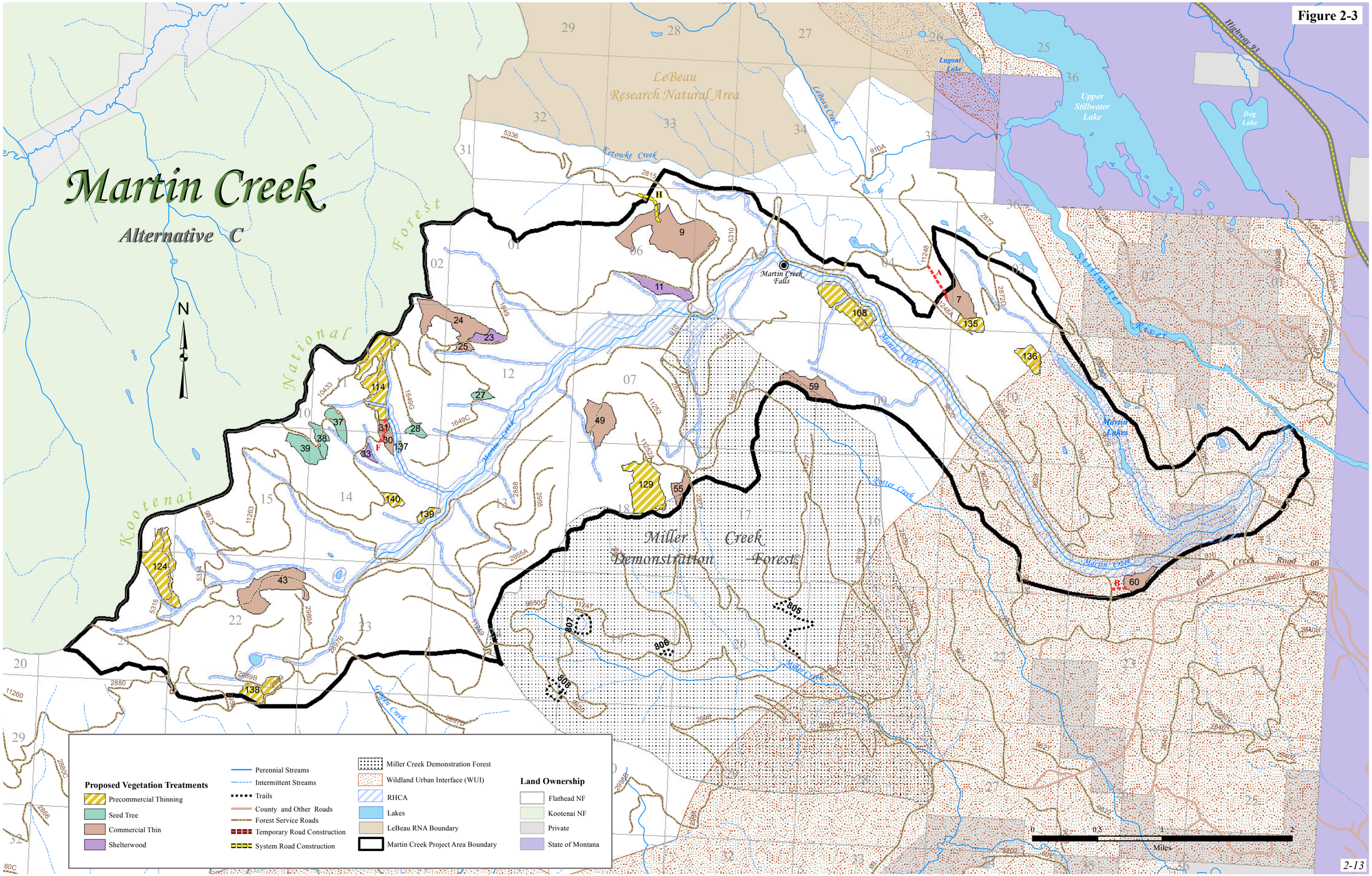
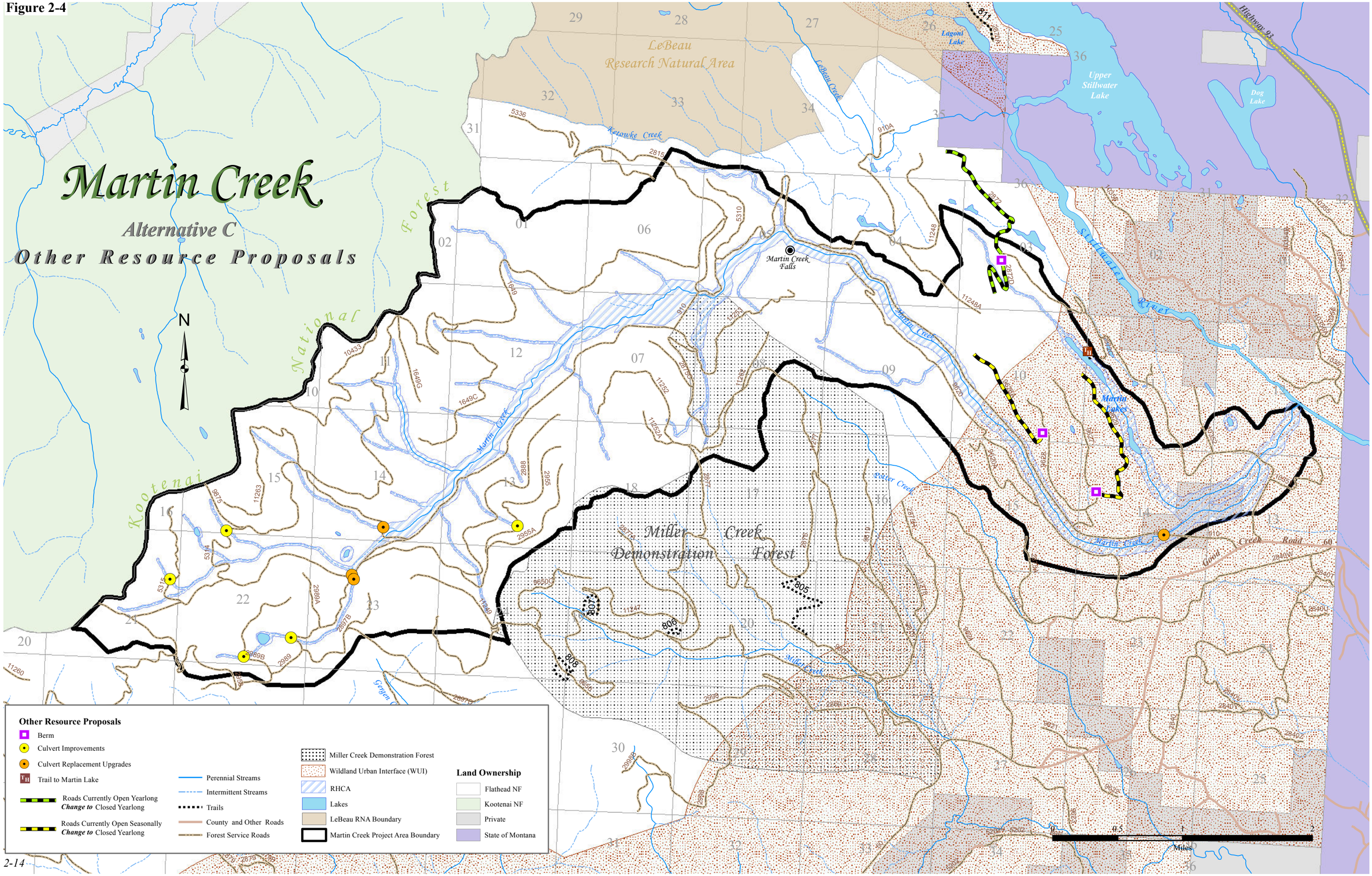

Martin Creek
Alternative C
N
Kootenai National Forest
LeBeau Research Natural Area
Upper Stillwater Lake
Lugoni Lake
Dog Lake
Highway 93
Stillwater River
Martin Lakes
Martin Creek Falls
Martin Creek
LeBeau Creek
Ketowke Creek
Potter Creek
Miller Creek
Miller Creek Demonstration Forest
Cowell Creek Road
Garden Creek
Proposed Vegetation Treatments
Precommercial Thinning
Seed Tree
Commercial Thin
Shelterwood
Perennial Streams
Intermittent Streams
Trails
County and Other Roads
Forest Service Roads
Temporary Road Construction
System Road Construction
Miller Creek Demonstration Forest
Wildland Urban Interface (WUI)
RHCA
Lakes
LeBeau RNA Boundary
Martin Creek Project Area Boundary
Land Ownership
Flathead NF
Kootenai NF
Private
State of Montana
0 0.5 1 2
Miles

Figure 2-4


Martin Creek
Alternative C
Other Resource Proposals
N
LeBeau Research Natural Area
Lagoni Lake
Upper Stillwater Lake
Dog Lake
Highway 93
Kootenai National Forest
Ketowke Creek
LeBeau Creek
Martin Creek Falls
Martin Creek
Stillwater River
Martin Lakes
Miller Creek
Miller Creek Demonstration Forest
Gordon Creek Road 60
Other Resource Proposals
Berm
Culvert Improvements
Culvert Replacement Upgrades
Trail to Martin Lake
Roads Currently Open Yearlong Change to Closed Yearlong
Roads Currently Open Seasonally Change to Closed Yearlong
Perennial Streams
Intermittent Streams
Trails
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Miller Creek Demonstration Forest
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RHCA
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LeBeau RNA Boundary
Martin Creek Project Area Boundary
Land Ownership
Flathead NF
Kootenai NF
Private
State of Montana
0 0.5 1 2
Miles

Features Common to Action Alternatives

The Forest Plan requires protective measures specific to a land management project be employed during implementation. These specific protective criteria are designed during the planning phase of a project and updated as the alternatives are developed and modified. Broad management direction is also taken from the Northern Regional Guide (USDA Forest Service 1983). Additional direction comes from applicable Forest Service manuals and handbooks. The following features have been incorporated as design criteria in the two action alternatives.

Timing of Activities

If either action alternative is implemented, vegetation and fuel treatment activities would be carried out beginning in approximately 2015 and continuing approximately four years. Other activities such as drainage improvements could begin immediately following the approval of an action alternative. Individual temporary roads will be constructed and reclaimed within three years.

Soils

To minimize detrimental impacts to the soil resource, all road construction, reconstruction, timber harvest, and fuels reduction would be completed using BMPs or Soil and Water Conservation Practices (SWCPs). The practices are described in detail in the Forest Service Soil and Water Conservation Handbook (FSH 2509.22), the Soil Management Handbook (FSH 2509.18), and the Forest Plan (pages II: 49-55). BMPs include practices such as providing for sufficient road drainage, limiting tractor logging operations to periods when soils are dry and less subject to compaction, seeding of landings and cut-and-fill slopes of roads, and maintaining undisturbed vegetation strips between cutting units and streams for sediment filtration. Each harvest unit and the proposed roadwork would be reviewed and applicable SWCPs identified on a site-specific basis for protection of the soil and water resource. These practices are listed and described for the activities described in the alternative at Exhibit G-12.

Harvest Activities

All mechanized units that remove commercial products would be logged using designated skid trails. Equipment would occasionally leave the trails to access trees or accomplish other activities. Skid trail spacing width must average at least 75 feet in all summer tractor harvest units. The goal is to occupy less than 15 percent of the treatment area, which includes soil disturbance from skid trails, temporary roads, and landings associated with either past or proposed activities.

Require winter logging in units 11 and 59 and cut-to-length/forwarder or winter logging in units 10 and 60 to reduce potential unacceptable levels of detrimental soil disturbance.

Winter logging requires that there be enough snow to prevent muddy water from mixing into the snow where equipment operates. This would require about ten inches of snow. The depth of snow varies with the snow conditions. It takes more dry powder snow than wet dense snow to protect the soil surface. Soils must be frozen enough to prevent deformation of the soil surface where equipment operates.

All activity areas currently have less than 15 percent detrimental soil disturbance. If post-implementation monitoring in Units 10, 11, 59 and 60 indicates that detrimental soil disturbance levels exceed 15 percent of the activity area, then all or a portion of the following actions would be used to begin the restoration of soil quality. Restoration activities would be focused on areas with high amounts of detrimental soil disturbance such as landings and designated skid trails.

- Scarification with excavator teeth to a depth of two to four inches.
- Seeding with the native plant mix as specified by the Forest Botanist.
- Planting native shrubs/trees to augment natural vegetation and scarification.
- Placement of slash and/or woody material on site.

Site condition would be used to determine which of the above mitigations would be used. These mitigations do not result in immediate restoration of detrimentally disturbed soils; rather they begin the restoration process.

All existing roads and skid trails would be reused to the extent feasible unless doing so would adversely affect soil, water or other resources. If roads or trails cannot be reused, their extent must be considered when laying out additional skid trails.

Logging would occur when soils are drier than field capacity as determined by the hand feel method (Exhibit H-20).

Sale administrators would monitor soil moisture conditions prior to allowing equipment to begin operations in summer (Exhibit H-20). This monitoring must be documented in the Timber Sale Daily Report.

All mechanical fuel reduction would be accomplished with excavators. Excavators would, to the extent feasible, remain on skid trails.

Prescribed burning prescriptions would be prepared and implemented for all pile burning treatments.

Temporary Roads

All newly constructed temporary roads would be reclaimed after timber harvest is completed or as soon as logistically practical. The reclamation of new temporary roads would include re-contouring the entire road template to the natural ground contour and, to the extent feasible, placing the top soil back on the soil surface and revegetating the disturbed area with native grasses, shrubs, and trees.

Wildlife

Non-Game Wildlife Habitat

Amendment 21 of the Forest Plan specifies the minimum number of snags, snag replacement trees, and pieces of downed wood to be left in each potential vegetation group (PVG). Although the minimum diameters are not always present in a given stand, these components would be retained to meet or exceed the intent of the Forest Plan under all alternatives wherever they exist (Exhibits Q-10 and Rd-5). To provide for these snag and downed wood

retention needs, as well as living tree canopy and large trees, the following would be prescribed:

- Retain the following standing unless leaving them would a) compromise safety, b) conflict with objectives for recreation management, or c) allow dwarf mistletoe, root disease, or bark beetles to increase to unacceptable levels:
    - All dead Douglas-fir, western larch, and ponderosa pine 12 inches and greater diameter breast height (DBH),
    - All live ponderosa pine seven inches and greater DBH,
    - All live larch 18 inches and greater DBH,
    - All live Douglas-fir 25 inches and greater DBH, and
    - All live or dead black cottonwood, quaking aspen, and paper birch.

    Girdling dwarf mistletoe infected larch may be used to retain these trees as snags.
- Leave on site as downed wood all snags greater than nine inches DBH that are felled for safety concerns.
- Wherever present, leave at least 32 downed logs per acre that are 9 to 20 inches in diameter and at least 20 feet long, distributed across the units as evenly as possible. If there are too few large enough logs, substitute logs six to nine inches in diameter to reach this number of pieces.
- Wherever present, leave at least 15 downed logs per acre greater than 20 inches in diameter and at least six feet long, distributed across the units.
- Leave some slash piles unburned in units, as described in Exhibit Rd-6.

Wildlife Security

Hunting, transporting of hunters, and transporting of game would be prohibited by timber, road building, or other contract workers while working on or off roads closed to motorized vehicle use by the general public.

Personal use firewood gathering would not be allowed by contractors or other workers on newly constructed roads or any other roads not open to motorized use by the general public.

All newly constructed roads would be closed by sign or gate to public motorized use during and after road building and other activities. All existing roads currently closed to public motorized use would remain closed during implementation of all proposed activities.

Big Game Habitat Enhancement

Shrub planting to improve habitat for big game and other species may occur on up to 500 acres, typically in or near some of the harvest units. Shrub planting would usually consist of willow, serviceberry, red-osier dogwood, mountain maple, or redstem ceanothus at a density of about 100 to 300 plants per acre. Shrub planting would typically take place in areas with light and/or moderate tree retention where sufficient soil moisture and light would assure survival and most often near riparian areas.

Threatened, Endangered, and Sensitive Wildlife

If any of the following are found within or close to any vegetation management unit or road location, operations within that unit or on that road would cease until the wildlife biologist is notified, and activities are modified if necessary:

- Active denning sites used by grizzly bears, wolves, lynx, fishers, or wolverines,
- Active nesting sites used by bald eagles, northern goshawks, black-backed woodpeckers, or flammulated owls, and
- Active rendezvous (pup rearing) sites used by wolves.

All contractors and others implementing the project would be required to comply with a food-storage and sanitation order.

Water Quality

BMPs are practices applied to minimize non-point source water pollution from forest practices, as well as protect watershed, fisheries, riparian, and soil resource values. The measures described in the Streamside Management Zone Act (SMZ-1993, also referred to as Montana House Bill 731) and applied to this project would protect all perennial and intermittent streams flowing adjacent to treatment units and are included in contract clauses.

Rehabilitation of drainage features on system roads (BMPs) as described in Exhibit G-12 would be implemented on system roads used for log haul. Additional culvert replacement may occur as opportunities are identified during project implementation.

Fisheries

The proposed units would be consistent with the guidelines and standards of the Inland Native Fish Strategy (INFISH) Environmental Assessment and its July 1995 Decision Notice (USDA Forest Service 1995b). No commercial timber harvest would take place within Riparian Habitat Conservation Areas (RHCA). RHCAs are defined as 300 feet from either side of fish bearing streams, 150 feet from perennial streams, 50 feet from intermittent streams and wetlands less than one acre, and 150 feet from lakes or large wetlands. Precommercial thinning in four units adjacent to RHCAs would also include some activity with the RHCAs. These four units are 101, 108, 114, and 139. Thinning would halt at 50 feet from the stream and no activity would take place immediately adjacent to the stream. Precommercial thinning within RHCAs would be conducted by hand crews only.

All new culverts and bridges installed or replaced on system roads would be designed to pass up to 100 year flow events, including during haul route BMP implementation. Installation of large culverts or bridges would greatly minimize the potential for the structure to fail during severe storms, runoffs, and debris flows; and also adequately pass all aquatic organisms at all life stages. Work would take place only during low flow, typically July through September. Stream water would be temporarily diverted through a pipe or channel during installation to minimize turbidity. As the water is returned to the channel, it would take place gradually over several hours to further minimize turbidity.

Air Quality

The primary air quality concerns associated with forest management activities is dust from unpaved roads and smoke from both wildland and prescribed fire. State Implementation Plans (SIPs) are developed to implement the provisions of the Clean Air Act. Prescribed burning requires a permit from the Montana DEQ and the burn must be implemented within the regula-

tory framework. This includes daily approval from the Flathead County Air Quality hotline and the Montana/Idaho Airshed Group. For a more specific discussion of air quality, see the *Air Quality* section of Chapter 3.

Vegetation

Timber Harvest

In units to be naturally regenerated, phenotypically superior leave trees would be selected whenever possible to increase the likelihood of leaving superior genotypes as seed sources. In all units, the largest trees would be favored to leave; harvest prescriptions would include minimum diameter limits for western larch, ponderosa pine, and Douglas-fir, as described above in the wildlife part of this section. All hardwoods would be retained, unless they compromise safety. Some small understory trees, either individually or in clusters, would also be left in harvest units to provide for vertical diversity in the stand to the extent possible without compromising fuel reduction objectives.

Precommercial Thinning (Sapling Thinning)

Precommercial thinning proposed in stands with a western white pine component. In those stands, thinning would be to specifically create space or "daylight" around planted, blister rust resistant white pine trees and no thinning would occur in parts of the stands without white pine. No more than 20 percent of the area in these stands would be treated.

Precommercial thinning is proposed in four stands outside the WUI for potential research on lynx/hare habitat requirements (108, 114, 124, and 129). The thinning specifications and locations within the stand could vary depending of the objectives of the research study. This thinning would not occur unless the District Ranger approves Forest Service financed research studies.

Up to half of the shrubs in the sapling thinning units may be cut where they have become decadent and difficult for wildlife to browse.

Fuels Reduction

Prescribed fire management plans (burn plans) are written for each individual prescribed burn and include plans for ignition, holding, escaped fire contingency, mop-up, and patrol to ensure that each burn meets the objectives prescribed for that particular area. The plan is designed to use the prescribed weather, personnel, and equipment that are needed to control the burn within the identified boundaries.

Most sub-merchantable trees in the commercial timber harvest units would typically be felled or "slashed" and subsequently piled and burned in order to reduce the amount of ladder fuels in the residual stand. As noted above, some understory trees would be retained to provide vertical diversity.

Invasive Species

Invasion and spread of invasive species is a concern in the analysis area. New cut and fill slopes would be seeded with a certified weed-free grass species mix for erosion control and to

prevent establishment of invasive species. Native grass seed is highly recommended; however, desirable (short-lived and non-invasive) non-native species may be used.

During project implementation, logging, site preparation, and road reclamation equipment used in the area would be washed to remove invasive species. This action is consistent with recommendations in An Evaluation of Noxious Weeds in the Lolo, Bitterroot, and Flathead Forests (Losensky 1987, FSM 2080, and USDA Forest Service 1995). When practical, commercial timber harvest units that have been determined to be free of invasive plants should be logged first using in-woods equipment that were washed before coming onto the national forest. Subsequent equipment moves from areas containing invasive plants to those areas that do not should consider an intermediate washing. Roadside clearing should be limited to retain as much shade as possible to help inhibit the establishment and persistence of invasive species. A Forest-wide environmental analysis (Flathead National Forest Noxious and Invasive Control Decision Notice and Finding of No Significant Impact 2001, Exhibit A-3) set priorities and parameters for invasive species control. Invasive species treatments in the analysis area would be consistent with this strategy.

Threatened, Sensitive, and Rare Plants

Known Regional Forester's Sensitive Species plant populations would be avoided by equipment and other ground-disturbing activities. These sites would be flagged by the Forest Botanist or certified technicians before timber sale layout.

If previously unknown populations of sensitive plants are found during project implementation, they would be evaluated and protected as necessary to retain population viability. A contract clause would be incorporated into the timber sale contract and would specify modification to protect these plants.

Ground-disturbing activities would avoid all wetlands; including lakes, ponds, marshes, fens, and streams. Buffers would be established around wetlands: 150 feet for areas greater than one acre and 50 feet for areas less than one acre. Buffers would be determined by wetland delineation parameters as defined by the Forest Botanist, Soils Scientist, or their technicians.

Revegetation with Native Plants

Where it is necessary to revegetate disturbed sites (landings, roadsides, culvert removals, etc.), a native seed or desirable non-native seed mix would be used. In areas requiring greater revegetation efforts, native shrubs would be used as funding becomes available.

Roads

Road Maintenance

Road maintenance actions consisting of brushing and blading may be needed on some of the haul roads within the project area. Other minor drainage work such as the placement of drain dips, installation of additional culverts, and upsizing or replacing culverts would likely take place. Dust abatement and blading would occur as needed on the main haul routes.

Over-Snow Travel

All new system roads would not be open to public wheeled motorized access but would be available for over-the-snow vehicles December 1 through May 14. Also, Roads 9875, 11263, 11253, and 910A (the portion within Martin Creek Project Area boundary, Figure 2-1) are currently open to over-snow travel from December 1 to March 31. These roads would be changed to open to over-snow travel from December 1 to May 14. See Exhibit M-3 for the Tally Lake Ranger District Over Snow Use Map.

Cultural Resources

Field investigation in accordance with the National Historic Preservation Act is ongoing. This includes consultation with the State Historic Preservation Office, the Advisory Council on Historic Preservation, and local Native American tribes. Special timber sale contract provision "B6.24# Protection Measures for Plants, Animals, Cultural Resources, and Cave Resources" would be included in the timber sale contract to assure protection of cultural sites.

Monitoring

Monitoring is gathering information and observing management activities to provide a basis for periodic evaluation of Forest Plan goals and objectives. The purpose is to determine how well objectives have been met and how closely management standards have been applied during and after project implementation. Evaluation of the monitoring results assists in the review of the condition of NFS lands as required by National Forest Management Act regulations. It may result in decisions for further action, such as modifying management practices.

There are three basic types of monitoring:

(1) ***Effectiveness Monitoring*** is used to determine if management practices as designed and executed result in the desired resource condition.

(2) ***Implementation/Compliance Monitoring*** is used to determine if goals, objectives, standards, and management practices are implemented as detailed in the Forest Plan, this EA, or by other State or Federal agencies. This would be performed by contract administrators, the ID Team, and resource specialists.

(3) ***Validation Monitoring*** examines the quality of the data and assumptions used in the analysis process.

Several sources of funding exist for resource monitoring. No assignment of funding source to the monitoring would be made at this time because future availability of funds is unknown. Priorities for annual monitoring are established and agreed upon by the ID Team and the Responsible Official, and implementation would be based on annual budgets and program direction. All legally required monitoring would be performed.

Monitoring activities are discussed by environmental component, consistent with those used in the EA.

Soils

Effectiveness Monitoring

Regional guidance is available from the Region 1 Forest Service Manual for Soil Management FSM 2500-99-1 (USDA Forest Service 1999). Region 1 policy states "Design new activities that do not create detrimental soil conditions on more than 15 percent of an activity area. In areas where less than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 15 percent."

Selected units would be monitored for any selected action alternative. Monitoring would be concentrated on units with the higher risk of exceeding the soil quality standards. At a minimum the following units would be monitored:

Alternative B: Units 10, 11, 59, and 60
Alternative C: Units 11, 59, and 60

Monitoring would follow the process outlined in the Forest Soil Disturbance Monitoring Protocol (USDA Forest Service 2009). Along with the condition of the soil surface, the amount of large woody debris and the percent effective ground cover would be determined. The objective for monitoring is to see that the productive potential of the land is maintained at a minimum of 85 percent of natural conditions.

Implementation Monitoring

For units harvested by mechanical means (feller-bunchers, skidders, etc.), soil moisture levels will be monitored by the sale administrator to ensure that logging, fuel treatment, and site preparation activities are conducted during periods when soils are below the recommended moisture content and less susceptible to compaction (Exhibit H-20). This monitoring must be documented in the Timber Sale Daily Report. Effects of logging on soils in units harvested by mechanical methods will be monitored by on-the-ground review.

Vegetation/Timber Management

Reforestation surveys would be conducted for each regeneration harvest unit. Surveys would occur at a minimum during the first, third, and fifth year following completion of the initiating activity for reforestation (site preparation or planting). This monitoring is necessary to assure adequate stocking levels for stand certification (Forest Plan, Appendix I).

Compliance surveys would be conducted on all units after harvest or thinning activities are accomplished. These surveys would meet the dual purpose of determining whether stand treatment, fuel management, and/or site preparation objectives are met and to gather data on the current condition of stands for planting or other future management needs.

All harvest and thinning activities would be monitored to ensure compliance with contract specifications. Minor contract changes or contract modifications would be enacted, when necessary, to meet objectives and standards on the ground. Treatment unit layout, prescriptions, and contract provisions would be reviewed by a district management team to determine compliance with Forest Plan goals, objectives, and standards prior to contract award.

Effectiveness and implementation monitoring for invasive species management would continue for at least three years following activities that impact infestations, as well as after treatment.

Wildlife

Monitoring would determine if timber sale and site preparation activities maintained appropriate levels of present and future snags and large woody debris. This should be done after the first several units are harvested.

Monitoring of species associated with old growth habitats would occur in accordance with the Forest Plan.

Monitoring to assess effectiveness of public motorized access restrictions on temporary roads and other closed roads used for project implementation would occur during project activities and during big game hunting season.

Roads

All road construction and road maintenance would be monitored to ensure compliance with specifications and to meet the intent of management practices. Specifications would be designed to meet objectives and management practices. The Forest Service would monitor the work performed by the contractor to ensure that their methods of operation and work are in compliance with the specifications. If the designed work is not meeting the objectives and management practices, a modification may have to be made by the Forest Service to change the work to meet the objectives and management practices.

Watershed/Aquatics

Potential sediment sources (such as stream crossings and road construction/reconstruction) in the sale area would be monitored to assess the implementation and effectiveness of BMPs, particularly on new road construction. This monitoring would indicate needs for further stabilization or sediment control measures to protect water quality. Areas of disturbed soil as a result of logging and road reclamation would be monitored for revegetation.

Monitoring of stream habitat conditions will continue. Measurements are taken at the lowermost Designated Monitoring Reach (DMR) every 5 years. This work is done by the PACFISH/INFISH Biological Opinion (PIBO) monitoring group, located in Logan, Utah. Measurements at the other two DMRs will occur every 3-5 years, and will be done by district personnel as time and budget allow.

Invasive Species

As funding becomes available, known infestations would be monitored for spread and disturbed areas would be monitored for new infestations.

Threatened, Sensitive, and Rare Plants

Any known populations would be monitored for effects to individuals and habitat after project implementation.

Recreation

District recreation personnel would monitor system trails and other areas for erosion problems and illegal use. Education efforts would be implemented through signage, direct visitor contact, and law enforcement patrols.

Comparison of Alternatives

The following table (Table 2-10) compares the features of all three alternatives. Table 2-11 compares the alternatives by the issue indicators identified earlier in this chapter. Information in the tables is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives. Further analysis of environmental consequences can be found in Chapter 3.

Table 2-10. Summary of the Features of the Alternatives.

Feature	Alternative A *No Action*	Alternative B *Proposed Action*	Alternative C
Temporary road construction	0	0.9 miles	0.6 miles
Permanent road construction	0	3.1 miles	0.3 miles
Road rehabilitation (BMPs)	0	44.0 miles	41.0 miles
Closure of seasonally open roads	0	2.1 miles	2.5 miles
Closure of yearlong open roads	0	0.8 miles	2.3 miles
Timber volume estimate in million board feet	0	6	3
Total timber harvest acres	0	868	460
- Commercial Thinning	0	264	357
- Shelterwood	0	272	40
- Seed tree	0	277	63
- Clearcut	0	55	0
Timber harvest logging system			
- Ground-based tractor acres	0	679	413
- Skyline cable acres	0	189	47
Fuel reduction acres without timber harvest	0	564	297
- Precommercial thinning	0	564	297
Total Acres of Vegetation Management	0	1432	757
Feet of new trail construction	0	150	150
Culvert Replacements/Upgrades	0	4	4
Culvert Improvements	0	5	5
Total Acres of Tree Planting	0	482	103
Acres of Shrub Planting	0	Up to 500	Up to 500
Acres of Shrub Slashing	0	Up to 100	Up to 100

Table 2-11. Response of Alternatives to the Issues.

Issue and Issue Indicator	Alternative A *No Action*	Alternative B *Proposed Action*	Alternative C
#1. Old Growth Forest			
• Acres of late-seral forest that appear to be moving towards old growth habitat with stand regeneration treatments.	0	103	12
• Miles of road construction through old growth habitat areas.	0	0.2	0.0
• Acres of old growth habitat affected by new abrupt edge.	0	79	23
#2. Forested Wildlife Habitat			
• Acres of potential lynx understory and sapling feeding habitats proposed for treatment.	0	573	314
• Acres of potential goshawk nesting habitat proposed regeneration harvest.	0	310	24
#3. Forested Wildlife Connectivity			
• Number of timber harvest units affecting forested connections between old growth habitat.	0	8	0
• Number of timber harvest units narrowing forested riparian connectivity to 300 feet or less.	0	3	0
• Number of connections between fisher habitat severed.	0	4	0
#4. Forested Wildlife Security			
• Percent of analysis area in elk hunting season security area.	31.0%	29.5%	32.8%

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Chapter 3

Affected Environment and Environmental Consequences

Introduction

This chapter presents both the existing environment of the project area and potential consequences to that environment by implementing the action alternatives presented in Chapter 2. The consequences of no action are also presented. Discussions of the current condition describe the physical, biological, social, and economic environment for each potentially affected resource. Discussions of environmental consequences form the scientific and analytical basis for comparing the alternatives. All direct, indirect, and cumulative effects are disclosed. The means by which potential adverse effects would be reduced or mitigated are also described (also see Chapter 2).

The Proposed Action and its alternatives are limited to the specific timber harvest, fuel treatments, and reforestation activities on NFS land in the Martin Creek Project area, although the geographic extent of some areas used to analyze different components (i.e., fisheries, weeds, and wildlife home ranges) may extend beyond the analysis 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 environmental analysis document. Any new information that develops after the Decision is made would be considered prior to implementation.

The discussions of resources and potential effects take advantage of existing information included in the Forest Plan, other project documents, project-specific resource reports and related information, and other sources as indicated. Where applicable, such information is briefly summarized and referenced to minimize duplication. The Project Record for the Martin Creek Project includes all project-specific information, including resource reports and results of field investigations.

Affected Environment Analysis

The resource information provided in the Affected Environment narratives in the sections that follow this introduction includes the effects of past actions in that they are now assessed as part of the existing condition of the landscape. Specific past actions considered in the Affected Environment analysis are summarized in Table 3-1 below. A decade by decade description of the amount and type of past timber harvest is presented in the *Vegetation* section in Table 3-3. The Project Record provides additional information for these actions. The list of past actions is not necessarily exhaustive, as records may not exist for all past activities (by project). This is particularly true for those actions that predate the passage of the NEPA in 1970. Nevertheless, the effects of such past actions are fully accounted for in the assessment of existing condition as the current condition assessment necessarily reflects the impact of such actions (to the extent they are still affecting the particular resource considered).

Environmental Consequences Analysis

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. The Council on Environmental Quality (CEQ) regulations implementing the NEPA includes a number of specific categories to use for the analysis of environmental consequences. Several are applicable to the analysis of the proposed project and alternatives, and form the basis of much of the analysis which follows. They are explained briefly here.

Direct, Indirect, and Cumulative Effects

Direct 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 be significant in the foreseeable future. Cumulative effects result from incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time.

Cumulative actions are those actions, which when viewed with past actions, other present actions, and reasonably foreseeable actions, may have cumulatively significant impacts and therefore should be discussed in the same environmental analysis document. Past, present, and reasonably foreseeable actions are activities that have already occurred, are currently occurring, or are likely to occur in the vicinity of the project area and may contribute cumulative effects. The past and present activities and natural events have contributed to creating the existing condition, as described in the Affected Environment sections of this chapter. These activities, as well as reasonably foreseeable activities, may produce environmental effects on issues or resources relevant to the proposal. Therefore, the past, present, and reasonably foreseeable activities described in the following tables have been considered in the cumulative effects analysis for each resource area.

Table 3-1. Cumulative Effects Summary by Ownership. Actions spanning each column are relevant to past, present, and reasonably foreseeable actions.

Actions on All Ownerships	Past	Present (Spring 2014-Spring 2015)	Reasonably Foreseeable
Wildland Fire Suppression	There is evidence of wildland fire in and near the project area over the last several hundred years. Fire history records show the last large fires greater than 100 acres burned in 1926 in the south, central part of the project area. Since about 1940, wildland fires have been actively suppressed by the Forest Service and other agencies. Wildland fires would continue to be suppressed. Recent wildland fires within the project area boundaries have typically been less than one acre and were suppressed using hand crews. A few fires have been over one acre and may have utilized aerially-applied chemical retardant during suppression efforts. The Tally Lake Ranger District has been assigned wildland fire protection responsibilities for the entire project area, however all suppression agencies would participate if necessary.		
Hunting, Trapping, and Predator Control	These activities have been and continue to be popular uses of National Forest System land and other ownerships. Popular hunted species include white-tailed deer, mule deer, elk, and moose. Some species that are now currently listed as threatened, such		

Actions on All Ownerships	Past	Present (Spring 2014-Spring 2015)	Reasonably Foreseeable
	as grizzly bears and Canada lynx, were hunted and trapped in the past. Some predator populations, such as gray wolves and coyotes, were reduced in numbers from the project area in the early part of the last century.		
Fishing	Fishing on the two bodies of water known as Martin Lakes is a common activity and is anticipated to remain as so. Fishing in the analysis area streams is less popular as fish typically do not attain a large size.		
Firewood and Other Miscellaneous Forest Product Gathering	Firewood gathering has occurred and would continue in the future; recent higher than historic energy costs may increase the public's desire to obtain firewood but air quality concerns may also reduce reliance on this source of fuel in the future. Other products gathered in small quantities in the area include posts and poles, mushrooms, berries, and Christmas trees.		
Snowmobiling	A minor amount of this activity currently takes place and is expected to slightly increase in the future. Most of the snowmobiling takes place on the established forest roads.		
Dispersed Camping	Dispersed camping is popular and would continue. The only boating opportunity is on Martin Lakes, although access for launching a boat is challenging. Camping and boating activities are expected to increase in popularity.		
Driving	Driving, sightseeing, and wildlife viewing on open Forest, State, and private roads would continue.		
Hiking, Mountain Biking, and Horse-back Riding	These activities have occurred and would continue to occur on primarily roadways. All roadways are available to each of these three activities.		
Cross Country Skiing	This activity has taken place on a minor scale. There are no formal track grooming operations that have or are expected to take place.		
Motorcycle and ATV Riding	There are no trails available for motorcycle or ATV (Four-wheeler) use. This activity is available on roads open to motorized vehicles. These activities are expected to increase in popularity.		
Fish Stocking	The only water bodies in the project area that have been stocked are Martin Lakes and Martin Creek. Montana Department of Fish, Wildlife and Parks stocked westslope cutthroat trout in Martin Lakes in 2008 and 2010. Anecdotal data gathered from local anglers indicates native and non-native fish were stocked in both Martin Creek and Martin Lakes as early as the 1940s. Fish population surveys in the 1980s support these data.	Montana FWP has proposed stocking westslope cutthroat trout in Martin Lakes in 2012.	Stocking of native fish in Martin Lakes by FWP is reasonably foreseeable.
Road Maintenance and BMPs	Roads on all ownerships would be maintained for use either by all users or for just the individual landowners. Roads used for the transport of forest products are generally maintained to meet Montana Best Management Practices (BMP). Road work to improve surface drainage, stabilize slopes, and reduce erosion and stream sedimentation has occurred primarily on roads used by the Forest Service since the early 1990s.		
Precommercial Thinning	Approximately 2206 acres of sapling-sized	No precommercial thinning is currently	No precommercial thinning is currently planned on any owner-

Actions on All Ownerships	Past	Present (Spring 2014-Spring 2015)	Reasonably Foreseeable
	stands have been thinned on National Forest System land, beginning in 1963. Some of these stands originated from wildland fire and others from timber harvest activities. No land has been precommercially thinned on private property.	being implemented on any ownership.	ship.
Beaver Control	Trapping of beavers and destruction of beaver dams occurred up to the 1990s on all ownerships.	This activity may continue to take place on private property.	
Mineral Extraction	The Martin Talus and Martin Stockpile areas have both been used in the past as sources and/or storage areas for mineral resources. The Martin Stockpile area is listed as closed and the Martin Talus area is listed as inactive on the Forest's quarry and pit inventory.	The Martin Talus area is not in use at this time.	The Martin Talus area could be used for large bolder, mid-size rock, and/or gravel in the future. Rock and gravel is available for extraction at this site.

Actions on National Forest System land only	Past	Present (Spring 2014-Spring 2015)	Reasonably Foreseeable
Timber Harvest	Approximately 5394 acres of timber have been harvested to some degree on National Forest System land since the 1950s within the project area. Some of these acres could be located on the same site with multiple harvest entries in different time frames. This is approximately 50 percent of all NFS land in the project area. The majority of the treatments were accomplished in the 1960s and 1970s. The Marty Timber Sale was the most recent harvest occurring in the project area, with approximately 750 acres being treated. The Vegetation section of		

Actions on National Forest System land only	Past	Present (Spring 2014-Spring 2015)	Reasonably Foreseeable
	Chapter 3 details the acreage by decade for the various treatment types. Please see Exhibit U-2 for a list of all recent timber sales and years of accomplishment, Exhibit P-4, map 4 for harvest by year and Table 3-3 in the Vegetation section for types of harvest by decade.		
Reed Canary Grass Control Project		This project would authorize the treatment of Reed Canary grass on three sites, one located in the project area, one immediately adjacent to the project area, and one south of Tally Lake. The treatments could include prescribed burning, mowing, application of herbicides, and coverings with black plastic sheets. This project could be implemented as soon as spring 2015.	
Radnor Resource Management Project			The Tally Lake Ranger District may propose a resource management project directly adjacent to the Martin Creek Project area. This project could consist of approximately 275 acres of commercial treatments, 220 acres of precommercial treatments, construction of approximately 1.1 miles of both temporary and permanent roads, and other resource enhancement projects to improve aquatic, fisheries and recreational opportunities. A Decision on this project could be made as soon as spring 2015.
Prescribed Burning	Fire has been prescribed in the past as a method to reduce fuel loading, prepare sites for reforestation, and to include fire as an ecosystem process in areas after timber harvest activities. This has occurred on approximately 275 acres. Prescribed fire without timber harvest was used on approximately 48 acres in 2001 to reduce fuels and improve big game forage conditions. See Exhibit O-1 for a map.		

Actions on National Forest System land only	Past	Present (Spring 2014-Spring 2015)	Reasonably Foreseeable
Road Construction	Approximately 64.2 miles of National Forest System roads have been built on federal land in the project area. The roads are in varying levels of use, ranging from the highly used Martin Creek Road (Road 910) to roads that have been closed and are no longer drivable. These roads were built since the middle of the last century, though the majority of roads built on federal land were completed between 1950 to the mid-1980s.		
Road Decommis-sioning	Roads have been removed from the transportation system and rendered undrivable to improve wildlife security, landscape hydrologic function, and reduce maintenance costs. Approximately 1.2 miles have been decommis-sioned in the project area. These roads were decommissioned with the 2000 Good Creek Record of Decision.		
Road Maintenance	Roads designated for motorized use by the public are maintained with safety as a high priority. This primarily involves repairing drainage features and clearing of live and down vegetation. Some roads have been closed and are maintained at a lower level. There are currently approximately 64.2 miles of road under USFS jurisdiction within the project area; of which 45.2 miles are open year-long, 8.9 miles are open seasonal-ly, and 39.9 are closed yearlong.		
Road Access/ Utilities Special Use Permits	There are two special use permits in the analysis area; one for a domestic use water line, held by a private landowner, and one for a power line, held by Lincoln Electric Cooperative. Both of these permits are near the private property in Section 14.	All permits within the analysis are up to date and in good standing.	Any permit in good standing that meets the Forest's screening process, is current with their yearly fees, and requests a renewal, would be eligible for a permit.
Access for Hunters with Disabilities	Forest Road 2989 has been utilized and may continue to be utilized for the foreseea-ble future as a road available for hunters with disabilities.		
Trail Construction	A short trail segment to access the Martin Falls		

Actions on National Forest System land only	Past	Present (Spring 2014-Spring 2015)	Reasonably Foreseeable
	recreation site was constructed in the 1970s.		
Trail Maintenance	The short trail that accesses Martin Falls is regularly cleared of downfall and brushed.		
Noxious Weed Control	Noxious weed control as outlined in the 2001 Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment and Decision Notice would continue to take place in the project area.		
Removal of Non-Native Fish	The Montana Dept. of Fish, Wildlife, and Parks in 2005 chemically treated the upper and lower Martin Lakes along with a half mile of the outlet stream to remove non-native fish. Subsequent monitoring by FWP determined the project was a success. These water bodies were stocked later the same year with westslope cutthroat trout.		
Rocky Mountain Research Station Demonstration Forest	The Miller Creek Demonstration Forest is partially located within the project area boundary, near Keith Mountain. It has provided forestry research data for over 40 years, especially in the realm of comparing vegetation recovery after wildfire, timber harvest, and prescribed fire. The research has been a joint effort of the FNF and the Forest Service's Rocky Mountain Research Station. The most recent research conducted at the Demonstration Forest involved measuring down woody material in relation to soil productivity.		
Snowshoe Hare Research	Research on snowshoe hare populations and habitat use has occurred in and near the Martin Creek drainage since 2001. This has included live-trapping and marking of hares, pellet transects, collection of vegetative data, and experimental precommercial thinning of two sapling stands. This research is expected to continue for the foreseeable future.		
Haying	A small acreage of meadow near private property in Section 14 south of Martin Lakes was informally utilized for hay production by the adjacent landowners. This practice ended in the 1990s.		

Actions on State and Private Ownership Only	Past	Present (Spring 2014-Spring 2015)	Reasonably Foreseeable
Private Land Development	A limited amount of construction of driveways, buildings, and other improvements on private land within the project area has been occurring for decades and would continue. The amount of development has been minimal due to the small amount of private land available in the project area. Most of the development is in the form of private primary or secondary residences on single lots near the intersection of the Good Creek and Martin Creek roads. The Forest Service is not aware of any applications for further development.		

Actions on State and Private Ownership Only	**Past**	**Present (Spring 2014-Spring 2015)**	**Reasonably Foreseeable**
Noxious Weed Control	Noxious weed control on state and private ownership would continue to take place in the project area and is expected to increase in the future. Individual landowners would continue to control weeds with primarily spot applications on their property.		
Timber Harvest	A very limited amount of timber harvest has occurred in the past on the 80 acres of private property. An estimated 50 percent of this land has experienced intermediate harvest methods over the past 50 years, some as recently as 4 to 5 years ago.	No timber harvesting on private property is currently observed.	Lands owned by private individuals are not expected to have any timber harvest in the foreseeable future.
Wood Products Manufacturing	A small, family-owned sawmill operated on private property for approximately 20 years, ending in the early 2000s.		
Treatments Specific to Forest Fuels Reduction	Removal of live and dead vegetation for the purpose of reducing wildland fire intensity has been accomplished on private property within the project area. This activity is expected to continue. The extent of fuel reduction on private property is not known but is primarily limited to areas immediately adjacent to structures.		
Agriculture	A minor amount of land on private property has been used and would continue to be used for agricultural purposes.		

Forest Vegetation

Introduction

This section describes the existing forest vegetation conditions in the Martin Creek area and how the No Action and two action alternatives would affect the various components of this resource. Several vegetation attributes could be affected by implementation of the alternatives, so they will each be analyzed. Forest vegetation structure, composition, insects, and diseases will be discussed at the landscape and stand level to facilitate analysis of direct, indirect, and cumulative effects. Refer to the *Threatened and Sensitive Plant Species*, *Invasive Plant Species*, *Fire and Fuels*, *Old Growth*, *Neotropical Migratory Birds and Riparian Habitat*, and *Snags and Downed Wood Habitat* sections of this chapter for further information on those particular aspects of forest vegetation are affected by the alternatives.

Background and supporting documentation is provided in the Exhibit P of the project file and in individual stand files located at the Tally Lake Ranger District.

Information Sources

This section provides a brief description of the sources of information used in the vegetation analysis, and the process for development of the forest vegetation data layer for the Martin Creek project. More detailed documentation on all these sources and analysis methodology is provided in Exhibit P-5.

The primary data sources used to describe existing vegetation conditions on NFS lands include the Natural Resource Information System (NRIS) FSVeg database, FACTS activity tracking database, and R1 Vegetation Map (R1 VMP) (Brewer, et al. 2004). FSVeg contains information such as stand age, species composition, and average diameter for stands that have had field inventories (stand exams). R1 VMP is a satellite image classified to provide information about species composition, stand size class, and canopy cover. It was used to describe vegetation in stands without on-the-ground exam data. Both FSVeg and R1 VMP provide consistent baseline data with accuracy assessments for vegetation conditions. National Agriculture Imagery Program (NAIP) satellite imagery from 2009 and field visits were used to verify or update stand exam and remotely sensed data. All of the stands proposed for treatment were field reviewed by a silviculturist to verify the vegetation data and diagnose treatment needs (Exhibits P-1 through P-3). The primary data sources for vegetation on non-federal lands were R1 VMP and NAIP imagery (Exhibit P-5).

Comparison of the existing and historical forest conditions with desired conditions provided the foundation for development of the proposed vegetation treatments in the Martin Creek project area. The main source of information that was used to help determine desired conditions was the Flathead National Forest Plan. The Forest Plan and other applicable guidance documents define objectives and provide direction for management of the lands on the Flathead National Forest. Refer to description and map of the MAs affected by the Martin Creek proposal in Appendix B, and to the Forest Plan, for more details on management direction.

The Good Creek Ecosystem Assessment at the Watershed Scale (EAWS); which included the Martin Creek drainage; described the area, compared it with historic vegetation patterns, and identified issues and areas of concern from an ecosystem standpoint. This mid-scale watershed-level assessment was completed in 1998. Although no recent EAWS exists for the Martin Creek landscape, the recommendations from the Good Creek EAWS are still applicable to some extent and help provide a basis for formulating the desired forest conditions at the landscape scale for the Martin Creek Resource Management Project (Exhibit U-4).

Historical Conditions Methodology

The evaluation of historical vegetative conditions relied on information used to estimate the natural variation in landscapes in the Upper Columbia River Basin (UCRB) (Hessburg, et al. 1999) and from the Midscale Historic Range of Variability Vegetation Analysis, completed for the FNF in March of 1999 by the Wenatchee Forestry Sciences Laboratory. Various parameters of Ecological Subregion 19 (ESR 19), which includes Martin Creek, were compared with average conditions for similar watersheds within the UCRB (Exhibit P-11). The product of this evaluation is referred to as the historic range of variability (HRV).

The current proportion of vegetation cover types, structure classes, and patterns in the Martin Creek area vary compared with the range of historical conditions. Consistent with findings from the UCRB study, the Martin Creek results suggest that the functioning of some ecological processes have changed as a result of fire suppression, increased road density, and past timber harvest patterns. Most vegetative conditions are near the historical mean or median values; others are at, near, or outside the maximum or minimum amount found historically. These departures reflect the amount of wildland fire, insect and disease mortality, and subsequent timber harvest that has occurred over the last four decades. Variation over time and across the landscape is desirable as it adds to the vegetative diversity and resilience to large scale disturbances. Specific vegetation conditions of interest or concern are further discussed below under the *Affected Environment* section and in Exhibit P-11.

Analysis Area

The analysis area for forest vegetation varies spatially and temporally based on the forest attribute being analyzed. The spatial boundary for analysis of cumulative effects to forest vegetation is the approximately 11,000 acre Martin Creek watershed (refer to Exhibit P-4, Map 1). It provides a well-defined region over which meaningful evaluation of trends, patterns, and ecological functioning of the forest vegetation can occur.

The spatial boundary for analysis of direct and indirect effects to forest vegetation is primarily the treatment unit and its immediate surroundings. A treatment unit is a forest stand with a contiguous group of trees relatively uniform in age classes, structure, and composition. Maps and lists displaying all units associated with the proposed activities are located in Exhibits P-2 and P-4.

The temporal bounds of the analysis are designed to capture the direct, indirect, and cumulative effects of the proposed activities on the forest vegetation attribute being analyzed. The direct, indirect, and cumulative effects would occur at the time of the activity and indefinitely into the future. The temporal bounds of the analysis vary depending upon the effect (direct, indirect, or cumulative) or forest vegetation attribute of interest. Effects to forest vegetation from histori-

cal activities extend back 60 to 130 years because reliable records of past human disturbance (specifically timber harvest and road construction) are limited to the 1950s and past fire history records to the 1880s. Reliable indicators of past insect and disease activity extend to about the 1960s. Some effects, such as changes in species composition, downed woody material, and stand structures, would be evident 100 or more years from now. This is due to the types of treatment proposed, the long lives and persistence of the tree component, and the long-term stand conditions the actions are striving to achieve. The analysis area used to examine the impacts of the proposed action and alternatives on vegetation resources is displayed on the Vicinity Map, Figure 1-1, in Chapter 1.

Affected Environment

This section discloses the condition of the forest vegetation within the analysis area. Conditions at the broader landscape level as well as the site specific forest stand level are covered. Factors that have the greatest influence on forest vegetation characteristics are discussed, including physical site conditions (such as soil and terrain), natural ecosystem processes (such as wildland fire, insect, and disease activity), human activities (such as timber harvesting), as well as regional and local climate conditions.

Climate

In general, a cool and moist pacific maritime climate, in combination with continental air masses, has the largest influence on the vegetative component in the project area. The greatest precipitation falls as snow during the winter months, but some precipitation occurs every month of the year. Typically, the (nearest) weather station in Olney, Montana records a mean summer and winter temperature of 60ºF and 22ºF, respectively. Average annual precipitation in Olney (elevation 3170 feet) is 24 inches, with approximately 50 percent occurring as snowfall. The project area has relatively low precipitation (20 to 30 inches annually) compared to other regions of the forest, mainly due to the prevalence of lower elevation sites (elevation ranges between 3300 to 6000 feet, with most of the project area less than or equal to 5000 feet). This relative dryness, along with the dominance of winter precipitation, contributes to the preponderance of plant species and forest types that tolerate cooler, drier site conditions. Refer to the *Aquatics Resources* section of this EA for greater detail on hydrologic processes.

Physical Site

Terrain, Landtypes, and Soils

The Martin Creek drainage is part of the Salish Mountain Range. Volcanic eruptions in the Cascade Mountain range approximately 6600 years ago set down a layer of volcanic ash across the area averaging seven inches thick and leaving a rich tree growing medium. This ash layer in large part determines the productivity of the sites. Continental glaciation, weathering, and stream erosion and deposition have carved the intricate network of streams and valleys across the landscape. The landscape is characterized by mostly gentle to moderately sloped mountainous terrain, with the majority of lands (more than 60 percent) less than 35 percent slope.

Landtypes are mapping units that incorporate landforms, geomorphic processes, soils, and vegetation to help describe landscape and site conditions (USDA Forest Service 1983).

Exhibit P-4 provides a map (#14) showing landtypes in the project area, and the table in Exhibit P-7 displays the landtypes and acres within the project area. Refer also to the *Soils* section of this chapter for additional information on landtypes and soils. Most of the project area is within landtypes characterized by soils formed in volcanic ash influenced loess overlying glacial till or residuum. The physical and chemical properties, as well as the nutrient and mineral environment of soils, are derived from the bedrock parent material. Landtypes where limestones, siltites, and argillites are the parent material for the soils occupy over 70 percent of the project area. The soil textures formed from these parent materials, along with the terrain characteristics and relatively lower elevations and precipitation across the project area, create a landscape where more cool and dry growing conditions dominate. These factors have a major influence on the specific plant species and plant communities inhabiting the area, as well as their growth rate, health, and vigor.

Potential Vegetation Groups / Habitat Types

Habitat types are a classification of a forest or grassland site based upon its potential natural vegetation, also called the "climax" forest community that would occur eventually as a result of natural succession. All land areas potentially capable of producing similar plant communities at climax through natural succession are classified as the same habitat type (Daubenmire 1968). Vegetation potential and limitations are described by recognizable potential vegetation groups (PVG), which are groupings of similar habitat types (please see the Flathead Forest Plan). Potential Vegetation Groups display similarity in elevation, aspect, weather, potential natural vegetation, nutrient cycling, successional change, productivity, and fire behavior. Six PVGs occur in the Martin Creek area (Table 3-2). Exhibit P-10 and Maps 16 and 17 in Exhibit P-4 further describe the PVGs and habitat types across the project area.

Table 3-2. Potential Vegetation Groups within the Martin Creek Project Area.

Habitat Types* (Acres)	Acres	% of Total Project Area	Potential Vegetation Group
PSME/VACA (18) PSME/SYAL (28) PSME/VAGL (59) PSME/CARU (81) PSME/LIBO (28) ABGR/LIBO (205)	419	4%	Warm-Dry
ABGR/CLUN (24) THPL/CLUN (1202)	1226	11%	Warm-Moist
ABLA/CLUN (3003); ABLA/MEFE (1728); ABLA/LIBO (1424); PICEA/LIBO (159)	6314	59%	Cool-Moist
PICEA/VACA (7) ABLA/XETE (1297); ABLA/LIBO-VASC (46); ABLA/VAGL (6) PICEA/VACA (120) ABLA/VACA (328)	1804	17%	Cold-Moist
ABLA/ALSI (785)	785	7%	Cold-Dry
ABLA/CACA (44)	44	0%	Riparian
Non-Forest	153	1%	Wet/Dry meadows, Ponds, Lakes

*Habitat type as defined in Forest Habitat Types of Montana, Pfister, et al. 1977.

Natural Disturbance Processes

Wildland Fire

Wildland Fire has historically been a primary disturbance factor influencing vegetation in Northern Rocky Mountain ecosystems. The relative absence of fire for the past several decades has influenced the current condition of the vegetation. Gradually increasing tree densities (especially of lower canopy layers) has occurred, with decreasing diversity of forest canopy cover variation (e.g. fewer open forest stands; denser, closed canopy stands). Higher stand density results in increased stress on individual trees. Increased stress leads to greater vulnerability of trees to insects and disease, exacerbated by the decreased diversity in forest age classes, species, density and structure across the landscape. Early successional tree and understory plant species and those most adapted to regeneration after a fire event have decreased in proportion, while late successional and climax species (Douglas-fir, subalpine fir) have increased. These changes in forest conditions, as well as the influence of other disturbance factors such as timber harvest on the vegetation, are discussed in further detail in the rest of this chapter. Also, the *Fire and Fuels* section of this chapter contains further discussion on historical fire regimes (and how they may have changed in the present time), fire history, and other aspects related to fire and fuels within the project area.

Insect and Disease

Insects and diseases can exert a major influence on forest conditions over time, though they are generally less noticeable than fire or timber harvesting. Their influence on a year-by-year accounting can appear deceptively inconsequential, but over time can cause major shifts in species composition, stand structure, and other forest characteristics by causing mortality to selective stand components. Sometimes their effects can be quick and dramatic, such as during a mountain pine beetle epidemic. Though native insects and disease are a natural component of the ecosystem, their effects, particularly at epidemic population levels may not be a desired condition from a resource management or social perspective. Aerial insect and disease detection flights conducted every year across the Northern Region since the 1960s and site specific field exams are the primary source of data for the following summary of insect and disease conditions in the recent past and presently within the project area. Field visits from a Forest Service entomologist also occurred and contributed to the analysis (Exhibit P-6 and Exhibit P-4, Maps 7 through 10 and 21). The following information focuses on the most prevalent insects and tree diseases that can impact forest vegetation in the Martin Creek area.

Bark Beetles

Bark beetles are native to Montana forests where they attack and kill individual stressed trees and are usually present in endemic or low levels. Endemic populations of bark beetles are common and integral to the functioning of a forest ecosystem. They serve to thin dense stands, create snags in the short term and small openings in the canopy in the long term, add woody material to the forest floor, and provide food for some birds and insects. Bark beetles lay eggs in the inner bark of suitable host trees. As the larvae mature, they feed on tree phloem, often killing the host tree. When environmental conditions are suitable and susceptible trees are abundant, beetle populations can rapidly increase and spread to epidemic or outbreak levels.

The potential for a bark beetle epidemic to occur can be evaluated in terms of risk and hazard. The risk of mortality relates to the population of bark beetles in the vicinity. If bark beetle

populations are high, the risk of mortality to host trees is elevated. To help evaluate risk, annual aerial detection surveys are used to map insect and disease damage with estimates of acres and number of affected trees (USDA Forest Service 2012).

Hazard refers to the susceptibility of a stand to infestation. It is characterized by the amount and condition of breeding and feeding habitat available for beetles. Each species of bark beetle has unique host tree species and certain tree size and stand density requirements. Warm, dry conditions throughout the year contribute to bark beetle hazard by causing stress that weakens the trees. Precipitation during most of the last decade has been below average, causing moisture stress in trees, making them more vulnerable to bark beetles. However, increased precipitation in the last few years should reduce that stress. Entomologists have developed models for rating the ability of a stand to support bark beetle populations (Randall and Bush 2010). At this time, Mountain Pine Beetle is the only beetle species that is actively affecting stands in the Martin Creek area***. Spruce bark beetle*** and ***Douglas-fir beetle*** are less active.

The most effective actions for managing actual or potential beetle infestations are efforts aimed at preventing outbreaks rather than suppressing them (Samman and Logan 2000). Actions may include altering tree densities and species composition to make stands less vulnerable before a disturbance triggers a beetle attack. Once an outbreak occurs, removing infested and susceptible trees is the most effective action to minimize beetle impacts. A less effective strategy for reducing mortality in the short term utilizes pheromones to trap and repel beetles, burning or peeling infested logs to destroy brood, and chemical treatments.

Mountain Pine Beetle (Dendroctonus ponderosae). Mountain Pine Beetle (MPB) is the most aggressive and persistent bark beetle in the western United States and Canada. Besides fire, MPB is the most important agent of change in lodgepole pine forests (Amman, et al. 1977). Lodgepole pine is its primary host in the Martin Creek project area. The adult beetle bores into the bole of the tree, lays eggs in “galleries,” which hatch into larvae that feed on the inner bark. This feeding often kills the tree by girdling it. As a native species, it exists most years at persistent but low population levels. However, MPB is capable of rapidly building up to very high population levels, given favorable forest and environmental conditions. This can overwhelm the trees’ natural defenses and cause large amounts of mortality in the host species. High beetle hazard stand conditions exist when stand age averages greater than 80 years old, average diameters are greater than eight inches, and elevation is less than 6000 feet (Amman, et al. 1977).

Large fire years occurred from 1889 through the 1920s across the Northern Rocky Mountains, favoring widespread regeneration of lodgepole pine, one of the most fire-adapted species in this ecosystem. Many thousands of acres of lodgepole pine originated from those fires, and by the 1970s vast stands of susceptible lodgepole pine occurred across the landscape. This allowed epidemic levels of MPB populations to develop, resulting in high mortality of lodgepole pine. MPB was present and active in the Martin Creek drainage, particularly between 1985 and 1990. The height of the MPB outbreak in the Martin Creek drainage occurred between 1986 and 1988 when there were more than 8000 acres affected.

MPB has again been increasing across Montana over the past decade. Widespread and significant MPB-caused tree mortality has occurred across Montana over the past three to five years. In pure stands of lodgepole pine, most of the trees greater than five inches in diameter when measured at 4.5 feet above the ground (Diameter Breast Height or DBH) are killed

during an outbreak (Sturdevant 2010). Currently there are an estimated 1611 acres of forest in the project area dominated by lodgepole pine, most of which are of a susceptible size. Stands with a lodgepole pine component in the Martin Creek area where assessed using the stand susceptibility rating system created by Amman, et al. (1977); they were assigned a rating of low, moderate, or high. Eight percent of the project area (838 acres) was rated as having a high hazard, five percent of the project area (555 acres) was rated as having a moderate hazard, and 87 percent was rated as having low or no MPB hazard (Exhibit P-6).

Root Diseases

The fungi that cause root diseases are so widespread that they are probably present to some level in soils on every forested site in the northern Rocky Mountain area. Root disease is one of the most damaging groups of tree diseases; causing mortality, wood decay, and growth reduction in host trees. All tree species are susceptible to one root disease or another; however some trees are particularly vulnerable. Douglas-fir is susceptible to a variety of root diseases, with the primary species being *Armillaria ostoyae*, *Phaeolus schweinitzii* and *Phellinus weirii*. Root diseases are attracted to trees weakened by other factors, such as competition, insects/disease, or drought. However, healthy young trees would also be infested and killed on sites where the pathogen exists at high levels. The fungus colonizes the roots or root collar, kills the living material in the tree (i.e. the cambium) and eventually may kill the tree through excessive decay, causing windthrow or girdling. Trees infected by root disease are weakened and, in turn, are often attacked by bark beetles. As trees are killed by root disease, they fall and create small openings in the forest canopy. Grasses, shrubs, and tree seedlings become established in these openings. Root disease persists and would eventually kill the seedlings of species susceptible to the disease; however, seedlings from resistant species also regenerate in these openings and create a mixed species forest. In a natural fire regime, these sites were periodically recycled by fire. Although present, root disease is not causing substantial mortality within the Martin Creek project boundary at this time.

Other Pathogens Affecting the Martin Creek Area

Several other forest pathogens are active in the Martin Creek area. The most common that currently or could potentially affect the forest include needle cast (that primarily affects western larch) and spruce budworm (that defoliates most tree species). Western balsam bark beetle, needle blight, larch bud moth, and fir engraver have been present historically in the Martin Creek area, but have not been active within the last five years. These native species are relatively non-aggressive and have caused only minor overall impact to the forests across Martin Creek within the past several decades. They typically may cause short term loss of growth and vigor, and can cause extensive damage, weakness, or mortality at the site infection, but usually the host would recover and long term or large scale landscape effects are uncommon.

Needle cast and needle blight frequently occurs together because they require similar conditions for infection. Both kill infected needles. Growth loss can result from severe infections particularly if successive years of severe infections occur. Needle cast causes infected needles to be shed within a few weeks of infections. Needles are infected in early spring and continue to re-infect throughout the summer if rainy weather continues. Needle blight kills infected needles quickly (within two weeks of infection) but causes the dead needles to remain attached for one to three years (Hagle, et al. 2003). Over 5000 acres of the Martin

Creek Project area have been affected by needle cast since 2005; 1600 acres in 2011 alone. These higher acres of infection may be attributed to above normal precipitation, which is the major disease vector.

Spruce budworm is native, but not common in the Martin Creek area. However, populations were high throughout western Montana between 2009 and 2011 (USDA Forest Service 2012). In 2009 alone, the Martin Creek project area had 9250 acres affected (Exhibit P-4, Map 9). Spruce budworm larvae eat needles and buds of most conifer trees; their preferred hosts are Douglas-fir and true firs. Spruce budworm outbreaks are cyclic. In most of western Montana, there are usually long periods between outbreaks when no defoliation is detected. 2012 aerial detection surveys showed a marked decrease in spruce budworm infection rates with only 360 acres of the project area affected.

Windthrow

Evidence of windthrow of individual trees, small clumps, or larger patches can be found throughout the analysis area. Trees on ridgetops and adjacent to openings are particularly susceptible to windthrow. Windthrown trees contribute to the large down wood that is valuable for ecological process such as soil building, nutrient cycling, and wildlife habitat. Large amounts can increase fuel loading to very high levels.

Human Disturbances

Land use patterns on the Martin Creek landscape have been timber production and harvest since the late 1950s. This was initiated by the spruce bark beetle epidemic. Road building and salvage harvest continued into the 1980s in response to heavy mortality from mountain pine beetle (Exhibit U-4).

Currently, there is a mosaic of forest structure across the Martin Creek landscape, ranging from seedling stands to multi-storied old growth. This mosaic occurs as a result of natural disturbance processes and of timber management. Approximately 50 percent of the area has had some level of harvest activity and reforestation, distributed in relatively small patches across the landscape. Most of these patches are less than 40 acres in size. The vast majority of timber management in the last 50 years has been even-aged, regeneration harvest, such as clearcutting, seed tree, and shelterwood treatments. Those harvests and associated road construction substantially influenced stand structure and fuel levels today. Table 3-3 below displays past harvest by decade. Map 4, Exhibit P-4 shows location of these harvest areas.

Reforestation

On NFS lands, reforestation in previously harvested stands has been successful. The National Forest Management Act of 1976 included requirements to assure forestlands meet reforestation objectives within five years after final harvest. A query of the FACTS database (see Exhibit P-12) shows all previous regeneration harvests within the Martin Creek Project Area have been or are progressing towards being successfully stocked. Forest Plan Monitoring Reports indicate the Flathead National Forest is consistently successful at regenerating stands after harvest in the desired timeframe and with the desired number and species of trees (Exhibit P-8). The Forest Plan monitoring report, Item #39, indicate the forest is very

Table 3-3. Past Timber Harvesting and Precommercial Thinning.

Harvest Type	Harvest Decade						
	1950-1959	**1960-1969**	**1970-1979**	**1980-1989**	**1990-1999**	**2000-2009**	**Total Acres**
Stand Clearcut	132	617	271	339	66		**1425**
Stand Clearcut (w/ leave trees)					6	44	**50**
Seed-tree cut (w/res)					550	79	**629**
Seed-tree Seed Cut (with and without leave trees)		181	639	282	40		**1142**
Shelterwood cut (w/res)			22		44	529	**595**
Shelterwood Establishment Cut (with or without leave trees)			129	36	2	41	**208**
Liberation Cut		334	504	24			**862**
Special Products Removal					42		**42**
Sanitation (salvage)			97	13			**110**
Group Selection Cut			207				**207**
Commercial Thin						43	**43**
Natural Changes (excludes fire)	19						**19**
Patch Clearcut			19				**19**
Single-tree Selection Cut			43				**43**
Total Acres	**151**	**1132**	**1931**	**694**	**750**	**736**	**5394**
Precommercial Thinning*		259	410	541	896	100	**2206**

*Precommercial thinning is also known as sapling thinning.

successful at regenerating stands after harvest, with stands certified stocked an average of 2.9 years after harvest (Exhibit P-8). Since 1968, approximately 2443 acres regenerated naturally, 137 acres were seeded, and about 1196 acres were planted within the Martin Creek area. There are no regeneration failures and all stands meet the reforestation objectives by progressing toward certified stocked.

Existing Forest Vegetation Condition

Forest Age and Size Classes

Forest or stand structure refers to the mix and distribution of tree sizes, canopy layers, and ages in a forest. It is a function of disturbance and plant succession. Successional stages are developmental stages of a forest and can be described in terms of forest structure. Amendment 21 to the Flathead Forest Plan divides vegetative structure into early-, mid-, and late-seral successional stages. For the Martin Creek analysis, size classes, instead of seral stage, will be used to describe forest structure as displayed in Table 3-4 and described in the following paragraphs. As with the classification of species, the values for forest size classes represent the most dominant size (either by basal area[1] or trees per acre), as opposed to an average value. Nearly all stands have trees in a variety of size classes and sometimes age classes as well. These different classes often occur as a smaller (but not always younger) understory

[1] Basal area is the cross-sectional area of all tree stems in a stand measured at breast height, and is a common measure of stand density, particularly for stands past the sapling stage of development.

tree layer beneath the main canopy layer of the stand, and/or as a scattered larger, older overstory tree layer.

Age and size of trees are obviously interconnected closely: as trees get older they also grow larger in height and diameter. However, it is not always a tight correlation. Height is influenced primarily by site and soil productivity, but diameter growth is more strongly affected by stand density and degree of competition for limited water, nutrients, and light. Very old trees (i.e. greater than 170 years old) may be quite small diameter (i.e. less than nine inches DBH) if they have been growing in high density stand conditions for much of their life. Vice versa, trees may reach large sizes at relatively young ages if they are on productive sites and have a low level of competition with other trees for available water, nutrients and sunlight.

Table 3-4. Acres and Percent of Dominant Forest Size Classes.

Dominant Forest Size Class	Acres	Percentage of Area
Non-Forest	154	1%
Seedling/Sapling (<5” DBH, typically 5 to ~30 feet tall)	3188	30%
Small Tree (5-9.9” DBH, typically 35-70 feet tall)	2746	26%
Medium Tree (10-15” DBH, typically 60-80 feet tall)	2357	22%
Large Tree (>15” DBH, typically 70-90 feet tall)	2301	21%
Total Acres	**10,746**	**100%**

The size classes used for this Martin Creek analysis do not correspond to those used for UCRB, so cannot be directly compared. However, rough comparisons were made using a general relationship between current Martin Creek size classes and historic conditions for UCRB ESR 19 structures (Exhibit P-11).

Seedling and sapling size classes represent the early-seral successional stage of forbs, grasses, shrubs, tree seedlings, and saplings. Under natural disturbance regimes (mainly large-scale fire), at any point in time the amount of area in a seedling or sapling stage of forest development could range from about five to 70 percent. The historic mean is about 20 percent. Currently, the seedling and sapling classes cover about 30 percent of the Martin Creek area.

The ***5 - 9.9 inch DBH (pole) size class*** represents a mid-seral successional stage. It includes stands of small size trees with average diameters ranging from five to ten inches. Many trees in this class are usually at lower risk from natural disturbances, such as insects, diseases, windstorms, or severe fires. However, lodgepole pine stands in this class can be very susceptible to mountain pine beetle. Historically, this structure class covered from about four to 60 percent of the Martin Creek and similar landscapes, with an average of about 31 percent. It currently covers about 26 percent.

The ***10 - 15.9 and 15+ inch (large) size classes*** represent the late-seral successional stage and consist of middle-aged to mature forests with most trees greater than ten inches DBH. In these stands, stand development begins to slow down creating some stability for a time. This stage contains medium and large sized trees with both single and multi-layered canopies that can be more susceptible to natural disturbances. Old growth conditions can develop during this stage (Green, et al. 2005). Large live trees, large snags, and downed logs become abun-

dant enough to provide habitat for a variety of old growth associated fauna. Together, they cover 43 percent of the Martin Creek landscape, which is close to the historic average of about 37 percent. The 15+ inch class by itself currently covers approximately 21 percent of the area, which is nearly the same as the historic average.

The ***nonforest*** class includes lakes, shrub-dominated wetlands, and rocky areas that do not support more than scattered trees. Together these classes cover only one percent of the Martin Creek area, which is well within the range of variation for ESR 19.

Patch Metrics

Patch metrics based on R1 VMP or stands cannot be accurately compared with the UCRB analysis, so the patch analysis described below for ESR 19 is not specific to the Martin Creek area. However, the current patch size of seedling/saplings in the Martin Creek area can be compared with the historic range for ESR 19 because the seedling/sapling size class corresponds reasonably well with the stand initiation structure stage used for the UCRB analysis.

Current patch size and density for most size classes/structural stages are different from historic conditions in ESR 19, reflecting more fragmentation from timber harvest, roads, and other development and less mixed severity fire disturbance. Patch size (in acres) is lower than historic for all structural stages, particularly the stand initiation stage. Patch density (number of patches per 10,000 acres) is relatively similar to the historic for all structural stages. This is due to the distribution of harvest units; adjoining regeneration harvest units are creating fewer patches. See Exhibits P-11 and P-4, Map 13.

Forest Cover Types

Forest cover type refers to the dominant tree species that currently occupy a forested area (Helms 1998). Nearly all forest stands are composed of more than one tree species in a myriad of different proportions. To facilitate the analysis process, the determination of forest cover type for the Martin Creek project analysis considered only the more dominant species in the stand, consistent with the R1 VMP method and codes. Table 3-5 displays the cover types present within the project area. Following the table is a description of the cover types. Refer to Exhibit P-4 for a map (#19) showing these cover types and Exhibit P-5 for a definition of these cover types.

Western larch and the shade intolerant species mix is the dominant cover type on nearly 40 percent of the project area. The Engelmann spruce/subalpine fir/shade tolerant species mix is the next most abundant cover type, at 31 percent, followed by the lodgepole pine and Douglas-fir groups at 15 and 14 percent, respectively. The remainder two percent of the project area is grand fir and non-forested area.

The current amounts of forest cover types (dominance type) in Martin Creek are all within the historical range and most are close to historical means for ESR 19. The proportion of western larch is near the high end of the historical range. The amount of spruce, subalpine fir, Douglas-fir, and non-forest (shrubs and grasses) are nearer the low end of the historical mean.

Table 3-5. Acres and Percent of Forest Cover Types in the Martin Creek Project Area.

Cover Type	FT Description (Acres)	Total Acres	Percentage of Area
PSME, PSME-IMIX, PSME-TMIX	Douglas-fir	1497	14%
LAOC, LAOC-IMIX, LAOC-TMIX IMIX	Western Larch (2475) Shade Intolerant Species Mix (1691)	4166	39%
ABLA, ABLA-IMIX, ABLA-TMIX PIEN, PIEN-IMIX, PIEN-TMIX THPL-TMIX TMIX	Subalpine fir (1089) Engelmann spruce (1135) Western Red Cedar (13) Shade Tolerant Species Mix (1025)	3262	31%
PICO, PICO-IMIX, PICO-TMIX	Lodgepole Pine	1611	15%
ABGR-TMIX	Grand fir	56	1%
NF	Non-Forest (Private & Water)	154	1%
Total Acres		**10,746**	**100%**

Western Larch and Shade Intolerant Species Mix

Western larch plant communities are considered at risk in the Northern Rockies Zone (from the Northern Region Overview, USDA Forest Service 1998a). Larch is an important component of stands in the project area, contributing to stand species and structural diversity and providing the large, old trees – and once dead providing large, very long lasting snags – that are utilized by many wildlife species as feeding or nesting habitat.

Fire plays a primary role in establishment and perpetuation of the western larch communities, thus fire suppression and/or changes in fire patterns and intensity can have profound effects. Since larch is less drought tolerant than ponderosa pine or Douglas-fir, it is restricted to somewhat more moist sites, which historically had a more mixed severity fire regime. It is one of the most fire resistant species across its range, due to its thick bark with low resin content, high and open branching habit, low flammability of its foliage, and low duff/litter volumes. It is very long lived, and tolerant to most insects and diseases, thus is able to maintain its presence within a stand and on the landscape for many decades, often centuries. It is very shade intolerant and requires high amounts of light to survive and grow. It is readily outcompeted in situations with even light tree or shrub cover, such as would occur in undisturbed or only lightly or moderately disturbed forest conditions. It also is more dependent than other species, particular Douglas-fir, subalpine fir and spruce, on mineral soil conditions for seed germination and seedling establishment.

Western larch is fairly wide spread across the analysis area; the dominant species on about 4166 acres, or 39 percent of the analysis area. Most of the stands (nearly 70 percent) where larch is the dominant species are less than 50 years old and are past regeneration harvest units (clearcuts, seedtrees, or shelterwood cuts). The very open stands and mineral soil exposure that was created by these harvest methods is very favorable to larch regeneration and growth. In the remaining stands where larch dominates, and in most of the stands where larch is a co-dominant or minor species, it typically occurs as a light to moderately stocked overstory layer of trees, usually larger and older than other trees within the stand. Most often the mid and

understory trees in these stands are Douglas-fir and sometimes lodgepole pine, and on the more moist sites subalpine fir. Larch tends to be less common in these younger understory layers. This structure and species composition suggests that in the more distant past (i.e. greater than 150 years ago) broad portions of the analysis area experienced relatively high intensity fires in patches of varying sizes, creating conditions where larch was able to establish and thrive. However, since then fires have more often been of low or moderate intensity or lacking altogether, creating conditions where other species were more successful and dominated the site.

Subalpine Fir, Engelmann Spruce, Grand Fir, and Shade Tolerant Mix

These groups are similar enough to be discussed together. They have a mix of primarily Engelmann spruce and subalpine fir, with lesser amounts of lodgepole pine, Douglas-fir, and/or western red cedar. This type occupies moist sites, stream bottoms, and basins characterized by accumulation of cold air at all elevations. The lower elevations have more spruce; the higher elevations are dominated by subalpine fir. Most of the stands within this group are larger, older forest with nearly 70 percent of them more than 100 years old. These stands have two or more age and size classes and many stands have old growth or near old growth characteristics (Green, et al. 2005). Stands where subalpine fir, Engelmann spruce, or shade tolerant mix is dominant occur across approximately 3262 acres or 31 percent of the analysis area. A shade tolerant classification is given to the stands where intolerant species account for less than 50 percent of total stocking, and no one species is greater than 40 percent of stocking. Shade tolerant species include Engelmann spruce, subalpine fir, western red cedar, and grand fir.

These species compete best on cool, moist sites; however subalpine fir and spruce occur as minor species within most other stands and are the indicated climax species on these sites. Subalpine fir and spruce are shade tolerant and relatively slow growing, compared to associated conifer species. They are very intolerant of fire, due to their very thin resinous bark and dense crowns that often extend to the ground. Even low severity fires will readily kill trees of all sizes. However, once established on a site, their tolerance of shade will allow them to persist for many decades, growing slowly under neighboring lodgepole. If and when the overstory trees die; due to disease, insects, windthrow, etc.; they are ready to capitalize on the increased light and grow into the upper canopy layers.

Lodgepole pine

Lodgepole pine, similar to larch, is very well adapted to fire disturbances. Not only can it sometimes survive low intensity ground fires, it also can produce serotinous cones (sealed by a resinous bond). These cones persist on a tree for decades, opened only by intense heat such as produced in a fire, and then seeds cover the site by the millions, often overwhelming any other tree species that may be present.

Stands where lodgepole pine is dominant occur across approximately 1611 acres, or 15 percent of the analysis area. Just over 40 percent of lodgepole pine dominated stands are less than 50 years old and are regeneration from past logging. Most of the remaining stands where lodgepole is a component are from 80 to 150 years old. Older stands where lodgepole dominates are concentrated on the cooler, moist sites near Martin Divide. These are stands that established in areas that burned at higher severity in approximately 1889. Some stands have other species, including larch, Douglas-fir, subalpine fir, and spruce. Most are mid-successional with subal-

pine fir, spruce, and/or Douglas-fir replacing the lodgepole pine as it dies and falls. These stands are changing into the shade tolerant cover type.

Historically, these stands become susceptible to mountain pine beetle after about 80 years (Amman and Cole 1983). These stands are now over 100 years old and many lodgepole pines that survived the mountain pine beetle outbreak in the 1980s have grown enough to become susceptible. Based on fire scar sampling in the Good Creek drainages of the Tally Lake Ranger District, the interval between fires in the mixed-severity regime is correlated to the susceptibility of stands to mountain pine beetle occurrence; i.e., the longer the interval between fires, the more susceptible a stand is to mountain pine beetle attack.

Douglas-fir

Douglas-fir is the dominant species on only about 1500 acres or 14 percent of the analysis area, where it comprises more than 40 to 60 percent stocking. Although not dominant, Douglas-fir is a component of most stands in the project area; it is most often found in association with other species (typically larch and lodgepole pine). This widespread distribution reflects its ability to compete well with associated species across a wide range of site conditions (particularly drier sites) and under the conditions created by past disturbances or lack thereof (e.g. partial cutting, mixed severity wildfire, and fire suppression activities). It is more shade tolerant and more successful than other early successional species, specifically larch and ponderosa pine, at regenerating under conditions of partial canopy cover, as well as deeper litter or duff layers, and competing grass or other vegetation. Therefore, mixed severity fire or partial cutting practices favor the establishment and growth of Douglas-fir over more light-loving species, such as larch, lodgepole pine, or ponderosa pine. However it is more vulnerable to fire damage and mortality than either larch or ponderosa pine, due to its low branching habit (particularly in more open grown conditions); relative lack of self-pruning; small buds; denser, more flammable foliage; and shallow rooting habit (Harrington 1990).

Douglas-fir has probably historically been a very common species in the Martin Creek landscape because of the mixed severity fire regimes, local site conditions, and the species' characteristics. However, it is also likely that recent human actions (or inactions) have altered the conditions of some of the Douglas-fir forests, particularly fire suppression and some timber harvest practices. Over 60 percent of the Douglas-fir dominated stands in Martin Creek are more than 100 years old.

Non-Forest Sites

There are very few naturally non-forest (less than 10 percent canopy cover) areas within the analysis boundary. Non-forest areas are primarily riparian (lakes, wetlands, and ponds) and private land (meadows/development). Stands where Non-forest is dominant occur across approximately154 acres or less than one percent of the analysis area.

Forest Canopy Cover

Table 3-6 below and Map 12, Exhibit P-4 display the proportion of forest canopy cover classes in the analysis area. Forest canopy cover reflects the amount of ground overlain by tree canopies as if viewed from directly overhead, and considers all size classes of trees in the

determination. It is used as an assessment of tree density. It also provides information of how fully a site may be occupied by trees versus other types of plants. The degree of tree canopy cover will influence the amount of light that reaches the ground and thus can affect understory plant abundance, vigor, and species. Generally, stands with greater than 40 percent canopy cover would be considered relatively dense with closed forest canopies. A very dense forest canopy, where very little light reaches the forest floor, would typically be in greater than 60 percent canopy cover. Stands in the 10 to 25 percent range are very open canopied forest, where substantial distance exists between tree crowns. Stands in the 25 to 40 percent canopy cover range would appear semi-open, sometimes with clumpy distribution of trees interspersed with small openings. Stands with less than 10 percent canopy cover are considered non-forest.

Table 3-6. Acres and Percent of Forest Canopy Cover in the Martin Creek Project Area.

Canopy Cover	Acres	Percentage of Area
<10%	154	1%
10-25%	1799	17%
25-40%	1313	12%
40-60%	3893	36%
>60%	3587	33%
Total	**10746**	**100%**

Nearly all of the analysis area is in a forested condition; the majority well stocked with trees (greater than 25 percent canopy cover). All of the more open canopy forests (less than 25 percent canopy cover) are stands that were harvested and are now in early stages of succession, in a seedling or sapling size class. As they grow, barring any disturbance (such as fire or thinning treatment), they would become taller and their crowns would eventually expand and interconnect, progressing towards a closed canopy forest.

The canopy cover classes used for the Martin Creek vegetation analysis do not correspond to those used for UCRB, so cannot be directly compared. However, rough comparisons were made using a general relationship between current Martin Creek canopy cover classes and historic conditions for UCRB ESR 19 structures (Exhibit P-11). Very open (10 to 25 percent) and relatively dense (greater than 40 percent) canopy cover stands had values that were nearly identical to the historical mean. The only substantial difference between historic and current conditions was in regards to the non-stocked areas (crown cover less than 10 percent). Historically, this canopy cover accounted for nearly 12 percent of the watershed, where as it accounts for only 1 percent of the Martin Creek watershed today. The exclusion of wildfire is likely the leading cause for this decrease.

Environmental Consequences

Introduction

This section describes the effects on forest vegetation from implementation of the alternatives as described in Chapter 2. The potential effects described below are the result of analysis based on research, field data, monitoring, experience, and best professional judgment of the

silviculturist and others on the interdisciplinary team and professional community. The direct and indirect effects are those on NFS lands, in and immediately adjacent to the treatment areas. The cumulative effects are described for the whole analysis area, including private lands. The effects on vegetation are discussed as changes over time for each forest attribute. Effects from the treatments proposed in the action alternatives relate to changes in:

- stand density, species composition, and canopy cover
- stand structural elements (snags, down wood debris, vegetation)
- potential for mortality from insects and diseases

Stand Groups

All stands in the analysis area were grouped based on their dominance type and size class (structure); please see the following table for these groupings. Stands within a group are expected to respond similarly to succession, natural disturbance, and management. Grouping by these stand characteristics allows a more simplified landscape and stand level analysis than had every stand been discussed individually.

Table 3-7. Description of Stand Groups for Silviculture Analysis.

Stand Group	Dominant Species	Other Species
Mixed Tolerant	AF, ES	WRC, GF, WL, DF, LP
Larch and Mixed Intolerant	WL, DF, LP	AF, ES, WP
Lodgepole	LP	WL, DF, AF, ES, WP
Douglas-fir	DF	WL, LP AF, ES

Direct and Indirect Effects of Alternative A (No Action)

Alternative A (No Action) provides a baseline for comparison of effects from the action alternatives. The effects of Alternative A represent potential natural changes over time.

There would be no immediate effects on vegetation and natural processes such as growth and mortality would continue over time. Successional change and disturbance are the basic processes in species composition, structure, and function of plant communities. In a simplified model of forest succession, the forest progresses through stages; described as early-seral, mid-seral, late-seral, and old growth.

If this alternative were selected, no new timber harvest, thinning, prescribed burning, associated weed control, or watershed, wildlife habitat, trail, or road improvements would occur at this time on NFS land. Forest Service policy to suppress wildland fires would continue. Assuming fire suppression and no harvesting would occur, live and dead fuel would accumulate leading to more stand replacement fires where mixed-severity fires historically occurred. This would shift the species composition to more shade tolerant trees and increase the probability of mortality to large old trees that have survived numerous fires.

Without treatment in lodgepole pine stands, the potential for a mountain pine beetle infestation would increase in the next 20 years as these stands age well beyond 80 to 100 years (McGregor and Cole 1985). Very dense lodgepole pine stands would become or remain stagnant with low vigor. Total stand mortality would exceed growth. In the absence of a

mountain pine beetle infestation or fire, species composition would gradually shift and would continue to shade-tolerant species as "understory reinitiation" (Oliver and Larsen 1996) occurs. Understory reinitiation refers to the trees that establish underneath an existing forest canopy.

The Douglas-fir, larch, and shade intolerant mixed conifer stands in the early and mid-seral stages of succession would differentiate over time, forming a multi-layered forest. Natural thinning would eliminate some of the overstory shade-intolerant tree species, and the understory would contain one or two layers of shade-tolerant tree species, such as subalpine fir, grand fir, spruce, and Douglas-fir. Extended periods with dense conifers and no natural disturbance would cause herbaceous and shrub species to decline. In the late-seral and old growth stages, shade tolerant regeneration would occupy more of the stand until they dominate; leaving only a few remnant intolerant trees in the overstory. Down wood would accumulate as trees die and fall. The larger pieces would rot slowly and be relatively fire-resistant, providing important structures for wildlife, soil processes, and other functions. The smaller material would continually add to the fuel bed.

In the shade tolerant mixed species stands, species composition would remain similar over time. Lodgepole pine would disappear in the mid-seral stage of succession, and subalpine fir and other tolerant trees species would dominate. Taking no action (Alternative A) would result in increased physiological stress and the potential for extensive tree mortality by a variety of insects and diseases (Arno, et al. 2000). In mid- to late-seral types, root disease and associated bark beetles would likely increase. Elevated levels of western balsam bark beetle, fir engraver, and spruce bark beetle would probably continue and expand as subalpine fir and spruce age. For the time period of this analysis, mid- and late-successional stage stands would largely remain the same in terms of their overstory and understory species composition and average size.

Sapling thinning, also known as precommercial thinning, would not occur with the No Action Alternative, resulting in dense mixed species stands that would stagnate at worst or grow well below site potential over the next ten to 50 years. Differentiation in growth of individual trees would be delayed indefinitely or extended substantially. It would take longer for these presently young stands to grow into large trees, increasing the amount of time until one or more of the attributes of old growth are realized. The return on the reforestation investment in the current stands would diminish due to the delayed time until merchantable wood products are removed. The ability to control species composition and future insect and disease outbreaks would be forgone. In stands with western larch, most of the planted larch trees would be suppressed by competition from other trees. The fuel loading and fire risk would increase with dense crowns and ladder fuels as the stands develop. The opportunity to shift the fire regime to a mixed severity, or non-lethal type with fire resistant overstory trees, would be lost or delayed.

As mentioned in the Affected Environment section above, hazard and risk factors suggest a high potential for continued mortality from mountain pine beetle. Even with apparently stable or decreasing bark beetle populations and effects of drought decreasing, it is reasonable to anticipate additional mortality if no action is taken.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

All action alternatives would have short and long term effects on the vegetation within the proposed treatment areas. The proposed treatments are similar between Alternatives B and C; though the acres of treatment (size) and shapes of treatment units are different.

The amount and distribution of trees retained in the overstory (stand density) varies by treatment type and the existing stand condition. See Chapter 2, Table 2-1 for a brief description of the retention levels and stand densities for the various treatment types proposed.

Effects by Treatment Type

The following sections describe the effects of vegetative management treatments proposed by the action alternatives. Regeneration treatments that shift stands to different species composition, stand structure, and density have the most effects. Table 3-8 presents approximate acreages of the various vegetation management treatments that are described in this section.

Table 3-8. Acres of Vegetation Management Treatments for Alternatives B and C.

Treatment	Alternative B	Alternative C
Total timber harvest acres	868	460
- Commercial Thinning	264	357
- Shelterwood	272	40
- Seed Tree	277	63
- Clearcut	55	0
Total Sapling Thinning	564	297
- Research Sapling Thin	226	226
- WUI Sapling Thin	267	0
- WP Sapling Thin	71	71
Vegetation Management Total Acres	**1432**	**757**

Commercial Thinning. Alternative B would commercially thin 264 acres and Alternative C would thin 357 acres. Canopy cover would be changed by treatment; size class and dominance type may also change. The amount and distribution of trees retained in the overstory would be the same between alternatives.

The commercial thinnings would retain 50 to 150 medium and large-sized trees per acre. Thinning would select the healthiest trees with large, well-formed crowns for leave trees. These trees would then have more growing space, light, nutrients, and water to allow them to develop into large, mature overstory trees. The leave trees would generally be the largest, healthy larch and Douglas-fir, with larch being preferred. Ponderosa pine and western white pine would also be retained where they occur. Some commercial thinnings are proposed in stands dominated by lodgepole pine or shade tolerant trees; these species would be retained along with any healthy larch, Douglas-fir, ponderosa pine, or white pine to meet stocking objectives. In most units, some seedlings and saplings would be left to provide species and structural diversity. These would generally be vigorous, healthy larch, Douglas-fir, ponderosa pine, or white pine. They may be left as scattered individuals or in small groups. Thinning

would encourage growth and discourage potential losses from insects, disease, and fire, thus offering options for future management.

The thinned stands would be more open, with a greater proportion of larch and Douglas-fir and less subalpine fir, grand fir, spruce, and lodgepole pine than currently present. They would be more resistant to a stand-replacing fire and better able to survive a ground fire. Wider spacing and less lodgepole pine, Douglas-fir, and subalpine fir would reduce the risk of bark beetle epidemics. Commercial thinning would not occur in areas with active root disease, where stands are under-stocked due to high levels of mortality, or in stands vulnerable to blowdown.

Thinning would increase the average diameter of these stands by removing the smaller trees and leaving the larger, healthier trees. In some stands, this would change the structural class. Without a major fire, most of these thinned stands would develop into stands dominated by larch and Douglas-fir with minor amounts of spruce, subalpine fir, grand fir, and lodgepole pine. Eventually, subalpine fir, spruce, and Douglas-fir regeneration would occur forming multi-layered stands.

Commercially thinned stands generally would not require reforestation, nor is it an objective. Fully stocked stands would remain after harvesting. However, shade tolerant species such as subalpine fir, grand fir, Douglas- fir, spruce, and possibly western hemlock can be expected to regenerate in these stands. They would contribute to long-term management objectives for structural diversity. They would also contribute to ladder fuels and stand densities that detract from hazardous fuel management. Logging and fuel reduction activities, as well as pile burning, would create a seedbed for shade-tolerant and intolerant plants. Conifer regeneration would vary by stand.

Regeneration Harvest Using Shelterwood, Seed Tree, and Clearcut Methods. Table 3-8 above displays the acres that would be harvested using the shelterwood, seed tree, or clearcut methods. All units would change to seedling stand structure, shade intolerant species cover types, and low canopy cover.

Shelterwood, seed tree, and clearcut harvest methods would create a new stand of trees, changing them from pole and large tree structure classes to early-successional seedling stage. The species composition would also change. Fewer shade tolerant trees would occupy the site and shade-intolerant trees would dominate for at least 20 to 50 years.

Increasing the proportion of larch and Douglas-fir in a stand would reduce the potential for future bark beetle infestations and root disease spread because mixed species stands with a higher proportion of these more resistant tree species would be less susceptible to those pathogens.

Shelterwood, seed tree, and clearcut treatments would resemble the effects of stand-replacing and mixed-severity wildland fires, except that harvesting leaves fewer snags and the reserve trees can be selected and left alive. There would be no assurance that any live trees would be left should a wildland fire occur. Also, with harvest, much of the wood would be physically removed rather than partially volatilized.

Tree species removed using these three methods would be lodgepole pine, subalpine fir, grand fir, spruce, Douglas-fir, and, to a lesser degree, larch. Large Douglas-fir may be

removed if they are infested with bark beetles or recently dead and not needed to provide adequate amounts of standing or down dead wood. The harvested trees would provide forest products such as sawlogs, plywood peelers, house logs, pulpwood, posts and poles, or firewood.

The shelterwood method would retain ten to forty medium and large-sized trees per acre. The seed tree method would retain five to twenty of the largest, phenotypically best, and windfirm trees. Species and numbers of trees retained after harvest would vary by cover type and tree size. The retained trees would generally be the largest, healthy larch and Douglas-fir. Ponderosa pine and white pine would be retained where they occur. In stands dominated by lodgepole pine or shade tolerant trees, some trees of these species may also be left. In addition to offering structural and species diversity, the retained trees would provide snag replacements, genetic reserves, aesthetics, shade, seed sources for the new stand, and future management options. In the event of blowdown, the trees would be left to become woody debris. In shelterwood stands with more than 20 leave trees per acre, an overstory removal harvest may be scheduled when the regeneration is established in ten to 20 years. This harvest would remove some leave trees to reduce shading and competition on the regenerated saplings.

The clearcut method would leave few or no live trees (less than ten trees per acre). This method is typically applied where there are no or few suitable leave trees or the trees that could be left are not desirable seed trees. The one stand proposed for clearcutting is nearly pure lodgepole pine that is more than 100 years old. This stand is in the north end of the project area. There are many trees dead or down from older mountain pine beetle attacks and windthrow. The only trees that would be left after harvest are any larch or Douglas-fir that may be present and/or some larger lodgepole pine snags or live snag replacements.

In most regeneration harvest units, some seedlings and saplings would be left to provide species and structural diversity. These would generally be vigorous, healthy larch, Douglas-fir, ponderosa pine, lodgepole pine, white pine, and/or spruce. They may be left as scattered individuals or in small groups.

Windthrow risk would increase in treated and adjacent stands. Douglas-fir, spruce, and subalpine fir are the most susceptible to windthrow and breakage, especially in small-diameter trees in dense stands that are opened by harvest. Most windthrow would affect individual trees and can be mitigated somewhat by locating reserve trees and unit boundaries in less wind-prone areas. Although windthrow is not an objective, the scattered down trees would add to the accumulation of large woody material for soil and wildlife habitat.

Down logs would be retained to provide habitat, nutrient cycling, and other ecosystem functions. Between five to 25 tons per acre of the largest available down logs greater than nine inches in diameter would be left. Down wood requirements could be achieved with material less than nine inches in diameter; however, this smaller wood is less effective in meeting fuel reduction and wildlife objectives. Lesser amounts of woody debris would be left on dry sites, areas with smaller diameter trees, and sites close to private lands. Greater amounts would be left on more mesic sites and areas farther from private land. Refer to the *Snags and Downed Wood Habitat* section and the *Soils* section for retention requirements. Excess fuels from logging slash, existing dead and down trees, and ladder fuels would be reduced by chipping,

masticating, excavator piling with subsequent pile burning, broadcast burning, or a combination of these treatments.

Site Preparation and Reforestation after Shelterwood, Seed Tree, and Clearcut Harvest. All shelterwood, seed tree, or clearcut harvest units would be regenerated from seed provided by onsite seed trees (natural regeneration) or supplemented with transplanted seedlings (artificial regeneration). The species selected to regenerate each stand depends on the PVG, species and condition of retained or adjacent seed trees, proximity and level of existing disease (dwarf mistletoe and root disease), and type and degree of site preparation. The objective would be to have less than 40 percent of the regenerated trees be Douglas-fir or lodgepole pine. The remainder would be larch, ponderosa pine, western white pine, spruce, and subalpine fir. This would provide a greater diversity of vegetation species and genetic material than would be expected if unmanaged. Table 3-9 outlines the type of regeneration planned for the action alternatives.

Table 3-9. Acres of Reforestation after Regeneration Harvest by Alternative.

Type of Reforestation	Alternative B			Alternative C		
	Shelterwood	Seed Tree	Clearcut	Shelterwood	Seed Tree	Clearcut
Plant	227	254	0	40	63	0
Natural	44	23	55	0	0	0
TOTAL	**271**	**277**	**55**	**40**	**63**	**0**

Site preparation for reforestation would require fuel reduction and scarification of the forest floor, either mechanically, by broadcast burning, or with hand tools. Successful regeneration of conifers is dependent on this process to reduce competition for sunlight and to expose mineral soil for natural regeneration or facilitate hand planting.

Fuel reduction and site preparation would be accomplished in most units by first yarding treetops and branches with the tree as it is removed (referred to as whole tree yarding) to reduce the amount of fuel to be treated in the units. Slashing would remove suppressed or damaged understory tree species that would not grow sufficiently after removing the overstory. The residue in excess of desired woody debris would then be piled with an excavator, chipped, or masticated on site. This process would also scarify the ground. Piles would be burned when fire hazard and risk of spread is low.

In stands with slopes too steep for an excavator, whole tree yarding, yarding unmerchantable material, or underburning would accomplish the fuels reduction and site preparation. In parts of units too steep for excavators and not compatible with burning, hand scalping the planting sites with no other scarification would occur.

Grasses, forbs, and existing shrubs would still inhabit the site the first year after site preparation. Conifer seedlings and new shrub sprouts would likely regenerate a year or two later. Natural conifer tree regeneration from seed trees would vary by stand. Where planted, trees would include one- or two-year-old seedlings. Seedlings are expected to be well established three to five years after regenerating. After several decades (60 to 100 years) the stands would consist of mature, mixed conifer trees.

Precommercial Thinning (Sapling Thinning). Table 3-8 above displays the acres by type for units proposed for sapling thinning, by alternative.

Both action alternatives propose sapling thinning in stands with a western white pine component. In those stands, totaling 71 acres, thinning would be to specifically create space or "daylight" around planted white pine trees and no thinning would occur in parts of the stands without white pine.

Both action alternatives propose sapling thinning in four stands totaling 226 acres for potential research on lynx/hare habitat requirements. These stands are western larch dominated and would only be thinned if used for a research study or studies that are financed from the Forest Service research budget or administrative studies financed from the National Forest System budget.

Alternative B includes 267 acres of sapling thinning within the Wild Urban Interface (WUI). This thinning would generally remove only seedling- and sapling-sized trees (two feet tall to five inches DBH). Most trees are ten to 25 feet tall and 15 to 50 years old. Stand density ranges from 500 to over 5000 trees per acre. Stand density after thinning would range from 200 to 400 of the largest and most vigorous trees of all species. Most of these stands would still function as early successional; the older stands with larger leave trees would be considered mid-successional. Thinning would help achieve the desired species composition and greatest possible diameter growth by leaving western larch, Douglas-fir, western white pine, and ponderosa pine; where available. A mix of lodgepole pine, spruce, and subalpine fir would also be left where they are a dominant species component.

The structure (size) class would likely shift from 1.0 to 4.9 inches to 5.0 to 9.9 inches DBH after sapling thinning in all units; the average diameter would increase by removing smaller trees. In most units, the cover type would remain as is or shift to larch dominated mixed species by reducing the proportion of lodgepole pine or spruce. Canopy cover would be reduced in all stands. The range or canopy cover group would not change except for in very dense stands with greater than 40 percent cover that would be thinned to less than 40 percent cover. The canopy cover is a function of tree spacing and tree size. As these small trees grow over the next 50 years, the canopy cover would increase. Meanwhile, in the more open stands, competition would be reduced thus allowing the trees to maintain vigorous growth rates.

Up to half of the shrubs may be cut where they have become decadent and difficult for wildlife to browse. Cutting shrubs would stimulate sprouting and growth from the base. Where shrubs are very dense, competition could be reduced providing the conifers additional light, water, and nutrients for several years. By the time the shrubs reach competitive heights and densities, the trees would be taller, vigorous, and beginning to shade the shrubs.

Thinning would generate slash consisting of fine, highly flammable fuels for a period of up to five years. To reduce the potential for wildland fire to spread to or from private property, most thinning slash adjacent to private property would be piled and burned to create a fuel break. This would not affect the tree growth of leave trees.

Road Access for Current and Future Management

Roads and their management indirectly affect the condition of vegetation. The presence or absence and the condition of a road influence the ability of firefighters to suppress fires. Road access can also determine whether or not silvicultural treatments that can influence the health and productivity of a stand are applied.

Permanent road construction would provide access to some proposed units and long-term access to NFS lands for management activities. Alternative B would allow construction of two new permanent roads totaling 3.1 miles. Alternative C would allow one new permanent road totaling 0.3 miles. See tables 2-5 and 2-9 for miles and units accessed by permanent roads.

Temporary roads would be required to access some units and would be reclaimed following their use. See Tables 2-4 and 2-8 for miles and units accessed by temporary roads. The reclaimed temporary roads would not be useable for future vehicle access. This would reduce efficiency and increase costs of future forest management activities. All temporary roads would be closed by the timber sale purchaser when harvest and site preparation activities are complete.

Alternative B would provide better road access than Alternative C for reforestation, silvicultural exams, sapling thinning, insect and disease monitoring, and initial attack fire suppression because more roads would remain on the system and be available for administrative use.

Shrub Planting for Wildlife Habitat

Shrub planting for wildlife habitat improvement may occur in or near some of the harvest units on up to 500 acres. Shrub planting would usually consist of willow, serviceberry, red-osier dogwood, mountain maple, or redstem ceanothus at a density of about 100 to 300 plants per acre. More shrubs would be planted near riparian areas to enhance wildlife forage, security, and nesting habitat. Post-harvest site conditions and natural conifer regeneration success would determine specific areas and planting density. Shrub planting would not affect conifer stocking objectives.

Forest Insect and Disease

Mountain Pine Beetle. Vegetation treatments in Alternatives B and C would affect vegetation conditions that could support mountain pine beetle populations by reducing the number and extent of stands that are susceptible. As mentioned above in the Affected Environment section, about 1393 acres (13 percent of the area) currently have a moderate to high level of mountain pine beetle hazard (Exhibit P-6). Table 3-10 displays the change in the number of acres in proposed treatment units by hazard level for mountain pine beetle infestation that would result from implementing the Alternatives.

Table 3-10. Mountain Pine Beetle Hazard by Alternative (acres).

Hazard Rating	Existing Condition (No Action)	Alternative B	Alternative C
1 none/low	9353	10,185	9777
2 moderate	555	196	315
3 high	838	365	654
Total	10,746	10,746	10,746

See Exhibit P-6 for more detailed information.

All action alternatives would reduce the susceptibility to mountain pine beetle in treated stands. In stands proposed for regeneration harvest, most or all lodgepole pine trees would be removed. In commercial thin units, lodgepole pine trees would be left, but they would be the most vigorous trees and at much wider spacing than currently exist.

The differences between alternatives are due to the differences in acres treated, types of stands treated, and harvest method. Alternative B would reduce susceptibility on the most acres with an eight percent reduction in high and moderate hazard stands across the project area. Alternative C reduces the percentage of moderate and high hazard stands by only four percent.

Spruce Budworm. Spruce budworm is defoliating a variety of tree species in the Martin Creek area. It is impossible to predict how long the budworm outbreak may last. Tree mortality caused by defoliation from this species may affect the number and types of trees that could be left when implementing the various treatments. However, the treatments would not measurably affect the insect populations or the length of the outbreaks.

Root Diseases. In affected stands, regeneration harvest that changes the species composition to less susceptible species, such as larch, can reduce mortality from and spread of the diseases. Regeneration harvest is proposed in stands with potential for root disease on 379 acres in Alternative B and 97 acres in Alternative C.

With commercial thinning treatments that leave susceptible trees, the diseases can develop and spread from the dead roots of harvested trees to susceptible live trees of all sizes. Commercial thinning is proposed in stands with potential for root disease on about 144 acres in Alternative B and 170 acres in Alternative C. Before implementing these treatments, the actual presence and level of root disease would be confirmed with field evaluations and appropriate harvest prescriptions prepared.

Cumulative Effects of No Action

Under the no action alternative, natural succession would continue to occur. Standing and down fuel would continue to accumulate slowly, increasing fuel hazard across the landscape. Wildland fire suppression would continue to reduce the likelihood of wildland fire as a natural disturbance process, allowing the forest to continue to develop under the influence of vegetative succession. Subsequent development of some stands into old growth may occur, though some stands would never achieve old growth forest conditions, due to their current conditions (i.e. high density, poor species composition, insect/disease infestations). Also, future disturbance events would affect development of old growth forests. If and when large stand replacement fire occurs, this would return any old growth or developing old forest back to an early successional stage. Insect and disease incidence would continue or may increase as tree stress increases from overstocking.

Cumulative Effects of Alternatives B (Proposed Action) and C

Changes in distribution of structure class, cover type, and canopy cover across the landscape are measures to determine the effects of management activities. Maintaining diverse forest structures and composition can help reduce the potential for large scale mortality from disturbances such as insects, disease, and fire. The existing stand conditions are a result of site conditions (PVG), wildland fire history, past timber harvest, other vegetation treatments, and

forest succession. Alternative A is described in this section to compare the existing condition with the post treatment conditions of the action alternatives.

Forest Structure, Pattern, and Disturbance. Table 3-11 displays the current amount and the effect of proposed treatments on structural stage distribution on all ownerships in the Martin Creek area. The change is displayed for four size classes: seedling/sapling, small, medium, and large trees. Non-forest areas, such as roads, lakes, rock, meadows, agricultural land, and private development, are not capable of becoming forested.

Table 3-11. Effect of Each Alternative on Size Class Distribution.

Structure Class	**Alternative A** acres (percent)	**Alternative B** acres (percent)	**Alternative C** acres (percent)
Non-Forest	153 (1%)	153 (1%)	153 (1%)
Seedling/Sapling (<5” DBH)	3188 (30%)	3792 (36%)	3297 (31%)
Small (5-9.9” DBH)	2746 (26%)	2271 (21%)	2385 (22%)
Medium (10-15” DBH)	2357 (22%)	2254 (21%)	2609 (24%)
Large (15+” DBH)	2301 (21%)	2275 (21%)	2301 (21%)
Total	**10,745**	**10,745**	**10,745**

Acres are approximate because of rounding and small errors introduced by GIS data analysis.

Alternative B would cumulatively add six percent to the existing 30 percent seedling/sapling class in the Martin Creek area. Alternative C would cumulatively add one percent to the existing 30 percent seedling/sapling class. Most of the seedling/sapling size class exists in Martin Creek as a result of past vegetation treatments.

The type, amount, and locations of disturbances that occurred naturally serve as a frame of reference for the treatments proposed in the action alternatives to manage the Martin Creek ecosystems within the range of variability and to sustain native species and ecosystem integrity. To achieve changes that approximate historical events yet reduce the potential for undesirable wildland fire or insect outbreaks, both of the action alternatives include creating patches of early-seral vegetation structure greater than 40 acres in size (see the *Regulatory Framework and Consistency* section below). This proposed pattern of disturbance is consistent with the natural disturbance patterns. In most cases the newly created openings offer a mosaic of scattered trees and/or clumps similar to what wildland fires created historically. Some proposed regeneration treatments (shelterwood, seed tree, clearcut) consolidate fragmented areas of seedlings and saplings to manage for large blocks of mature and old forest in the future. When combined with existing natural and harvested openings, where ungulate hiding cover has not recovered (including on adjacent private lands), all alternatives would result in openings greater than 40 acres as follows: Alternative B would result in six openings greater than 40 acres that range in size from 46 to 299 acres; Alternative C would result in four openings of 43 to 90 acres; and Alternative A would not create or add to openings, but existing and past adjacent openings greater than 40 acres exist and range from 62 to 90 acres.

Cover Type. Table 3-12 displays the effect of proposed treatments on cover type distribution on all ownerships in the Martin Creek area. Non-forest areas are not capable of becoming forested, even though some have scattered trees.

Table 3-12. Effect of Each Alternative on Cover Type Distribution.

Cover Type	**Alternative A** acres (percent)	**Alternative B** acres (percent)	**Alternative C** acres (percent)
Douglas-fir	1497 (14%)	1757 (16%)	1560 (15%)
Western Larch and Shade Intolerant Mix	4166 (39%)	4504 (42%)	4389 (41%)
Shade Tolerant Mix	3318 (31%)	3180 (30%)	3278 (30%)
Lodgepole Pine	1611 (15%)	1151 (11%)	1365 (13%)
Nonforest	153 (1%)	153 (1%)	153 (1%)
Total Acres	**10,746**	**10,745**	**10,745**

See the Affected Environment above for description of included species. Acres are approximate because of rounding and small errors introduced by GIS data analysis.

Both action alternatives shift cover types from shade tolerant mix and lodgepole pine to shade intolerant mix (Douglas-fir and western larch) on approximately three to five percent of the Martin Creek area. Alternative B would increase the amount of the two intolerant mix cover types by about 598 acres or six percent of the area. Alternative C would increase the amount of the two intolerant mix cover types by about 286 acres or three percent. All action alternatives would increase the proportion of larch and Douglas-fir and decrease the proportion of lodgepole pine, spruce, and subalpine fir within the all cover types. The proposed treatments that would change cover type cumulatively affect less than eight percent of the total analysis area.

Canopy Cover. Table 3-13 displays the effect of proposed treatments on canopy cover on all ownerships in the Martin Creek area. Non-forest areas are not capable of becoming forested.

Alternative B would reduce the high (greater than 40 percent) canopy covers on about nine percent of the Martin Creek area. The treatments that reduce the high canopy cover result in increases of three percent in moderate (24 to 40 percent) cover and six percent in low (less than 25 percent) cover across the Martin Creek area. Alternative C would reduce the amount of high canopy cover and increase moderate and low canopy cover on about five percent of NFS lands in the Martin Creek area.

Table 3-13. Effect of Each Alternative on Canopy Cover.

Canopy Cover	**Alternative A** acres (percent)	**Alternative B** acres (percent)	**Alternative C** acres (percent)
0-9.9%	154 (1%)	258 (2%)	154 (1%)
10-24.9%	1799 (17%)	2365 (22%)	1921 (18%)
25-39.9%	1313 (12%)	1659 (15%)	1774 (17%)
40-59.9%	3893 (36%)	3220 (30%)	3545 (33%)
>=60%	3587 (33%)	3243 (30%)	3351 (31%)
Total Acres	**10,746**	**10,746**	**10,746**

Acres are approximate because of rounding and small errors introduced by GIS data analysis.

Reducing canopy cover would create more open forest stands and landscapes; reduce competition for light, water, and nutrients for residual vegetation; and allow shade intolerant species to become or remain more dominant in the stands. All alternatives provide a diversity of stand densities across the landscape. Alternative B would reduce stand densities more than Alternative C because it proposes more acres for treatment, especially in regeneration harvests. Much of the low canopy cover (0 to 25 percent) in all alternatives (including Alterna-

tive A) would change to higher canopy cover levels as seedlings become established and grow into saplings over the next 20 years.

Cumulative Effects from Past, Present, and Reasonably Foreseeable Activities

Past timber management has occurred on approximately 40 percent of the Martin Creek area. Some of the proposed treatments are in the same stands that had previous harvests. Past timber management on NFS lands is described in detail in Table 3-4 and under Past Timber Management in the *Affected Environment* section above. Past timber management, along with wildland fire and fire suppression, have created the current forest vegetation patterns in the area. The landscape level effects of past harvest and wildland fire, along with implementation of the action alternatives, is displayed in the sections above on structure, cover type, and canopy cover.

Wildland fire suppression has been mostly effective in the Martin Creek area since the 1940s. The last large fire in Martin Creek burned 1027 acres of the drainage in 1926. Most fires since then were lightning caused and suppressed at less than one-half acre. Active suppression protected many stands that are managed largely for timber production. Fire exclusion allows forests to develop under the influence of vegetative succession, rather than the natural disturbance processes.

Sapling thinning reduces stand density in 15 to 40 year old stands and allows for a higher proportion of shade intolerant species across the landscape. The slash left from thinning increases the potential for high severity fire in those stands for several years. As it decomposes, it releases nutrients that encourage soil development and plant growth. Sapling thinning has been accomplished on 2206 acres (20 percent) of NFS land since the 1950s. The amount of thinning on private land is not known. However, timberland managers tend to intensively manage their forests for growth and yield. With implementation of any of the action alternatives, thinning would provide benefits to stand growth, species diversity, and long-term fuel reduction at the stand and landscape scale.

Miller Creek Demonstration Forest is partially located within the project area boundary, near Keith Mountain. It has provided forestry research data for over 40 years, especially in the realm of comparing vegetation recovery after wildfire, timber harvest, and prescribed fire. The research has been a joint effort of the FNF and the Forest Service's Rocky Mountain Research Station. The most recent research conducted at the Demonstration Forest involved measuring down woody material in relation to soil productivity. No research projects are currently being conducted on the Martin Creek portion of the Demonstration Forest, however projects in the future could be proposed. These projects would be analyzed for cumulative effects in a separate decision-making process from this Martin Creek EA.

Radnor Resource Management Project may be proposed for the area just north of the Martin Creek drainage. This project could consist of approximately 300 acres of commercial treatments, 350 acres of precommercial treatments, and construction of approximately 1.0 miles of both temporary and permanent roads. This project in combination with Martin would increase the proportion of seedling/sapling stands, increase the proportion of shade intolerant species, and decrease canopy cover thereby reducing competition between trees and improving stand growth. This project would provide a diversity of stand densities across the landscape.

Regulatory Framework and Consistency

Flathead National Forest Land and Resource Management Plan (Forest Plan). Forest Plan goals include maintaining a diversity of vegetation and habitats across the forest to meet the needs of a variety of wildlife species and providing for a sustained yield of timber products that is cost-effective, responsive to the needs of the local economy, and is consistent with other Forest Management goals (Forest Plan page II-5). These goals are discussed in Forest-wide timber management objectives described on pages II-7 to II-9 of the Forest Plan. Forest Plan standards on pages II-47 to II-49 and in Appendix I provide direction for protection and improvement of the timber and vegetation resources.

The proposed Martin Creek project is consistent with Forest Plan direction and its amendments concerning vegetation as follows:

- The treatments would contribute to maintaining long-term sustained yield. The prescriptions were not chosen primarily because they would give the greatest dollar return or timber outputs. However, cost efficient implementation methods would be used as much as possible to achieve the project purpose and need, while still protecting all resource values.
- Firewood opportunities in landing piles would be determined after harvest operations to see whether there is interest in the material or if there are any adverse effects in allowing firewood cutters to remove the material. Also, the units have non-sawlog material that may be included in timber sale contracts as firewood.
- Vegetation treatments in the action alternatives are consistent with the objectives in Appendix I for timber, site preparation, reforestation, etc. for the habitat type groups in the project area. Silvicultural exams and prescriptions for treatments that increase vigor and reduce losses due to insects and/or disease were part of the analysis for the project. Current USFS Region 1 timber utilization guidelines would be used when preparing timber sales.
- Existing old growth would be maintained by not treating any stands identified as old growth habitat. Commercial and sapling thinning may allow thinned stands to continue developing into future old growth habitat.
- Site-specific prescriptions developed for this project include providing for the minimum snag, snag recruitment, coarse woody debris, and long-term structural diversity specified for the applicable PVGs. The prescriptions were developed with consideration for current and desired conditions of vegetation structure and disturbance processes at both the landscape and stand level. See the Features Common section of *Chapter 2* for details of the snag and coarse woody debris retention requirements.

The National Forest Management Act (NFMA) (16 USC 1604). The NFMA establishes requirements for vegetation management on National Forest System lands. These requirements ensure that “management prescriptions, where appropriate and to the extent practicable, preserve and enhance the diversity of plant and animal communities” (36 CFR 219.27). The specific provisions address a wide range of vegetation management, including the consideration and protection of other resources (e.g. soils, water, wildlife) when managing vegetation; the appropriateness of even-aged management systems and adequate site reforestation following such harvests; and the proper consideration of the economic aspects of the project. These provisions, and others, are described in the Forest Service Manual at 1921.12.

The proposed Martin Creek project is consistent with NFMA direction concerning vegetation as follows:

- Vegetation treatments would adequately protect and not irreversibly damage soil, watershed, fish, wildlife, recreation, esthetic values, cultural and historic resources, and the regeneration of timber resources because the design criteria and protection measures outlined in Chapter 2 are sufficient to protect resource values. In addition, by reducing existing forest fuel loads within the treatment areas, there would be a reduced chance of having a severe surface fire or crown fire event on the site that could result in adverse soil and water effects.
- Based on the historical regeneration success after previous timber harvesting in the Martin Creek area, adequate stocking within five years is assured in the proposed regeneration harvest units (see Exhibit P-12). Commercial and sapling thinning treatments would retain adequate stocking of trees after treatment.
- Forest products and the revenue derived from them are a positive outcome of the vegetation treatments. However, the purpose of the treatments are to improve forest stand diversity and tree vigor within the treatment areas and to reduce hazardous fuels, not to generate revenues from a timber sale. The stands proposed for regeneration treatment are beyond culmination of mean annual increment (CMAI) of growth, and are losing volume to insects, disease, and windthrow. Commercial thinning is expected to improve growth of the remaining trees.
- The treatment units are delineated with consideration of the natural terrain as much as practicable.
- To provide conditions for desired species, between 42 percent (Alternative B) and 15 percent (Alternative C) of the proposed treatment acres are regeneration treatments (shelterwood, seed tree, and clearcut harvest). Regeneration would be achieved with a combination of natural and planted seedlings. These treatments meet the project purpose and need of improving the desired species diversity across the landscape and reducing the vulnerability of stands to future large-scale disturbances. The shelterwood, seed tree, and clearcut methods are determined to be the appropriate method to achieve these objectives. Clearcutting is the optimum method for 55 acres (one unit) in Alternative B; it is a lodgepole pine stand with no or few desirable or appropriate leave trees. Commercial and sapling thinnings are proposed for the other 58 to 85 percent of the treatment areas. These are not regeneration harvest methods but are intermediate treatments within an even-aged management system.
- Proposed regeneration treatments (shelterwood, seed tree, clearcut) would create openings that are greater than 40 acres in size (46 to 237 acres) where western larch, Douglas-fir, and western white pine would be planted, would naturally regenerate, or are already regenerated. The units are located to maintain a diverse pattern of forest structures across the Martin Creek landscape, increase or maintain the size of the patches on NFS lands to more closely resemble the historic fire-maintained conditions, allow for more effective fire suppression over the next several decades, and reduce the potential for and losses from a mountain pine beetle outbreak in the area. When combined with existing openings, opening size would range up to 299 acres. Regional Forester approval for exceeding the 40-acre limit would be completed before a Decision Notice is signed. Please see the discussion above under Forest Structure, Pattern, and Disturbance.

Invasive Plant Species

Introduction

The introduction of non-native invasive plant species continues to reduce the ecological integrity and economic productivity of natural systems and agriculture on a worldwide basis. In the United States, it is estimated that invasive plant species create more than $35 billion in economic losses and treatment costs each year nationally (Pimental, et al. 2005). Non-native invasive plant species, also called noxious weeds, invasive plants, or invasive species, have disrupted natural processes on nearly 100 million acres in the United States and are spreading at an estimated rate of 14 percent per year (USDA Animal and Plant Health Inspection Service 2003). These are plant species that are not native to a particular place and are disrupting the natural processes of that place (i.e. displacing native plants or animal species, degrading natural communities, changing hydrology, changing microclimatic features, etc.). Non-native invasive species usually have no natural control in the place to which they are introduced, allowing them to spread aggressively, out-compete native plants, and reduce overall native community biodiversity.

Forest Service Policy (EO 13112) identifies prevention of the introduction and establishment of non-native plant species as an agency objective. This policy directs the Forest Service to:

- Determine the factors that favor establishment and spread of invasive plants;
- Analyze invasive species risks in resource management projects; and
- Design management practices that reduce these risks (USDA Forest Service 1995, 2001c, 2011c).

The desired condition inferred from EO 13112, Forest Service Manual 2900, and the 2001 Flathead National Forest Noxious and Invasive Weed Control Environmental Assessment and Decision Notice is the prevention of new infestations (within the area where activities would occur or from the use of travel routes associated with those activities) and to manage the infestations currently established on the forest through control measures.

Invasive Species Management

The Flathead National Forest implements the Noxious and Invasive Weed Control Decision Notice of 2001 (Noxious Weed DN) to evaluate the effects of treating invasive plants (Exhibit A-3). The objective of this DN is to implement an adaptive and integrated pest management strategy to control and reduce the presence of invasive species on the FNF. Currently, inventory and treatment is prioritized by the Forest Weed Coordinator. The Noxious Weed DN outlines factors for prioritization (pp. 6 –7).

Methods used to prevent invasive species from being introduced and spreading into new areas include closing infested areas to travel, washing vehicles and equipment upon entering or leaving an area, and using weed-free seed and straw mulch for re-vegetation. Methods to control the spread of invasive species include prevention, treatment, and containment. Treatments such as manual, mechanical, biological, and chemical methods are generally

limited to localized areas and Montana State listed invasive species (Montana Department of Agriculture 2010). Containment combines prevention and treatment with the objective of limiting spread of an existing infestation and reducing the acres of existing infestations by treating around the perimeter of the infestation.

The seeding of temporary roads as a conservation measure to reduce invasive species infestations has been occurring on the FNF for the past 30 to 40 years. Desirable non-native mixes of grasses and forbs have primarily been used. Native grasses and forbs have been used only recently. Observations of some of the temporary roads constructed in the last 30 to 40 years indicate some success in the prevention of infestation in the road corridors. Sun-loving species, such as knapweed, are not as abundant as the native and non-native grass and forb seed mixes on these old roads. However, shade-tolerant species such as hawkweed, Canada thistle, and oxeye daisy are often abundant along these old temporary roads. There is no information on the circumstances of how these old roads were built or rehabilitated to make inferences on how invasive species became established in these old road beds. Observations of historic roads built over 50 years ago indicate that plant communities on some roads may recover with the encroachment of forest vegetation in the abandoned road template. Prevention measures were most likely not implemented during these older harvest operations. The FNF now implements an integrated invasive species management process, which includes prevention methods, such as equipment cleaning and spraying prior to operations to reduce seed set.

Information Sources

The FNF uses the Montana Noxious Weed List (2010) to identify which invasive species to manage across the Forest, as well as a weed risk assessment (WRA) project in the Northern Region coordinated between The Nature Conservancy and the Forest Service (USDA Forest Service 2003). The WRA identified species that pose a threat to native vegetation in addition to Montana's state weed list.

Surveys for invasive species within the project area were conducted during the 2010 field season across approximately 3337 acres in the project area and 1287 acres (90 percent) of the proposed treatment units. As project areas are surveyed during each field season, new infestations are inventoried. The data are entered into the Natural Resource Inventory System (NRIS) database, an agency-wide corporate database for storing, managing, and retrieving data on soils, geology, geomorphology, vegetation, wildlife, and climate. From this database, the Forest Botanist can retrieve invasive plant location data to create a GIS layer for further analyses. There are still many infestations that have not been entered into the NRIS database; however, NRIS was updated with known infestations located between 2005 and 2012, which includes the project area. Using the NRIS database GIS layer, the invasive species infestations were analyzed for the project.

Analysis Area

The spatial bounds of the analysis area for invasive species are based on the project's influence and impacts on the risk of introduction, spread, and establishment of invasive species within the project area. Because ground disturbance increases these risks, the analysis area includes all treatment units and road systems with activity related to this proposed project. A

0.25 mile buffer on treatment areas (road systems, proposed units, etc.) is based on the maximum skid distance logging equipment can potentially move vegetation and soil.

Project activities leading to soil disturbance and increased light would increase the risk of invasive plant introduction, spread, establishment, and persistence. Some shade-tolerant species, such as hawkweed, may persist indefinitely even after the canopy closes. The risk of invasive plant introduction and spread can occur immediately after activities begin, or until five to ten years (average seed viability) after activities cease. The risk of invasive plant establishment and persistence may occur up to 50 years after implementation is complete, depending on native vegetation recovery. After 50 years, in the longest example, the overstory and understory tree and shrub canopy cover conditions would shade the ground and greatly reduce the risk of establishment and persistence by most invasive species (Kuropat 2009).

It is assumed that after the project is completed, the risk of introduction and spread due to project activities would be low. It is also assumed that after the canopy closes the risk of establishment and persistence would be low.

Affected Environment

Historic Condition

During the mid-to late-1800s, non-native invasive species rapidly established in the northwest United States due to settlement related to agriculture, importing of goods at main sea ports, farming, timber production, and livestock grazing (Parks, et al. 2005). Exotic seeds and plant material were transported with grain and feed and dumped with ballast water along the shore at major port entries. However, mountainous regions have relatively fewer invasive species than lowland regions, owing to the large amount of public land and minimal access in these areas. As a result, there are not as many people settling in these areas and the rate of introduction and spread are not as high as in more populated areas. However, invasive species have become established in these relatively isolated areas and often dominate landscapes. Locally, the rate of establishment and spread has been influenced by timber harvest, road building, grazing, and recreation. Most of these activities began on a large scale in the 1960s on the FNF. Some roadless areas remain relatively invasive-free because of healthy undisturbed native plant communities where few vectors exist to spread invasives.

The FNF has been less affected than many other public lands because most invasives are best adapted to grasslands, shrublands, and warmer/drier forest types than exist here. However, the Forest has many roads, log landings, clearings, gravel pits, trails, campgrounds, and other areas that are disturbed and highly susceptible to invasion.

Existing Condition

Invasive species considered in this analysis are those listed as noxious by the State of Montana, as well as other non-native species determined to be highly invasive by the Forest (Montana Dept. Agriculture 2010; Table 3-14). Currently there are 9387 separately recorded invasive plant infestations on the Forest, comprised of 28 invasive species over approximately 24,696 infested acres. The majority of these sites are in road corridors, gravel pits, and log landings. The main vector for spread are vehicles, (road maintenance equipment, logging

vehicles, and passenger cars and trucks), although the seeds of many species are also wind or animal dispersed. Sixteen of these species (234 sites, 289 infested acres) occur in the project area. The most abundant invasive species in the project area are the hawkweed complex, spotted knapweed, and Canada thistle (Table 3-14). Refer to Exhibit T-3 for species descriptions.

Table 3-14. Non-Native Invasive Plants Found within the Martin Creek Project Area. Acres are rounded to the nearest integer.

Species	Common Name	Sites	Infested acres
Achillea nobilis	noble yarrow	3	1
Artemisia absinthium	common wormwood	16	3
Bromus tectorum	cheat grass	1	1
Centaurea stoebe	spotted knapweed	39	49
Cirsium arvense	Canada thistle	26	52
Cirsium vulgare	bull thistle	7	1
Hieraceum spp.	hawkweed	62	139
Hypericum perforatum	common St. John' s wort	13	11
Leucanthemum vulgare	ox-eye daisy	37	19
Linaria vulgaris	yellow toadflax	2	1
Phalaris arundinacea	reed canarygrass	2	1
Potentilla argentea	silver cinquefoil	5	1
Potentilla recta	sulfur cinquefoil	4	1
Senecio jacobaea	tansy ragwort	2	1
Tanacetum vulgare	common tansy	15	8
	Total	**234**	**289**

Almost all of the infestations in the project area are on roadsides or are associated with roads. There are also many infestations that are in openings or under canopy cover. Many invasive species are sun-loving species. The exceptions are the hawkweed complex and Canada thistle, which can thrive under shaded conditions as well as in sunny areas. Invasive species usually establish in disturbed areas where native plants are slow to re-establish. These areas are mostly associated with road corridors, landing sites for timber harvesting, gravel pits, skid roads, mechanical site preparation treatment on well drained or shallow soils, and utility and railroad corridors. See Exhibit T-2 for infestation locations.

Environmental Consequences

The action alternatives propose various amounts of harvest prescriptions and road construction (Table 2-10). The proposed action contains the most timber harvesting and road construction. Alternative C proposes the least amount of activities.

Analysis Measures

All soil disturbing activities provide some level of risk for invasive species spread and establishment. Any habitat has a low risk of invasion, regardless of activities occurring in that area. Since this low risk is always present, this report only analyzes those areas that are at risk of spread, introduction, establishment, and/or persistence of invasive species through project-related activities.

Direct effects are the risk of spread/introduction of invasive species within the project area. These effects are the expansion or dispersal of current infestations as a result of project activities. They are measured by:

- The proximity of known infestations (within 0.25 mile) to proposed activities. Sites closer to known infestations and seed sources are more likely to become infested.
- The amount of travel through infestations spreading seed directly adjacent to infestation. This measure pertains to project-related activities and cannot be related to non-project traffic such as recreational vehicles or passenger cars.

Indirect effects are the risk of establishment/persistence of invasive species within the project area. These effects are the likelihood that habitat becomes more suitable for the establishment and/or persistence based on project actions. They are measured by:

- The acres of harvest types affecting light availability by changing canopy cover. Sun-loving invasive species are able to establish and persist longer in units with increased light, and shade-tolerant invasive species would either be maintained or adapt to closing canopies.
- The acres of soil disturbance (both detrimental and non-detrimental), based on harvest activity and miles of road projects. Disturbed areas are more likely to be colonized by invasive species.

As stated above, the direct effects in this report are measured by the proximity of known infestations to activities, and the amount of travel through infestations. These measures are closely related since travel through infestations can both spread and introduce invasive species. Vehicle travel through infestations can spread invasive plant seed along road corridors from short to long distances. Invasive plant seed could be introduced from a nearby infestation or a distant source, in soil clinging to off-road vehicles, passenger vehicles and logging equipment, or transported by other sources (i.e., birds, animals, wind) (Von der Lippe and Kowarik 2007). Wind-dispersed seeds can be moved by fast-moving vehicles without having to be physically attached. It is difficult to quantify the amount of traffic on highways, town roads, and NFS roads, although improved roads generally have more traffic than the unimproved roads.

The direct effects of road use are qualitatively analyzed based on maintenance level (ML) as a measure. The maintenance level of a road indicates the type of traffic it can accommodate (USDA Forest Service 2005b). For example, ML 5 roads “provide a high degree of user comfort and convenience” and are normally paved surfaces like highways. Maintenance Level 4 roads “provide a moderate degree of user comfort and convenience at moderate travel speeds” and can generally accommodate two lanes of traffic. The road surface is generally aggregate but sometimes paved. Maintenance Level 4 and 5 are better road surfaces that

accommodate almost any vehicle. These roads would have the greatest amount of traffic and thus the higher risk for invasive plant introduction and spread. Maintenance Level 3 are open, aggregate roads that can accommodate most passenger vehicles, although "user comfort and convenience are low priorities." This ML is the most common forest road type on the forest and in the project area. Maintenance Level 2 is "for use by high clearance vehicles. Passenger car traffic is not a consideration." These roads have a low volume of traffic. The lowest level, ML 1, is reserved for closed roads that can have any drivable surface but are not open for any use until needed for project work or emergencies. The majority of these roads are not accessible during times of the year when the weather makes them dangerous or impassible, such as deep snow or during spring break-up when the roads are extremely muddy. However, even with low traffic flow, the risk of picking up invasive plant seed is higher, since most of these roads are overgrown or brushed-over with vegetation.

Close proximity of infestations can increase the risk of introduction and spread. The risk of introduction is greater when project activities are located near an existing seed source. For example, invasive species like Canada thistle have wind-dispersed seeds which can easily establish in freshly disturbed soil. The closer the infestation is to the disturbance, the greater the quantity of seed and the higher the rate of establishment.

Indirect effects are measured by changes in habitat that make it more suitable for invasive species to establish and/or persist. They can be measured by the acreage of soil disturbance and the availability of light after vegetation removal. Measures of indirect effects can be related to the proximity of infestations since the risk of establishment and persistence in an area is higher if there is a nearby seed source.

Soil disturbance does not necessarily lead to increased rates of spread of invasive species, but can create favorable conditions for establishment of invasive plants (Christen and Matlack 2006). The removal of native vegetation and the compaction of the soil, which restricts native plant growth, allow invasive species to invade unchallenged (Trombulak and Frissell 2000). Soil disturbance prepares the ground for colonizing plant species by removing the native vegetation and duff layer and exposing mineral soil. If seeds are introduced, they can germinate more readily in disturbed soil than if the soil surface was intact (Silveri, et al. 2001). If an area is already infested, disturbing the soil can expose dormant seeds, allowing them to germinate. Activities associated with timber harvesting, road maintenance and reclamation, temporary road construction, and fire suppression all disturb the soil.

The estimates in this analysis are based on detrimental soil disturbance surveys collected by the Forest Soil Scientist; however, all soil disturbances that expose fresh soil or the dormant seed bank is considered at risk for infestation. Measurements of non-detrimental soil disturbance are not available. Detrimental disturbance calculations provide a minimum estimate of disturbance for each alternative. Where there is detrimental disturbance, it is assumed that there is an associated and relative amount of non-detrimental disturbance. Depending on the harvest type and activity, detrimental soil disturbance can occur between zero percent and 20 percent of the treated unit. The Region One Soil Quality Standards requires detrimental soil disturbance to be less than 15 percent on average over the treatment area (see the *Soils* section in this EA). When referring to soil disturbance in this invasive plants analysis, the author is generally referring to all soil disturbance. Additional soil would be disturbed by the construction of permanent and temporary roads, and the subsequent reclamation of the temporary roads, for an average of six acres per mile (based on a 50 foot average width including cut/toe

slopes and road bed; personal communication with the IDT transportation specialist). Temporary roads would be obliterated by any site-appropriate combination of the following:

- Removing any installed culverts or temporary bridges
- Installing erosion control features where needed
- Placing woody material on the template
- Seeding with the native plant mix as specified by the Forest Botanist
- Planting native shrubs and/or trees to augment natural vegetation

Light availability is a crucial factor in plant growth. An increase in the amount and duration of light availability can increase the risk of establishment and persistence of certain "sun-loving" species. Invasive species like spotted knapweed thrive in open conditions. Some species such as hawkweed thrive in both sun and shade. Other species like Canada thistle can survive on the forest edge without penetrating into deep shade. Depending on the species and the harvest activity, an area can either be susceptible to an infestation or can resist an infestation.

Light conditions can be measured by the acres of thinning and regeneration harvest types. Clearcut and seed tree harvests would allow more light onto the forest floor, increasing the risk of spread, establishment, and persistence. Only when the canopy closes would sun-loving invasive species be unable to thrive. If the increased light conditions are near an infestation of sun-loving species, the risk of spread is higher than in a clean area, and light conditions may encourage establishment into a suitable habitat. Once an infestation is established, it may persist for a long time, provided that vegetation conditions remain favorable. However, as vegetation conditions change, the infestation may die back. For example, tansy ragwort may invade a burned area and establish, but once the canopy recovers, the infestation would not persist. Forest edges created by the more intense harvest types would have a risk of establishment/persistence by edge species or species that can survive in both shady and sunny environments. Acres of harvest types and the proximity and/or presence of infestations would help to determine risk of introduction/spread and risk of establishment/persistence.

Risk Determination Criteria

The determination of risk of weed spread, introduction, establishment, and persistence is based on several criteria. There are no National, Regional, or Forest guidelines that describe risk to a project area. The following tables define some criteria for low, moderate, and high risk.

Before defining risk criteria, it is imperative to understand what factors contribute to invasive plant infestations in a project area. As discussed above, there are four functions of weed movement where effects can be identified. For each function, there are a variety of factors that contribute to that function.

Table 3-15. Factors Contributing to Weed Movement in a Project Area.

Introduction	Spread	Establishment	Persistence
Proximity to main roads	Amount and timing of activity	Substrate preparation	Silviculture prescription
Number of roads and amount of traffic	Proximity to infestations	Soil disturbance	Soil disturbance
Type and amount of machinery	Type and amount of machinery	Proximity of infestations	Re-establishment of native vegetation
Location and amount of recreation	Amount of activity in infested units	Removal of native vegetation	Weed control efforts (including biocontrol)
		Timing of activity	
		Revegetation activity	

Determining the risk of weed introduction, spread, establishment and persistence requires criteria that come from the proposed project activities. Below are primary risk criteria for each level of determination. However, there may be more criteria that factor into a determination that may be specific to a particular project. The final determination will be identified and justified at the end of the invasive plant species analysis.

Table 3-16. Definitions of Risk Criteria Based on Contributing Factors.

Low	Moderate	High
Little to no soil disturbance by machinery; hand methods; no temp roads	Soil disturbance by machinery; skyline and tractor log skidding; few temp roads to be recontoured; detrimental soil disturbance <7%	Soil disturbance by logging activities, skidding long distances, temporary roads built or opened with little or no rehabilitation; no recontouring
Planned revegetation (trees and shrubs)	Planned revegetation (trees and shrubs)	No revegetation or only seeding of roadsides
No or few NFS main roads near or in the project area	One NFS main road nearby or accessing project area	Many roads, both closed and open; multiple main roads accessing area
Little or no traffic (closed roads or administrative use only)	Vehicular traffic common (roads are open)	Traffic regular and with speed; illegal motorized use is known in the area
Little or no recreation (no developed sites); little used trails or dispersed sites	Recreation such as non-motorized trailheads, boat access, dispersed camping; some private lands nearby	Recreation such as popular trailheads (horse and/or motorized use), dispersed and developed campsites, boat access; large amounts of nearby private lands with easy access to NFS lands; industrial timber lands intermixed in the project area
Very few existing infestations or none near activities	Infestations are common and within one-quarter mile of proposed activities	Densely infested along trails, roads, in proposed areas, and on privately owned or industrial timber lands
Winter and spring activities	Timing of activities not specified	Timing of activities not specified or are planned for late summer and fall

Direct and Indirect Effects of Alternative A (No Action)

There would be no activities and, therefore, no direct or indirect effects that would change the existing condition. Non-native invasive species would continue to persist at their current rates and may increase through natural means of spread (animals, wind, water) or by humans (vehicles, ATV/OHVs, road maintenance), but not as a direct or indirect result of the No Action Alternative.

No Action carries the least amount of risk for invasive species introduction, spread, establishment and persistence, since there would be no entry into forested stands and no additional areas of ground disturbance. However, invasive species currently present within the project area could potentially spread into disturbed and undisturbed sites. Invasive species are well adapted to disturbed soils and open bare ground. Open roads serve as corridors for spread. Once seeds are dispersed to a new site, the type of habitat and local disturbance patterns can influence the establishment and persistence of invasive species. Because No Action proposes no entry into recently disturbed areas and no additional ground disturbance related to this project, the risk of introduction, spread, establishment and persistence for invasive species in the project area would be low, which is preferable to the other alternatives.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Chapter 2 (Table 2-10) describes the actions proposed for each alternative. Each action alternative contains various amounts of similar actions such as timber harvesting, temporary road construction, and resource enhancement projects. Below is a description of the direct and indirect effects of those action alternatives in regard to invasive species.

Proximity of Known Infestations

There are 1108 acres (Proposed Action) or 611 acres (Alternative C) proposed for vegetation management which contain known infestations. All units but one (26 acres) have an infestation within a quarter mile. There may be more than one occurrence of a species and more than one species in a unit. Most of these infestations occur in old road beds or active road corridors at the edge of the units, but a few infestations occur within unit boundaries away from roads, either in openings or under canopy (Exhibit T-2).

The infested units have a high risk of spread when heavy equipment moves through them, disturbing the soil and removing canopy cover. There are an additional 298 acres (Proposed Action) or 119 acres (Alternative C) of proposed treatment which are not currently infested but have infestations within one-quarter mile of their unit boundary. Units which are not currently infested but have infestations within one-quarter mile of their unit boundary puts these units at a high risk of introduction, most likely by equipment or machinery transporting seed from another unit or nearby infestations along the road. For the units that are within the Wildland Urban Interface (WUI) and available for mechanical fuel reduction, the risk of introducing and spreading invasive species increases over those units that are proposed for hand-treatment. Alternative C has the least amount of risk of introduction and spread due to fewer proposed units.

Ninety-eight percent of the 81 miles of existing road corridors in the project area either contain or are adjacent to an infestation. All of these miles would be retained as the only reclamation proposed in any of the action alternatives are for temporary roads.

There is a high risk of moving seed from the infested main roads down the proposed temporary and permanent roads and introducing invasive species, if they are not already present, to natural areas. The existing roadside infestations would likely spread onto new road templates. The main vector for introduction in the action alternatives would be vehicle use and the movement of equipment from site to site. The timber sale contract specifies that all off-road

equipment would be cleaned before entering NFS lands to prevent new invasive species from entering the forest. The contract does not specify that equipment needs to be cleaned when moving from site to site on the forest. Use of dedicated skid trails would minimize the risk of spread across units. Alternative C has the fewer miles of road proposed to be built then the Proposed Action and would have the least amount of risk of spread and introduction of invasive species.

Amount of Travel through Infestations

Travel through infestations is difficult to quantify, even without considering non-project activity like passenger vehicle travel, bicycles, horses, and wildlife vectors. Seeds can be transported in soil, clinging to equipment and can later drop into an un-infested, or "clean area," spreading or introducing an invasive species. The maintenance level of a road can indicate the type of travel a certain road can accommodate. The higher clearance of a vehicle that is necessary to pass over a road may indicate less traffic over that road surface. Maintenance level 1 does not have traffic, as is the case with some ML 2 roads. Maintenance levels 3 through 5 would presumably have more traffic since they are easier to travel. To reduce spread and introduction, if feasible, contractors should harvest clean units prior to infested units. In many cases, invasive species such as knapweed can encompass all the travel routes in the area, which then invade roads that are required for project activities. In these cases, the infestation is so severe that there is no practical way to treat it or avoid it. The majority of the roads in the project area are ML 1. Although they are not currently traveled, they are most likely infested from past activities. Opening these roads to project activities would increase the amount of travel through infestations, spreading seed along the travel route.

Soil Disturbance

Soil disturbance indirectly affects establishment of invasive species by providing suitable habitat. Drifting seed establishes easier on prepared soil than on intact soil. Harvesting equipment and road activities would detrimentally disturb up to 867 acres in the Proposed Action, and 459 acres in Alternative C (see the *Soil* section for more information). Specified roads are not included in the soil analysis since they are taken out of land productivity indefinitely. These estimates measure only detrimental disturbance. In regard to invasive species, all soil disturbance creates a suitable substrate for seed germination. Since it is infeasible to measure all soil disturbance for each unit and associated activities, it is assumed that the proposed activities have an associated amount of general soil disturbance along with the detrimental soil disturbance measures, which allows for the comparison of relative disturbance between alternatives.

The use of dedicated skid trails would minimize the risk of introduction and spread as well as reduce the amount of soil disturbance across the treatment area. Excavator piling would cause ground disturbance and expose bare soil. Burning these piles would reduce native vegetation competition in those areas and expose mineral soil to create suitable conditions for invasive species. Burn piles often have high incidence of invasive species infestations due to initially removing native vegetation and the slow response of native plants to re-colonize. Although severe burning sterilizes the soil of most of its nutrients, native vegetation seems to colonize "red soil" (severely burned soil) as well as it colonizes unburned soil (Hebel, et al. 2009). However, while invasive species establishment is greatly reduced in nutrient-poor areas compared to greater nutrient sources, they still out-compete native vegetation, and establish

and persist for long periods of time. Chipping, lopping, and scattering fuel material across the unit would carry less risk for the establishment and persistence of invasives than burning slash piles. Alternative C would have less soil disturbance as a result of project activities and, therefore, would have a lower risk of establishment for invasive species than the Proposed Action.

New roads would be built for timber access in both action alternatives. These activities include road maintenance and BMPs, new permanent road construction, and new temporary road construction and reclamation. These activities would create new ground disturbance for potential weed establishment, as well as disturb existing weed infestations. Both of the action alternatives propose varying amounts of permanent road construction and temporary road construction (Table 2-10). The Proposed Action proposes a combination of these road types for a total of four miles. Alternative C proposes 0.9 miles. Regardless of proposed reclamation activities, these road activities would disturb soil and existing infestations, changing the landscape in those areas for the long term. Seeding, where necessary, would minimize the risk of establishment of invasive species (Ch. 2; page 2-16). Native or desired non-native species would compete with invasive species on disturbed soils of the obliterated temporary roads. However, temporary roads would remain on the landscape as these roads are not completely obliterated via comprehensive revegetation and re-contoured to the natural landscape to facilitate natural hydrologic processes. Soil compaction and native vegetation disturbance would still occur in the initial construction, despite any reclamation. Over the long-term, the temporary roads would most likely have a mix of the seeded re-vegetation species, new colonizers from the surrounding vegetation, and invasive species.

Light Availability

The short-term effect of logging would be that more light is let into the understory allowing the introduction (via equipment, wind, animals, etc.) and establishment (available suitable habitat) of sun-loving invasive species. Eventually, as the overstory in an unit recovers following thinning harvests, invasive species requiring more open conditions may not survive, and the increased risk of introduction and establishment would be a short-term impact. However, the longer the overstory remains open, as it would after regeneration harvests, the longer the habitat remains suitable for sun-loving species and the longer the risk of establishment and persistence exists.

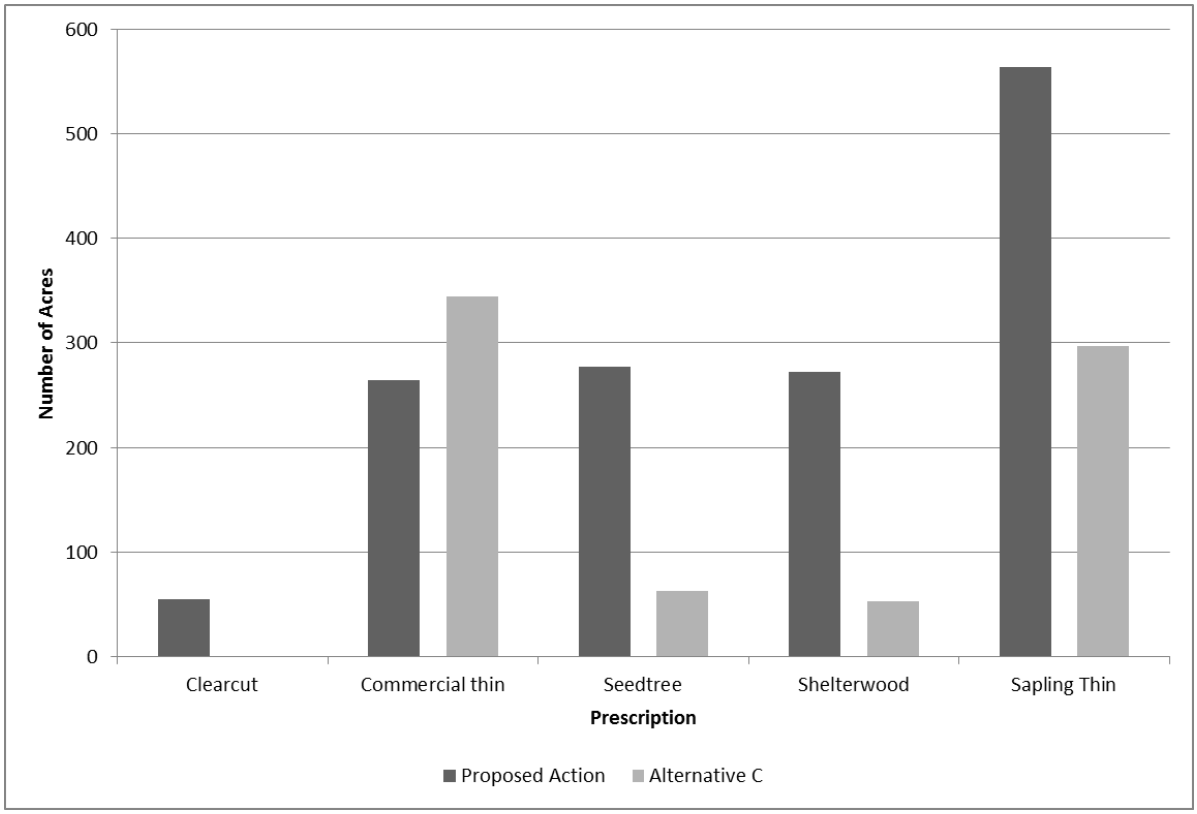
The amount of light reaching the forest floor can be controlled by the amount of canopy cover. Regeneration harvests such as clearcut, seedtree, and shelterwood open up the canopy and leave less than 30 percent cover (Table 2-1). There are 604 acres (Alternative B) and 116 acres (Alternative C) proposed for these regeneration harvests in each action alternative (Table 2-10). Figure 3-1 shows how much each alternative would increase available light to the forest floor by harvest type. Regeneration harvests could increase the risk of spread of invasive plants and allow introduced sun-loving and edge species to persist until the canopy closes. Units with nearby infestations would have a higher risk of spread and establishment. The Proposed Action would have higher increase in light availability than Alternative C.

While the closure of overstory may limit the duration of the risk of establishment and persistence for some sun-loving species, it may elevate and prolong that risk for shade and edge-tolerant species, such as hawkweed and Canada thistle, since these species can quickly

colonize an area before the native vegetation has a chance to recover after activities cease. Nearly all of the units within the project area are infested with at least one of these edge species or within a quarter mile of these species (Exhibit T-2).

Intermediate treatments like commercial thinning leave 70 percent or less of the canopy, with an average of 40 percent canopy cover retained (Table 2-1). There are 264 acres of commercial thinning proposed in the Proposed Action, and 344 acres proposed in Alternative C. Commercial thinning does not have as high of a risk of sun-loving species spreading through the units as regeneration harvests; however, there is still a moderate risk of introducing and spreading sun, shade, and edge-tolerant species. Alternative C carries less risk than the Proposed Action.

Figure 3-1. Increase in Light Availability (acres) by Alternative.



Remaining canopy cover by prescription: Clearcut <5%; Commercial Thin 30-70% (average 40%); Seedtree 5-10%; Shelterwood 10-30%; Sapling Thin 5-40%.

Sapling thinning can leave 40 percent or less canopy cover, depending on the site and the thinning needs. Since there is generally little soil disturbance associated with this activity, sapling thinning carries a low risk of introducing and spreading invasives into the understory. However, in the WUI, non-commercial thinning can be accomplished mechanically, which creates soil disturbance and can provide habitat, in addition to more light, for invasive species to establish and persist. Depending on the specific treatment, there is a moderate risk of persistence related to the amount of light let into the understory. Table 2-10 displays the amount of sapling thinning proposed by each action alternative.

Other activities, like tree and shrub planting, may also contribute to the risk of introduction and spread. Associated vehicles and personnel can be vectors for introduction and spread. However, planting activities would be short-term with minimal impact to the soil. In addition, planting conifers and shrubs would assist in regeneration of native vegetation and reduce the risk of establishment and persistence of sun-loving invasive species when the canopy cover becomes established. Both action alternatives propose the same amount of shrub planting, up to 500 acres. There are up to 100 acres of shrub slashing proposed in both alternatives.

Other Activities

Shrub planting for wildlife and road BMPs for aquatic passage are also proposed in both action alternatives. Native species would be used for shrub planting and would benefit the native plant community in those areas. Although larger culverts and bank stabilization are beneficial for aquatic organisms and waterways, soil disturbance and possible introduction of contaminated riprap could possibly introduce new weeds or spread existing infestations.

The project proposes to address the issue of a user-created trail from a dispersed site to Upper Martin Lake. Not only has the user-created trail disturbed native vegetation and soil, but the new trail proposed to take its place would also disturb native vegetation and disturb the soil. The proposal includes rehabilitation of the user-created trail, which would help prevent or reduce the spread of invasive plants. Trail construction and maintenance increase the risk of introducing invasive species by recreationists to natural areas. These linear, non-vegetated features create edge effects into the adjacent understory, providing suitable conditions for invasive species, as well as corridors for invasive species, allowing them to move into the understory.

Cumulative Effects of Alternative A (No Action)

Since there would be no direct or indirect effects from Forest Service actions that could contribute to invasive species introduction or spread, there would be no cumulative effects from this project. Ongoing actions such as annual road maintenance (mowing, grading, etc.) would still have the potential to affect invasive species. All infestations within the project area are eligible for treatment under the 2001 Noxious Weed Decision Notice. There are many areas of disturbed soils (roads, trails) and open bare ground across the Tally Lake Ranger District, which can provide habitat for invasive species. There is one area of private land development in the project area that has also contributed to a changed landscape.

Past ground-disturbing activities such as timber harvest and road construction and maintenance have contributed to the spread of invasive species in the area. Recreational and economic land uses (hunting, hiking, fishing, logging, firewood gathering, etc.) have also contributed to the spread of invasive species, since users and their vehicles can be vectors for seed spread. Wildlife has likely contributed to weed spread in the past by transporting seeds across the landscape. All these activities are likely to continue into the future to some degree.

For all alternatives including the No-Action Alternative, there is the potential for wildland fire. A wildland fire within the project area could increase the risk of spread, establishment, and persistence of invasive species weeds in the project area. Wildland fire would expose bare ground that may be susceptible to invasive species establishment. The areas that would

have a higher risk of spread following a wildland fire are adjacent to roads, recreation trails and suppression activities.

Cumulative Effects of Alternatives B (Proposed Action) and C

Past, present, and reasonably foreseeable actions within the project area that have affected or would affect invasive species include timber harvesting, wildland fires and fire suppression, road construction, road maintenance and closures, recreation (fishing, hunting, snowmobiling, etc.), forest products gathering, invasive species control, beaver control, gravel sources, land development, special use permits, and other activities (Exhibit T-1). The earliest activities considered in this analysis occurred in the 1950s (excluding wildland fires) and, until recently, past activities incorporated few or no actions to prevent the introduction and spread of invasive species. In general, past, present, and reasonably foreseeable activities with the greatest amount of ground disturbance, accompanied by a vector source of invasive plant seeds, had and have the greatest risk of invasive plant introduction, spread, establishment, and persistence.

It is unknown when non-native invasive species became established within the analysis area. The earliest inventory date in the NRIS Database is 2003, and the earliest chemical treatment record is from 1991, but there have been invasive species on the FNF for much longer. Previous activities (timber harvest, road construction and maintenance, recreation, land development, agriculture, grazing, etc.) most likely contributed to the establishment and spread of invasive species. Since the establishment of invasive species is unknown and cannot be inferred from existing records, all infestations have been integrated into the existing condition.

Proximity of Known Infestation

The Tally Lake Ranger District has 16 percent of the infestations on the forest (Table 3-17). The project area contains approximately one percent of infestations on the Forest and seven percent of the Tally Lake Ranger District's known infestations (Table 3-17). It is due to the many projects that have taken place in the past that have led to the abundance of infestations in the project area. With more roads built and harvesting equipment used in this project and future projects, infestations would continue to spread into adjacent natural areas. Infestations occurring in the project area may spread outside the project area to other parts of the district due to project activities. Seed would most likely drop closer to the project boundary than farther away since equipment would travel over rough roads. The main haul routes would be along main access roads, which are already treated for weeds under the 2001 Noxious Weed Decision Notice.

Table 3-17. Non-Native Invasive Species Found Forest-Wide and in the Martin Creek Project Area. Acres are rounded to the nearest integer.

Scientific name	Common Name	Forest Acres	District Acres	Project Acres
Priority 1A – Not present in Montana				
Centaurea solstitialis	yellow starthistle	0	0	0
Priority 1B – Limited presence in Montana				
Butomus umbellatus	flowering rush	0	0	0
Chondrilla juncea	rush skeletonweed	0	0	0

Scientific name	Common Name	Forest Acres	District Acres	Project Acres
Cytisus scoparius	Scotch broom	0	0	0
Isatis tinctoria	dyer's woad	1	0	0
Lythrum salicaria, L. virgatum	purple and wandlike loosestrife	0	0	0
Myriophyllum spicatum	Eurasian water milfoil	0	0	0
Polygonum cuspidatum, P. sachalinense, P. polystachyum	Japanese knotweed complex	1	0	0
Potamogeton crispus	curlyleaf pondweed	0	0	0
Priority 2A – Common in isolated areas in Montana				
Berteroa incana	hoary alyssum	1	0	0
Echium vulgare	blueweed	0	0	0
Hieracium aurantiacum	orange hawkweed	2766	903	96
Hieracium caespitosum, H. floribundum, H. piloselloides, H. pratense	yellow hawkweed complex	1842	412	44
Iris pseudacorus	yellowflag iris	0	0	0
Lepidium latifolium	perennial pepperweed	0	0	0
Ranunculus acris	tall buttercup	30	2	0
Senecio jacobaea	tansy ragwort	520	66	1
Priority 2B – Abundant and widespread in Montana				
Cardaria draba	whitetop	0	0	0
Centaurea repens	Russian knapweed	0	0	0
Centaurea diffusa	diffuse knapweed	0	0	0
Centaurea stoebe	spotted knapweed	5856	839	49
Cirsium arvense	Canadian thistle	3445	656	52
Convolvulus arvensis	field bindweed	1	1	0
Cynoglossum officinale	hound's-tongue	184	11	0
Euphorbia esula	leafy spurge	1	0	0
Hypericum perforatum	St. John's-wort	2408	200	11
Leucanthemum vulgare	ox-eye daisy	4341	442	19
Linaria dalmatica	Dalmatian toadflax	3	0	0
Linaria vulgaris	yellow toadflax	69	28	1
Potentilla recta	sulphur cinquefoil	469	64	1
Tanacetum vulgare	common tansy	294	83	8
Tamarix spp.	salt cedar or tamarisk	0	0	0
Regulated Plants – Not Listed as Noxious in Montana				
Bromus tectorum	cheatgrass	19	1	1
Hydrilla verticillata	hydrilla	0	0	0
Eleagnus angustifolia	Russian olive	0	0	0
Additional Invasives of Concern for the Flathead National Forest				
Achillea nobilis	noble yarrow	13	5	1
Arctium minus	common burdock	1	0	0
Artemisia absinthium	common wormwood	274	41	3
Campanula rapunculoides	creeping bellflower	1	0	0
Carduus nutans	musk thistle	1	0	0
Cirsium vulgare	bull thistle	957	181	1
Euphorbia species	spurge (all)	0	0	0
Phalaris arundinacea	reed canarygrass	761	82	1
Potentilla argentea	silvery cinquefoil	81	6	1
Tragopogon dubuis	yellow salsify	346	23	0
	Total	**24,696**	**4046**	**289**

Amount of Travel through Infestations

The continued use of roads in the project area would increase the risk of introduction and spread of invasive species over time. Although vehicles traveling unpaved roads seem to have a higher risk of transporting seed from one site to another than those traveling paved roads, it is difficult to quantify how often the roads are traveled, the amount of seed that could be collected, and the distance that seed is transported. Unpaved roads (ML 1, 2, and 3) tend to have vegetation growing along the sides that hang directly over the road bed which can be brushed by vehicles. Paved roads have shoulders that are graveled and do not support much, if any, vegetation. To get a better idea of use, road ML can indicate the type of use. For the most part, passenger vehicles do not drive off of the pavement and therefore do not travel through infestations. However, these vehicles create wind at high speeds, which is a vector for spread. Unfortunately, there are no preventative measures to reduce weed spread except for public education. The Forest has an active invasive species management program that chemically treats high traffic areas.

The majority of drivable roads in the project area are ML 2 and 3, which indicate the traffic flow is low, yet the risk of picking up seed and spreading it is high if there are infestations along the road corridor. The most abundant ML rating in the project area are roads closed to vehicles (ML 1 roads). Almost all of the roads have an infestation on at least a part of the road corridor, if not entirely along the road corridor, or are within 0.25 miles of an infestation.

This project proposes to build new permanent and temporary roads in both action alternatives. New roads would provide access and suitable conditions for the spread of invasive species in the project area from the existing road system when passenger vehicles, logging vehicles, and equipment drive over them. Temporary roads would be closed to motorized access after project implementation yet the soil disturbance and increase in light availability would increase the risk of establishment and persistence. Permanent roads would remain on the landscape and used indefinitely, providing a constant source of weed seed to and from other parts of the district.

As the project design criteria described in Chapter 2 includes an equipment cleaning clause, spraying along haul routes before project activities, and seeding disturbed areas with an approved seed mix; the risk of introduction, spread, and establishment would be moderate.

Soil Disturbance

Soil disturbance estimates for past actions are based on the same type of activities proposed in this project. They are a minimum estimate of past soil disturbance and not meant to be an exact quantification of past projects. Combined previous management activities have detrimentally disturbed less than one percent of the soil on NFS lands since the 1950s (see the *Soils* section of this EA). The Martin Creek project would disturb one percent or less of the project area in all action alternatives (Table 3-18). Much of the NFS lands in the project area have been disturbed by other means, mostly through timber management and road construction, which means that a portion of the project area still contains suitable conditions for infestations in those areas of disturbance that are still recovering. Although there is a required equipment cleaning clause in the Timber Sale Contract, infested soil or plant material can move when equipment travels through existing infestations. Chemical treatment of haul roads, along with equipment cleaning, would reduce the risk of introduction and spread. It is

assumed that vegetation management and other soil disturbing activities would likely continue in the project area. Alternative C would have the least amount of cumulative soil disturbance. The risk of establishment and persistence would be moderate to high because of widespread infestations in primary access corridors. Wildland fire effects were not considered in the vegetation management calculations.

Wildland fire suppression activities, such as dozer lines, hand-dug fire lines, vehicle traffic, helicopter landing sites, etc., contribute greatly to soil disturbance in those localized areas (Zouhar, et al. 2008). These activities carry a high risk of introduction and spread for invasive species based on the urgency of the activities and low priority of invasive species management compared to protecting life and property. Once fire operations cease, there is a high risk of establishment and persistence in these freshly-disturbed areas that are now open to more light. Fire suppression would be likely to continue to occur in the project area and there is no way to predict where or when these events would occur.

Table 3-18. Cumulative Effects Summary of Soil Disturbance and Light Availability.*

	Proposed Action		Alternative C	
	Acres	**Percent**	**Acres**	**Percent**
Soil Disturbance (Acres)**				
Past	18	<1	14	<1
Present	85	<1	44	<1
Reasonably Foreseeable	0	0	0	0
Total	103	1	58	<1
Light Availability (Increase in Acres)				
Past***	5394	50	5394	50
Present	1432	13	757	7
Reasonably Foreseeable	0	0	0	0

* Percentages (percent) are of the total amount of NFS land (10,800 acres) in the project area.
**Detrimental soil disturbance acreage from Soils section of this EA.
***Numbers reflect total acres initially affected by light increasing activities, which in many cases have recovered as vegetation grows back to closed canopy conditions (please see the *Vegetation* section in this chapter).

Light Availability

Past harvesting in the project area increased the amount of acres with more light availability by 50 percent (Table 3-18) from past project activities. Generally, acres which are opened up by activities are more susceptible to the persistence of sun-loving invasive species than if no activities occurred. Eventually, if the canopy is allowed to close, most infestations would be shaded out. The project would increase light availability by from 7 to 13 percent depending on the alternative, which is much lower than the cumulative impact from past activities.

The overriding disturbance that initiated the forests on the Martin Creek landscape is wildland fire. Many sites show evidence of recurring stand-replacing fires; others experienced low intensity, mixed severity fires. Wildland fires were often preceded by tree mortality from insect outbreaks. These fires created large openings until vegetation recovered, unlike the smaller openings created by humans in the latter half of the twentieth century. Wildland fire suppression has changed the natural burning cycle on this landscape. Increasingly dense

multi-storied stand structure and high fuel levels put these stands at risk for disturbance, particularly from wildland fire.

No large wildland fires have occurred in the Martin Creek area since 1926. Approximately one-quarter of the analysis area burned between 1889 and 1926; thick stands of lodgepole pine regenerated in many parts of these burned areas. Since that time, there have been only a few wildland fires near the project area. The closest one was a small spot a little less than two miles from the south project boundary. Other larger fires occurred five to eleven miles from the project area. Generally, high-severity wildland fires completely burn up native vegetation, including the overstory, and create suitable conditions for invasive species to establish. Native vegetation has presumably recovered since the last fire in the project area. It is possible that invasive species increased during that time but without historical records, it is difficult to make that assessment.

Considering the frequency of vegetation management and wildland fire in and near this project area, the forest canopy may not reach closure across all the impacted areas. Increasing light availability in the project area carries a moderate risk of establishment and persistence of invasive species, since the majority of the project area has been opened up before and invasive species are already present in the project area.

Invasive Species Control

The FNF has an integrated weed management program that identifies and controls infestations across the Forest. Prevention of new infestations and controlling spread of existing infestations are the goals of invasive species management in the project area. Herbicide is the most commonly used treatment to kill invasive species, which also can affect native plant species. In addition, the forest uses biological control on tansy ragwort, spotted knapweed, and Canada thistle. These organisms have spread on their own, as well as with human help, into the project area.

Without prevention measures, inventories, and treatment, the risk of spread would increase in this project area and would further affect suitable habitat. The project design features in this proposed project would contribute to preventing further invasive species establishment as a result of project activities; however, due to the large amount of existing infestations, there would still be a moderate to high risk of spread. Future spraying of haul routes and other roads in the project area could temporarily decrease invasive species spread on a short-term basis; however to benefit from these treatments, more long-term integrated management would be necessary.

A foreseeable project in the Martin Creek project area is the Reed Canarygrass Control Project. Although two of its sites area outside of the Martin Creek project area, a third site is within the boundaries of this project area. This weed control project would experiment with different control measures for reed canarygrass (*Phalaris arundinacea*), an invasive grass that has infested many wetlands and waterways on the Flathead National Forest. The Forest would determine with method is the most efficient for small infestations with the hopes of using that process in the Swan Valley near water howellia sites.

Recreation

Recreation across NFS lands has increased over the past few years and would continue to influence the spread of invasive species on the forest and in the project area; however, the amount of ground disturbance and travel through infestations from recreation activities, compared to large-scale vegetation management, is much less and is generally limited to established roads, trails, and a few dispersed locations. Areas frequented by recreationists typically require construction and maintenance. People and associated activities are vectors contributing to the introduction and spread of invasive species within the project area. Other recreation activities such as off-trail hiking, hunting, trapping, berry picking and collection of forest products, and horse riding can also provide vectors for the spread of invasive species.

Land Development

Past development and clearing on private lands most likely have introduced and spread invasive species; however, since there is no historical data regarding invasive species on private or public lands, it is difficult to analyze those actions. Much of the native vegetation has been removed on private lands. These areas have been used for grazing or development and were often cleared of trees or drained. Continued development of lands would reduce native vegetation, alter hydrologic regimes, and increase the likelihood for new invasive species establishment. There are 147 acres of other ownership lands in the project area.

Other Activities

As with many other activities, special use permits for actions such as access roads and utility corridors, increase the risk of introducing and spreading invasive species, as well as removing native vegetation. The two existing permits, a private water line and power line, would remain in effect indefinitely, and there may be more in the future.

Conclusions

Based on Forest Service policy, regulations, and management requirements, the risk of invasive species spread, introduction, establishment, and persistence as a result of project actions, would be *moderate to high* in both action alternatives of the Martin Creek project, although Alternative C has a lower risk than the Proposed Action. The risk is moderate to high due to the high number of infestations in the project area, the increase of light and soil disturbance from treatments, yet offset by the required equipment washing, pre-treatment of haul routes, temporary road obliteration, and seeding disturbed areas with an approved seed mix.

Other than implementing an intensive invasive species treatment plan that would have overwhelming costs and take years for execution, there would be an invasive species problem in the project area indefinitely.

Regulatory Framework and Consistency

Management direction for noxious and invasive weed control on the Flathead National Forest is set at the National and Forest levels. Forest Service policies were developed in response to Federal laws guiding implementation of noxious weed control actions. These policies are set forth in Amendment 2000-95-5 of FSM 2080 Noxious Weeds Management and have been incorporated into the Forest Plan. Forest Service Manual 2900 Invasive Species Management was issued in 2011 and supersedes FSM 2080; however it has not yet been incorporated into the Forest Plan. The Flathead National Forest will comply with both the Forest Plan and FSM 2900. Treatment and monitoring of known infestations in the project area would be implemented under the authority and guidance of the 2001 Noxious Weed Decision Notice. These documents were designed to meet Forest Service policies for invasive species control and associated legal requirements. The proposed project incorporates and is consistent with the Noxious Weed DN. Design Criteria and management requirements for actions proposed under this project follow the FSM amendment for invasive species management.

Threatened and Sensitive Plant Species

Introduction

Under provisions of the ESA, federal agencies are directed to conserve endangered and threatened species and to ensure that actions authorized, funded, or carried out by these agencies are not likely to jeopardize the continued existence of threatened or endangered species, or result in the destruction or adverse modification of their critical habitats.

Water howellia (*Howellia aquatilis*), a vascular plant species in the family *Campanulaceae*, was listed as threatened under the ESA by the US Fish and Wildlife Service (USFWS) on June 14, 1994 (FR 59(134): 35860-35864). No critical habitat has been identified for the species. A draft recovery plan has been issued, but as of yet, no recovery plan has been finalized (USDI Fish and Wildlife Service 1996).

Spalding's catchfly (*Silene spaldingii*), a vascular plant species in the family *Caryophyllaceae*, was listed as threatened under the ESA by the USFWS on November 9, 2001 (FR 66(196): 51598-51606). Although the USFWS intends to identify critical habitat for this species, critical habitat designation was precluded at the time of listing due to a lack of funding. No recovery plan has yet been drafted.

Whitebark pine (*Pinus albicaulis*), a tree species in the family *Pinaceae*, was listed as a candidate species under the ESA by the USFWS on July 19, 2011 [FR 76(138): 42631-42654]. Whitebark pine was analyzed by the USFWS in 2010 as a candidate for listing. Their 12-month finding states that whitebark pine as a species is declining based on synergistic threats from habitat loss due to climate change, past and ongoing fire suppression, predation by mountain pine beetles, and the pathogen white pine blister rust (USDI Fish and Wildlife Service 2011). Timber harvesting was analyzed as a possible threat although it was dismissed due to the minimal amount of harvesting of whitebark pine, which is not a commercial species. However, the USFWS also states in their finding that the entire range of whitebark pine is not threatened by extinction and that there are many other species ahead of whitebark pine waiting for Federal listing. They cite budgetary and personnel constraints preventing them from listing the species. The USFWS determined that whitebark pine Federal listing is warranted but precluded, which makes the species a candidate for Federal listing as threatened or endangered. As a result, Region 1 added whitebark pine to the Regional Forester's Sensitive Species list, effective December 24, 2011 (USDA Forest Service 2011b).

Forest Service Sensitive Species Policy (FSM 2670) directs national forests to assist states in achieving conservation goals for endemic species; complete biological evaluations of programs and activities; avoid and minimize impacts to species with viability concerns; analyze the significance of adverse effects on populations or habitat; and coordinate with states and the USFWS. The Forest Service Manual (2670.15) further defines sensitive species as those plant species identified by the Regional Forester for which population viability is a concern, as evidenced by substantial current or predicted downward trend in numbers, density, or habitat capability that would reduce a species distribution. In addition to federally listed threatened and sensitive plant species, the forest also has an obligation to conserve Montana state listed rare plants.

Information Sources

Data sources used in this analysis include the Montana Natural Heritage Program's (MNHP) Element Occurrence Database, the Flathead National Forest's Survey Atlas, and the Forest Service Natural Resource Information System (NRIS).

A habitat suitability review was conducted to evaluate the potential for additional sensitive plants occurrences within the action areas. Sensitive and rare plant species are grouped in habitat guilds (Exhibit S-2). Known vegetation types and elevation ranges of the project area were considered in evaluating suitable habitat for rare plants. All proposed treatment areas were evaluated for potential habitat and those identified areas were field surveyed for Threatened, Endangered, and Sensitive (TES) plants and invasive species. Surveys for TES plants within the project area were conducted during the 2010 field season in 90 percent of the proposed treatment units.

Analysis Area

The analysis area for this project is based on the area of the project's influence/impacts on known occurrences or suitable habitat for TES plant species. The analysis area is confined to the project area and includes all treatment units and road systems with activities related to this proposed project.

The temporal bounds may be up to 100 years after project implementation (Kuropat 2009). The recovery of individual plants and populations after a disturbance event is species-specific and may depend on the disturbance type and its effects to the microsite, the tolerance of the species to disturbance, and the species methods of reproduction (i.e. rhizomes, taproots, bulbs, and/or corms). Following project implementation, vegetation conditions may be suitable for some TES plant species to become established immediately while other species may take between 50 and 100 years to return to the tree and shrub canopy cover conditions that are suitable habitat.

Affected Environment

Water howellia (*Howellia aquatilis*)

There are no known occurrences of water howellia within the project area. Wetlands were identified in aerial photos and within the project area and surveyed in 2010. Wetlands in the project area had very low potential for water howellia. Water howellia was not detected during surveys. It will not be analyzed further.

Spalding's catchfly (*Silene spaldingii*)

There are no known occurrences of Spalding's catchfly within the project area or within the Flathead National Forest. In addition, no grassland habitat with potential for Spalding's catchfly was identified during 2011 field surveys or identified in aerial photos in the Martin Creek Project area. Spalding's catchfly will not be analyzed further.

Regional Forester's Sensitive Species

Little is known about the historical condition for sensitive plants in the FNF and in the project area. Botanical surveys were not initiated in the area before the onset of the Forest's Botany program in 1991. There are 52 recognized Regional Forester's sensitive plant species (RFSS) for the FNF (USDA Forest Service 2011b; Exhibit S-2). The MNHP and NRIS databases were queried to determine known sensitive plant occurrences within the analysis area. There are no known RFSS populations within the project boundary. The closest sensitive plant populations to the project area are less than 0.1 mile from the project area to the south in a small wetland away from project activities and roads. Another population occurs approximately a half mile from the project area far from proposed activities although accessible by road. Stand examinations, regeneration exams, and general observations by certified silviculturists have been conducted in the Martin Creek area. No whitebark pine trees have been found in any of these surveys.

Suitable Habitat

The project area contains habitat types for sensitive plants associated with canyon walls, rocky outcrops and slides, subalpine forest, mid-elevation moist coniferous forest and margins, grasslands and forest openings in dry Douglas fir, wet meadows, marshes and seeps, and disturbed habitat groups. These are listed in Exhibit S-2.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

There would be no direct or indirect effects to RFSS plants as a result of this project.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Suitable Habitat

Unknown occurrences of RFSS plants may be affected by soil disturbance, competition from invasive species, roadside dusting, increased light availability from opening up the canopy, and hydrology alteration due to project activities.

Timber Harvesting – Timber harvesting may alter the hydrologic processes for sensitive plants of wetland-associated habitat groups such as the riparian, wet meadow, and moist coniferous forest groups. Changes to the hydrologic processes of wetlands may result in both a decrease or increase of wetland water levels and alter species diversity (Chadde, et al. 1998). Timber harvesting often decreases canopy cover and consequently may decrease evapotranspiration rates of surrounding upland trees. This may result in increased inundation of wetlands from runoff. In addition, increased canopy openings near wetlands may increase evaporation of the wetlands, effectively reducing water levels earlier in the growing season. See the *Aquatic Resources* section of this chapter for more information regarding the effects of timber harvest on hydrologic processes.

Harvesting in upland forested areas can also alter suitable habitat. The removal of canopy cover allows more light to the ground, as well as more air movement, which can decrease

humidity and increase temperatures. These changes to microclimate can indirectly affect any existing TES individuals. Impacts include wilting from increased temperature and decreased humidity, as well as sunburn from increased light levels. These changes to the habitat can also make these areas more suitable for invasion by invasive species.

Each action alternative has a combination of regeneration and intermediate harvests (Table 2-10). Commercial thinning would retain an average of 40 percent canopy cover, while regeneration treatments remove most trees from the harvested area. Clearcutting leaves up to 10 trees per acre at less than five percent canopy cover. A seedtree prescription leaves five to 15 overstory trees per acre, while a shelterwood prescription leaves up to 30 or 40 trees per acre (Table 2-1). These harvest prescriptions (clearcut, seedtree, shelterwood) would have the most impact on suitable habitat, since they would change the site conditions considerably, and it could take up to 50 years for the canopy to recover. Habitat guilds that would be directly affected by these treatments include subalpine and mid-elevation moist coniferous forests, and indirectly affected guilds would be wetland-associated habitats, which would suffer from edge effects (increased light, wind, temperature) and possibly more inundation during wet seasons.

Methods of tree removal would be mechanized or by hand on the steeper slopes or sensitive soils. Tractor based harvesting would occur in all units proposed for commercial harvest in both action alternatives, utilizing ground-based equipment (clippers, skidders, forwarders, etc.). Mechanized harvesting creates soil disturbance, which removes native vegetation from the landscape and alters suitable habitat. Hand removal is lighter on the land and would not create nearly as much soil disturbance. Timber removal would typically be whole-tree-yarding, which would create soil disturbance as trees are dragged over the ground and across native vegetation.

Reforestation would occur in both action alternatives by planting in the regeneration treatments after harvesting is complete. These are units where inadequate natural regeneration or undesirable tree species is predicted. The remaining acres would naturally regenerate with seed from on-site and adjacent leave trees, such as western larch and Douglas-fir. The Proposed Action has 482 acres proposed for artificial regeneration and Alternative C has 103 acres.

Alternative C would have the least amount of timber harvesting, affecting the least amount of TES plant habitat. The Proposed Action has the most amount of timber harvesting and would affect the most amount of TES plant habitat.

Fuel Treatment Activities – Sapling thinning treatments would reduce tree densities within stands with the objective of promoting healthier and more resilient forest conditions now and into the future, as well as improving timber productivity. Desired species, such as ponderosa pine, Douglas fir, and western larch, would be favored as leave trees while removing adjacent competing trees (primarily lodgepole pine and subalpine fir). Increased light and moisture would be available to these leave trees and to the understory vegetation, improving growth and vigor of these components. Units within the WUI can be treated mechanically, although hand tools would primarily be used. Thinning mechanical treatments would have similar effects to suitable habitat as commercial thinning treatments; much of the canopy would be left behind but there would still be soil disturbance and removal of native vegetation. Hand treatments are preferable since there is less soil disturbance and virtually no removal of native vegetation.

Slash created from hand treatments would be hand piled and burned. Mechanical units would have excavator piling and burning. Past observations have seen these piles as high risk for invasive species infestations. The high intensity burning of the confined area essentially sterilizes the soil and greatly inhibits native revegetation (Hebel, et al. 2009). Although invasive species are also inhibited by the lack of nutrients, they are better adapted to these sterile conditions, and once they are introduced, there are no natural barriers to prevent establishment and persistence of invasive species. These areas are priority for post-treatment monitoring and possible herbicide treatment. Alternative C has the least amount of understory removal and would have the least amount of change to suitable habitats.

Roads – There are approximately 65 miles of existing roads on NFS land within the project area. Both action alternatives propose new permanent and temporary road construction (Table 2-10).

Direct effects to suitable habitat would be the removal of vegetation and soil compaction. The construction of new road template removes vegetation, often putting it to the side of the corridor where it is left to decompose. Equipment can compact the soil creating a drivable surface and, depending on the project need, gravel is laid down to improve the driving surface. This construction removes the area from the productive landbase for the life of the road, preventing native vegetation to grow back. Generally, temporary roads are on the landscape for the life of the project and then blocked, obliterated, or recontoured after it is no longer needed. If the road is obliterated via ripping and putting back the native surface and/or recontouring, eventually native vegetation would grow back, if it is not outcompeted by weeds. If the road is left as is on the landscape without reclamation, vegetation would still grow back, but plant growth would be hindered due to soil compaction and lack of nutrition, and weeds would have the competitive edge in the harsher growing environment.

Indirect effects to suitable habitat would include edge effects from road construction and changes to hydrology of wetlands that support suitable habitat. Edge effects are described as an increase in light, temperature, and wind, as well as a decrease in humidity, and, in the case of roads, an increase in dusting (Trombulak and Frissell 2000). The extent of edge effects is difficult to determine, since it depends on the size of the adjacent opening/road corridor and the affected forest type, but it can extend from 15 feet to 50 feet (Watkins, et al. 2003). The effect to native vegetation would be a change in habitat that could affect the diversity of the stand edge.

Roads can also possibly alter hydrologic regimes by increasing or decreasing the water levels of the affected wetlands, as well as increasing silt to downstream wetlands (Chadde, et al. 1998). These changes can indirectly impact native vegetation and sensitive plant suitable habitat. Roads are corridors for invasive species, which can also indirectly impact wetlands and other natural areas (Tyser and Worley 1992, Trombulak and Frissell 2000, Von der Lippe and Kowarik 2007).

Temporary roads can potentially pose the risk of siltation into wetlands and temporarily alter water chemistry, which may affect native vegetation. Presumably, once the temporary roads are obliterated and the landscape and vegetation has had time to recover, any indirect effects to the downstream wetlands would cease. Project activities would maintain a buffer from documented streams and wetlands, however there is a possibility of undocumented wetlands in the project area that could harbor RFSS plants.

It has been observed on the landscape that if not obliterated properly, temporary roads have a lasting effect on the land. They can become corridors for invasive species to enter areas that would not normally be at risk of invasion. By allowing invasive species into natural areas, suitable habitat decreases. Recontouring these roads and heavily seeding them with an approved seed mix has inhibited weed spread in the past and should be implemented in this project.

Alternative C would have less impact to TES habitat in regards to road construction than the Proposed Action since it has the least amount of construction.

Non-Native Invasive Species Control – Sensitive and rare plants adjacent to areas of chemical invasive species control may be at risk of exposure to herbicide. However, on the Flathead National Forest, TES plant surveys are conducted for each site before any chemical control treatments are implemented, as required by the FNF Noxious and Invasive Weed Control Decision Notice (Exhibit A-3). With the exception of some TES plants that occur in "disturbed" or early successional habitats (i.e. Howell's gumweed, pale corydalis, Austin's knotweed, and western moonwort), most invasive species generally do not persist in intact TES habitat due to differing habitat requirements.

Cumulative Effects of Alternative A (No Action)

There would be no cumulative effects to RFSS plants as a result of this project.

Cumulative Effects of Alternatives B (Proposed Action) and C

Past, present, and reasonably foreseeable actions within the project area include timber harvest, fuel treatment, road construction and maintenance, dispersed recreation, land development, wildland fire, and fire suppression. These actions may have historically affected RFSS plants and may continue to have effects.

Timber Harvesting and Thinning – Timber harvesting on NFS lands occurred in this area beginning in the 1950s. Most activities occurred in the 1960s and 70s. Timber harvesting decreases canopy cover and increases light to the forest floor. This may be beneficial for some sensitive species, but may have adverse effects for other species requiring greater canopy cover (e.g. clustered lady's-slipper). Over time, changes in forest structure alter native vegetation types and sensitive species habitat. In many cases, timber harvesting creates stand changes similar to wildland fire; however, the pattern and distribution of forest size classes has drastically shifted from historical patterns that were created under natural disturbance regimes. Today, forested stands are more fragmented in forest structure and size class across the landscape than in the past.

Harvesting activities disturb soil which increases the amount of exposed mineral soil. This includes mechanized equipment moving over the ground, as well as skid trails necessary for tree removal. Soil disturbance carries a higher risk of invasive species establishment, and if equipment is contaminated, also has a higher risk of introduction of invasive species. Soil disturbance also exposes the dormant seed bank in the soil. The introduction and establishment of invasive species would affect the integrity of native and sensitive species habitats.

The objective of precommercial thinning is to reduce the density of young, overstocked stands to facilitate healthier and more resilient residual trees. The conditions created after precommercial thinning are not naturally produced and do not necessarily provide for suitable sensitive plant habitat. However, many of these stands prior to precommercial thinning are very dense, allow very little light to the forest floor, and do not support a diverse understory. They do not provide suitable habitat for most of listed TES plants either before or after precommercial thinning. There has been precommercial thinning since the 1960s.

Roads – Past, present, and future maintenance/construction of roads can have both adverse and beneficial cumulative effects on TES plant populations. Disturbance of roadsides may benefit those species that have a competitive edge in disturbed environments (i.e. Howell's gumweed, pale corydalis, Austin's knotweed, and western moonwort); yet disturbance would temporarily adversely affect these populations until new seedlings establish in the openings. Maintenance may increase traffic along these roads and thus increase the risk of the introduction of invasive species which could affect TES plant populations or habitat. Maintenance such as blading activities may also disturb plant populations adjacent to roads. Road construction and maintenance may also affect wetland habitats by disrupting the hydrology (Trombulak and Frissell 2000).

It is possible that road construction may affect ground water and sediment flow in wetlands. Increased siltation may result in shifts in the wetland vegetation composition, supporting emergent vegetation in place of submergent vegetation types (USDI Fish and Wildlife Service 1996). Past road closures have positively affected suitable habitat and native vegetation by reducing the above effects and decreasing the potential for invasive species invasion.

There are 65 miles of road currently in the project area. They include system roads that are open year-round, as well as seasonally open or closed year-round. This figure does not reflect the amount of temporary roads or decommissioned roads that have been on the landscape in the past. Many of those corridors still exist and are grown over with young saplings, other native vegetation, or heavily infested with weeds. The action alternatives would add to the current system roads by varying mileages, which would then be on the landscape indefinitely.

Wildland Fire – In general, fire suppression over the last century eliminated the role of wildland fire in reducing fuels and encroaching vegetation. Wildland fire suppression has reduced light levels and affected understory vegetation. Additionally, wildland fire suppression activities increase exposed mineral soil which can be vulnerable to invasive species establishment, which would affect the integrity of TES habitat. When wildland fires occur, they can often burn hotter, affecting the soil and reducing its nutrient content. Native plants eventually grow back over time, but often compete with invasive species for the remaining nutrients.

Fuels reduction, whether by the Forest or by other landowners, reduces the risk of wildland fires and the need for fire suppression activities. Since vegetation removal is part of fuels reduction activities, there is a risk of disturbing unknown TES plant populations; however, an intense wild burn would also disturb existing TES populations. The last known large wildland fire in this area was in 1926. The forest has been suppressing them in the area since the 1940s.

Recreation – Dispersed camping, lake access points, and other areas frequented by recreationists cumulatively affect sensitive plants by removing suitable habitat, especially in areas along streams, lakes, and associated wetlands. Dispersed camping increases the risk of introducing invasive species to TES plant habitat, as well as trampling of native vegetation surrounding these sites.

Trails (likely on old roads) near wetlands may affect wetland species by increasing siltation into wetlands or increasing the risk of introducing invasive species by recreationists. These linear, non-vegetated features create edge effects into the adjacent understory and affect suitable habitat by increasing light and temperature, and decreasing humidity. These features also provide corridors for invasive species, allowing them to move into the understory.

Other recreation activities such as off-trail hiking, hunting, trapping, berry picking, and horse riding can also impact sensitive plant habitat. Native vegetation and TES plants may experience cumulative effects of trampling and collecting from dispersed recreation.

Invasive Species Control – Past vegetation management, wildland fire suppression, recreation, land development, and road related activities have all contributed to the spread of invasive species in the project area. The proposed activities also carry the risk of introduction and further spread of invasives. The FNF has an integrated weed management program that identifies and controls infestations across the Forest. Herbicide is the most commonly used treatment to control invasive species, which also can affect native plant species. In addition, the Forest also uses biological control on tansy ragwort, spotted knapweed, and Canada thistle. These control organisms have spread on their own, as well as with human help, into the project area. Since areas to be treated with herbicide are surveyed prior to spraying, there would not be an effect to known populations of sensitive plants. Currently, the Forest sprays the Martin Creek Road (FS Road 910) on an annual basis, as well as some of other roads that are used by the public.

A foreseeable project in the Martin Creek project area is the Reed Canarygrass Control Project. Although two of its sites area outside of the Martin Creek project area, a third site is within the boundaries of this project area. This weed control project would experiment with different control measures for reed canarygrass (*Phalaris arundinacea*), an invasive grass that has infested many wetlands and waterways on the Flathead National Forest. The Forest would determine with method is the most efficient for small infestations with the hopes of using that process in the Swan Valley near water howellia sites.

Land Development – Effects to sensitive plant resources as a result of past development and land clearing on private lands could have been detrimental to population viability; however, since there is no historical data on sensitive species, it is difficult to analyze those actions. Much of the suitable habitat for plants associated with wetlands has been lost or degraded on private lands. These areas have been used for grazing or development and were often cleared of trees or drained. Continued development of lands could reduce potential habitat, alter hydrologic regimes, and increase the likelihood for new invasive species establishment. There is not much private land or other ownerships in the project area, although the existing private ownership has been developed.

Other Activities – As with many other activities, special use permits for actions such as access roads and utility corridors, increase the risk of introducing and spreading invasive species, as

well as removing native vegetation. The two existing permits, a private water line and power line, would remain in effect indefinitely.

Summary of Effects

The proposed Martin Creek Project would not have direct or indirect effects on Regional Forester's sensitive plant species, as there are no known occurrences in the project area. There would not be any cumulative effects on TES plants. There would be direct, indirect, and cumulative effects to suitable habitat. Suitable habitat would presumably recover in 10 to 50 years after implementation.

Regulatory Framework and Consistency

The Martin Creek Project would meet the direction outlined by the Flathead National Forest in the Forest Plan and Amendments, as well as direction found in FSM 2670. It is also in compliance with the Endangered Species Act and the National Forest Management Act. The biological evaluation and assessment (Exhibit S-2) analyzes the potential effects of the alternatives.

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Fire and Fuels

Introduction

Fire has historically been the dominant disturbance factor in forests across the northern Rocky Mountains. Most forests have evolved with the continual influence of fire, and forest ecosystems depend on this type of disturbance regime for their continued perpetuation on the landscape (Habeck and Mutch, 1973).

Historical natural fire regimes best illustrate fire disturbance patterns. A fire regime describes the frequency, predictability, and severity of fire in an ecosystem. Fire regimes can range from non-lethal to stand-replacing levels; typically, fire frequency declines as fire severity increases.

Drought cycles, fuel availability, and ignition have a considerable influence on fire regimes. Wildland fires most often occur during the driest months of the year (July, August, and early September) and can be especially numerous and severe during drought periods. The quantity, arrangement, and type of fuels also play a major role in determining fire behavior. Wildland fuels are composed of dead, woody debris and living vegetation. Fuel quantities and arrangement can vary considerably, depending on the vegetation composition and recent fire history.

Historically in the Martin Creek Project Area, wildland fires typically burned until extinguished by fall precipitation. Suppression efforts since approximately the 1930s have altered fire regimes and reduced the number of forested acres burned each year in this area. The combination of fire suppression, fire exclusion, and natural disturbance processes has allowed fuels to accumulate in unmanaged timber stands.

Information Sources

Data gathered from the National Interagency Fire Management Integrated Database (NIFMID) were used to evaluate fire ignition and suppression events and their associated causes from 1885 to the present. The fire history analysis in the Martin Creek area was based on data from the Flathead GIS library (Exhibit O-4, Exhibit O-9). The Stillwater Remote Automated Weather Station (RAWS) was used as the source of the weather data for this project area. Weather conditions from the RAWS stations are reported to and cataloged by NIFMID. The analysis of the historical fire regime and condition class used data from the Vegetation Models developed for The Landscape Fire and Resource Management Tool (LANDFIRE), the Biophysical setting (BpS), and succession class (SCLASS) layers developed by LANDFIRE (www.landfire.gov).

The Common Stand Exam (CSE) data from stands within the project area was entered into the Forest Vegetation Simulator (FVS) software to model current conditions and project future conditions. Within FVS, the Fire and Fuels Extension (FFE) was used to obtain canopy fuel characteristics at the stand level for canopy bulk density and canopy base height, and to model current potential fire behavior within these stands.

Analysis Area

The area evaluated for this fire and fuels section includes the entire Martin Creek project area as illustrated in Figure 1-1. The fire regime patterns in Martin Creek drainage are characteristic of those in the northern Rocky Mountain region. The analysis area is dominated by temperate coniferous forest at all elevations. Western larch and the shade intolerant species mix is the dominant cover type on nearly 39 percent of the Martin Creek Project Area. The Engelmann spruce, subalpine fir or a shade tolerant species mix is the next most abundant cover type, at 31 percent, followed by the lodgepole pine and Douglas-fir groups at 15 and 14 percent, respectively. The remaining two percent of the project area is grand fir and non-forested area. This mosaic is formed as a result of disturbance processes including timber harvest, forest insects and diseases, windstorms, and wildland fire. For a more specific discussion of species cover types, see the *Forest Vegetation* section.

Affected Environment

Historical Natural Fire Regimes

A natural fire regime is defined as the role fire would play across a landscape in the absence of modern human intervention, but including the possible influence of aboriginal fire use (Barrett, et al. 2010). This classification system includes five historical fire regimes (see Table 3-19).

The historical natural fire regimes of the Martin Creek analysis was based on vegetation models created for LANDFIRE. Using this data, LANDFIRE can then assign a fire regime to each of the BpS, as well as current vegetation departure from simulated historical reference conditions, including SCLASS, and departure (DEP). See Exhibit O-11. The two predominant fire regimes that currently occur in the Martin Creek area are as follows:

III, Low to Mixed-severity fire regime areas can experience the broad range of severities during either a single fire event or consecutive fire events. In other words, low to mixed-severity fire regime areas may experience fires of intermediate effects, often consisting of a mosaic of varying severity and is defined as fires that replace up to 75 percent of the overstory, and can include low-severity fires or fires that replace less than 25 percent of the dominant overstory vegetation. Low to mixed-severity is the predominant fire regime type within the Martin Creek area. The mean fire interval in the mixed-severity fire regime ranges from 35 to 200 years, depending on the site's BpS.

IV, Replacement Severity fire regime areas typically have high-severity fires replacing greater than 75 percent of the dominant overstory vegetation. In the Martin Creek area, these are low frequency high severity events. The mean fire interval in the stand replacement fire regime ranges from 35 to 200 years, depending on the site's BpS.

Fires were common within the Martin Creek area before 1930. Since this time, wildland fires have been actively suppressed by the Forest Service and other agencies and have affected their number and size. Wildland fires would continue to be suppressed. Recent wildland fires within the project area boundaries have typically been less than one acre and suppressed using hand crews or engines. For a spatial representation of fire starts and historical fire boundaries see Exhibits O-4, O-7, and O-9. Data for these exhibits were generated using the Flathead

National Forest fire history and starts layer which includes historical information for private land.

Historically, the spread of a typical moderate to severe large fire was on a west-to-east axis with a broadening north-south axis as it moved across the moderate relief landscape, while low to moderate fire spread was confined in a valley-to-ridgeline pattern. Fire history data shows the overriding disturbance that initiated the forests in Martin Creek is fire. Approximately 67 percent of the Martin Creek landscape is a mixed-severity and replacement-severity fire regime. Prior to 1940, fire intervals ranged from one to 73 years with the mean fire interval (MFI) for the area of 11 years. No large fires have occurred in the Martin Creek area since 1926. (Exhibits O-4, O-7, and O-9).

Table 3-19. Fire Regime Groups.

Classification	Description
I	0 to 35 year frequency[1], low to mixed severity[2]
II	0 to 35 year frequency, replacement severity
III	35 to 200 year frequency, low to mixed severity
IV	35 to 200 year frequency, replacement severity
V	200+ year frequency, any severity

[1] Fire frequency is the average number of years between fires.
[2] Severity is the effect of the fire on the dominant overstory vegetation.

Current Condition Class Departures

The condition class departure is a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. Current Condition Class Departures are defined in terms of the relative risk of losing one or more key components that define an ecological system (Laverty and Williams 2000) including:

- Disturbance regimes (patterns and frequency of fire, insect, disease, etc.);
- Disturbance agents;
- Hydrologic function; and
- Vegetative attributes (composition, structure, and resilience to disturbance agents).

The higher the number of condition class departure, the more the risk of losing key components of an ecological system if a wildland fire occurs (see Exhibit O-11).

Condition Class Departures are categorized by the National Fire Plan as:

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 and severity, and landscape patterns. Vegetation attributes have been substantially altered from their historical range (Laverty and Williams 2000).

Table 3-20. Current Condition Class Departure by Historical Natural Fire Regime on all Ownerships within the Martin Creek Area.

Fire Regime	Current Condition Class Departure 1	Current Condition Class Departure 2	Current Condition Class Departure 3
Any Severity (V)	1	1129	1
Replacement Severity (IV)	4,796	1	1
Low to Mixed Severity (III)	296	3,262	3
Replacement Severity (II)	0	1224	1
Low to Mixed Severity (I)	27	2	6
Total by Current Condition	**5,120 acres**	**5,618 acres**	**12 acres**

* The table also displays the current Condition Class Departure by vegetation type for timbered stands that have not been entered for timber management activities. Current Condition Class 2 total does not reflect 36 acres within the project area that is water.

Forest Management

Although timber harvest and associated fuel treatments have not replicated wildland fire, they have changed the patterns of vegetation and woody debris accumulations in the forest. Approximately 50 percent of the area has had some level of harvest activity and reforestation, distributed in relatively small patches across the landscape (see Vegetation section, Table 3-3 for a comprehensive list of past harvest activities). These previously managed areas are considered to be in a Condition Class 1. The forest management activities have created a fuel mosaic, which are breaks or changes in standing timber and surface fuel patterns.

Fire Ignitions and Suppressions Since 1986

The appropriate response in the Martin Creek area is full or modified suppression using initial attack actions to control, contain or confine a wildland fire as discussed in our FNF Fire Management Plan (Exhibit O-5) with the safety of the public and fire management personnel being the first priority, and sequentially the protection of property and natural resources.

An analysis of fire history in the Martin Creek area was used to determine:

- Spatial and temporal distribution of fire disturbances.
- Mean fire intervals in areas with similar biophysical and climatic characteristics.
- The impact of fire suppression on historical fire regimes.

The Flathead National Forest fire history GIS layer identified 17 suppressed ignitions (14 lightning-caused and three human-caused, primarily campfires) that occurred from 1986 through 2012 within the Martin Creek area (Exhibit O-7). Recent fire history data does not show evidence of a large fire since the Keith Mountain Fire in 1926. The Keith Mountain

Fire burned approximately 1000 acres (Exhibit O-4). Since that time fire suppression has been successful, with only two fires in the small fire category growing to three acres each.

Wildland Urban Interface

Structural development has occurred on private land in and around the project area, raising concerns about the risk to human life and property when wildland fire occurs. Following the 2000 fire season, Congress directed the Forest Service to identify high-risk areas, using the 2000 National Fire Plan Guidelines (USDI and USDA 2000 and 2001, Interagency Federal Wildland Fire Policy Review Working Group 1995 and 2001). The communities of the Flathead Valley have been identified as "communities at risk" from wildland fire (USDI and USDA 2001). Flathead County, in cooperation with area fire districts, land management agencies, and corporate timber land owners, responded with a county-wide fire protection plan. This plan, known as the *Flathead County Community Wildfire Protection Plan* (CWPP) (Exhibit O-2), defines areas where communities and other enclaves of residential development are at greatest risk from wildland fire, known the Wildland/Urban Interface (WUI). The WUI in the Martin Creek project area encompasses the lower quarter of the Martin Creek Drainage (Exhibit O-3).

Although the amount of private ownership is limited within the analysis area, the current trend of development on private ownership is expected to increase. When wildland fire enters these areas, the suppression efforts require a large commitment of firefighting resources. During the fires of 2000, 2003, 2007, 2012, and 2013 in Montana, large sectors of otherwise high-priority fires remained unstaffed because resources were committed to structure protection.

Vegetation treatments within the WUI are designed to increase the likelihood of success for initial attack by providing a safe, defensible environment for firefighters. Fuel treatments in and near the WUI also serve to protect National Forest System lands from the risk of wildland fire spreading from private property.

Other issues and problems faced by resource managers, fire professionals, and residents when considering fire in the WUI. When fire enters the WUI, there remains the potential for loss of life, property, and other values even if homes have been made fire safe. Many homeowners would likely find it undesirable to live in an intensely or severely burned-over forest, even if their home has survived the passage of fire. Not only are aesthetic values decreased for most people, but the risk of flooding and landslides can put homes and lives at risk during subsequent precipitation events.

Because of the problems and complexities associated with the WUI, resource managers and fire managers find it desirable to exclude, to the extent possible, wildland fire from these areas, and prefer to use prescribed fire to manage fuels; however, sociopolitical constraints may preclude or limit its implementation (Kalabokidis and Omi 1998; DellaSalla, et al. 1995). Limitations include public attitudes toward smoke, fear of escaped fire, and potential negative visual effects of burns.

Home Ignitability

Recent research (Cohen 2000a) addresses home ignitibility, or the potential for a home to ignite, in the wildland urban interface. Cohen concludes that homes most often ignite via one

of two processes: direct flame contact with the structure and lofted firebrands landing on a receptive fuel such as a house. The Structure Ignition Assessment Model (SIAM) developed by Cohen (1995) and results from the International Crown Fire Modeling Experiment (Alexander, et al. 1998) generally concur that a flaming front at a distance of 130 feet or more from a structure does not deliver sufficient heat energy to ignite the exterior of a home. However, lofted firebrands are also a principle WUI ignition factor. In the 2000 Cerro Grande Fire in New Mexico, surface fires ignited homes while leaving green needles on trees around the home (Cohen 2000b). Highly ignitable homes can ignite during a wildland fire without the fire spreading near the structure. This occurs when firebrands are lofted downwind from fires. The firebrands subsequently settle on and ignite flammable home materials (such as roofs) and adjacent flammables (such as woodpiles, decking, or landscaped vegetation). Firebrands that result in ignitions can originate from wildland fires that are a distance of one mile or more (Cohen 2000a).

Existing Condition of Forest Fuels and Fire Behavior

The greatest effect of fire suppression and exclusion, in unison with other natural disturbance processes, has been to allow biomass to accumulate in unmanaged timber stands. The bulk of the biomass currently found in 50 percent of unmanaged stands in the analysis area is in the form of dead standing and downed trees and shrubs, as well as live, Western larch, Engelmann spruce, subalpine fir, and other shade tolerant species, lodgepole pine, and Douglas-fir. The combination of dead fuel and continuous live vegetation from the forest floor to the upper forest canopy creates a complex of fuel that, when ignited under severe fire conditions, would leave little or no surviving above-ground vegetation. These types of fire are generally described as stand-replacement in nature as they result in a recycling of primary successional processes and complete forest regeneration. These fires also exhibit crown-fire behavior, can consume vast amounts of acreage, and result in extensive alteration of the forest community. Depending upon the circumstances associated with these types of fires, slow-moving fires that are transported primarily though the understory fuel can also be described as being infrequent and high-severity. Again, this is based upon the fact that slow-moving fires, while technically less intense that a crown fire, can produce a great deal of heat over an extended period of time resulting in high-percentage mortality to the overstory vegetation, thereby resulting in stand-replacement effects.

Wildland fires will always occur and may escape initial attack during severe fire conditions. The intensity of these fires would be dependent upon weather, fuels, and topography. When burning conditions are less than severe, fires may be of low to moderate severity and result in only moderate or no damage to overstory trees. If downed fuels are present, tree mortality can occur even during moderate burning conditions.

Fuel Models and Fire Behavior

Fuels are made up of the various components of vegetation, live and dead, that occur on a site. These components include litter and duff layers, the dead-downed woody material, grasses and forbs, shrubs, and trees of varying age. Various combinations of these components define the major fuel groups of grass, shrub, timber, and slash. The differences in fire behavior among these groups are related to the fuel load and its distribution among the fuel particle size

classes. Fuel load and depth are critical fuel properties for predicting whether a fire would ignite, its rate of spread, and its intensity (Exhibit O-15).

Fuel component characteristics contribute to fire behavior properties. Fuel loading, size class distribution of the load, and its arrangement (compactness or bulk density) govern whether an ignition would result in a sustaining fire. Horizontal continuity influences whether a fire would spread or not and how steady the rate of spread would be. Loading and its vertical arrangement would influence flame size and the ability of a fire to torch into the overstory. With the proper horizontal continuity in the overstory, the fire may develop into a crown fire. Fuel moisture content has a substantial impact upon fire behavior, affecting ignition, spread, and intensity.

Fuel models are a tool to help the user estimate fire behavior. Each fuel model is described by:

- Fuel load and the ratio of surface area to volume for each size class.
- Depth of the fuel bed involved in the fire front.
- Fuel moisture, including when the fire would not spread (called the moisture of extinction).

The fuel models either existing or desired in the project area are based on Albini's (1976) paper "Estimating Wildfire Behavior and Effects," which is well described in Anderson (1982). Of greatest concern in the Martin Creek analysis area are the 5777 acres of Fuel Model 10, which may allow rapid fire growth and spread during periods of severe fire weather. The predominant fuel models found in the Martin Creek area are Fuel Models 5, 8, 9 and 10. Please see Exhibit O-15 for Anderson (1982).

Table 3-21. Fire Behavior Fuel Model Distribution.

Fuel Model Number	Total Fuel Load, <3" dead & live, tons/acre	Dead Fuel Load, 1/4", tons/acre	Live Fuel Load, foliage, tons/acre	Fuel Bed Depth, feet	Moisture of Extinction^	Rate of Spread, chains / hour	Flame Length, feet	Approx. Acres in Analysis Area
1	0.7	0.7	0	1.0	12 %	18*	< 4*	107
2	4.0	2.0	0.5	1.0	15 %	12 - 20**	< 4**	63
5	3.5	1.0	2.0	2.0	20 %	13	< 4	1087
8	5.0	1.5	0	0.2	30 %	1.6	1.0	1827
9	3.5	2.9	0	0.2	25%	7.5	2.6	1853
10	12.0	3.0	2.0	1.0	25 %	7.9 - 72#	4.8 - 78##	5777

^ Moisture of extinction is the fuel moisture content at which the fire would not spread or spreads only sporadically and in an unpredictable manner.
* Lower due to discontinuous fuel bed created by interspersed rock outcrops or the treatment of the grass on private pastureland. Flame lengths on utilized private pastureland would generally be less than one foot. Rate of spread established during the monitoring of the Elk Mountain Wildlife Prescribed Fire of 1999 in this fuel type.
** Lower due to discontinuity of fuel bed from harvest activity, post-harvest site preparation/slash treatment and inclusions of Fuel Model 5, i.e. surface fire behavior experienced on the Elk Mountain Fire and the Stone Young Fire Complex of 2000, Swaney Fire of 1999 in these fuel models.
# Average crown fire potential of 40 chains per hour with a maximum rate of spread of 72 chains per hour. (Rothermel 1991)
Crown fire potential of 38 to 78 feet. (Rothermel 1991)

Table 3-21, above, gives numerical estimations of fire behavior by fuel model. The fire intensities and spread rates of the fuel models listed below are indicated by the following values when the dead fuel moisture is eight percent, live fuel moisture is 100 percent, and the

effective wind speed at mid-flame height is five miles per hour. As indicated in the table, fires burning in stands typical of Fuel Model 10 can exhibit extreme rates of spread and flame lengths, posing severe risks to fire fighters and property.

Fire Behavior Modeling Tools

Climatology

Historical weather data was gathered from the Stillwater (240221) RAWS located approximately four miles south of the project area. Data was downloaded from FamWeb and can be found in Exhibit O-6. Data collected contained records from 1993 through 2012. The computer program Fire Family Plus version 3.0.1.0 was used to summarize the weather data. Weather data was collected from May 1 to October 15 and is shown in Exhibit O-6. Outputs for fuel moistures and wind can be seen in Table 3-22. This information was used to model fire behavior and fire effects in FVS/FFE.

Table 3-22. Weather Data (Percentile).

Stillwater (240221) RAWS	90th Percentile Severe	97th Percentile Extreme
Percentile Range	90-97	97-100
% of Days	7	3
1 Hour	6.2%	7.2%
10 Hour	8.47%	8.65%
100 Hour	11.96%	11.47%
1000 Hour	11.33%	7.72%
Herbaceous Moisture	54.31%	23.91%
Woody Moisture	90.13%	59.41%
20 Foot Winds, MPH	11.33	7.72

Fuel moisture is the amount of moisture in a piece of fuel relative to its oven dried weight. Fuel moistures are displayed in six categories based on type of fuel (live or dead) and size class. The size classes for dead fuels are as follows; 1 hour fuels are 0 to ¼ inch in diameter, 10 hour fuels are ¼ to 1 inch in diameter, 100 hour fuels are one to three inches in diameter, and 1000 hour fuels are three + inches in diameter. Dead fuels are classified in this manner because different sizes of fuels take different amounts of time to gain or lose moisture, thus the number of hours associated with each class (Anderson 1982). Live fuels are classified as either herbaceous or woody, depending on the type of plant.

Twenty foot wind speed is the speed of the wind measured 20 feet above the vegetation. It is important to note that 20 foot winds are often three times the strength of the wind we feel on the ground in a forested area. For example, in a moderately dense conifer stand it would take a 20 mph 20 foot wind to produce a six mph eye level wind (NWCG 2004). Eye level winds are often referred to as mid-flame winds because these are the winds that most directly affect surface fires. Mid-flame wind speeds are calculated from 20 foot winds by using a wind adjustment factor (NWCG 2004). When a forested stand density is reduced through removal of trees, the potential mid-flame wind speeds increase. This was considered and adjusted when estimating fire behavior in post fuel reduction treatment areas.

Stand Modeling, Fire Effects, and Potential Fire Behavior

The CSE data from stands within the project area was entered into FVS to model current conditions and project future conditions. Within FVS, the FFE was used to obtain canopy fuel characteristics at the stand level for canopy bulk density and canopy base height, and to model current potential fire behavior within these stands. Downed and dead wood fuel loading from each of the particular stands, as well as 97th percentile fuel and weather conditions, were used to model fire behavior. Along with current conditions, fire behavior was looked at for each action alternative post treatment. Other outputs from the potential fire report that were beneficial for understanding the effects of fuel manipulation were type of fire, stand mortality, fuel loadings, crowning index, and torching index. FVS/FFE (Reinhardt, Crookston, 2003) computes fire behavior using the same methods developed by Rothermel, Albini, Scott and Reinhardt, and Scott. The FFE/FVS Model Inputs and Outputs for the Potential Fire Reports and Fuels Report can be found in Exhibit O-14.

Surface fire behavior was modeled using the FFE extension of FVS. A surface fire is one that burns in the surface fuel layer, which lies immediately above the ground fuels but below the canopy, or aerial fuels. Surface fuels consist of needles, leaves, grass, dead and down branch wood and logs, shrubs, low brush, and short trees. Surface fire behavior varies widely depending on the nature of the surface fuel complex. Surface fires are generally easier to contain than any type of crown fire, although flame lengths do dictate suppression techniques. Flame lengths greater than 4 feet are not conducive to effective suppression by on-ground forces, and if flame lengths are greater than 8 feet, mechanized equipment is not considered effective (NWCG, 2004).

Crown fire is a fire that burns in the elevated canopy fuels. Canopy fuels normally consumed in crown fires consist of the live and dead foliage, lichen, and very fine live and dead branchwood found in the forest canopy. We generally recognize the following three types of crown fire:

1. *Passive* - A passive crown fire, also called torching or candling, is one in which individual or small groups of trees torch out but a solid flame is not consistently maintained in the canopy. These can encompass a wide range of fire behavior, from the occasional tree torching out, to a nearly active crown fire. The increased radiation to surface fuels from passive crowning increases flame front spread rate, especially at the upper end of the passive crown fire range. Embers lofted during passive crowning can start new fires downwind, making containment more difficult and increasing the overall rate of fire spread. Passive crowning is common in many forest types, especially those with an understory of shade-tolerant conifers.

2. *Active* - An active crown fire is a crown fire in which the entire fuel complex becomes involved, but the crowning phase remains dependent on heat released from the surface fuels for continued spread. Active crown fires are characterized by a solid wall of flame extending from the fuelbed surface through the top of the canopy. Greatly increased radiation and short-range spotting of active crown fires lead to spread rates much higher than would occur if the fire remained on the surface. Medium and long-range spotting associated with active crowning leads to even greater rates of fire growth. Containment of active crown fires is very difficult.

3. *Independent* - An independent crown fire is one that burns in canopy fuels without aid of a supporting surface fire. Independent crown fires occur rarely and are short-lived, requiring a combination of steep slope, high windspeed, and low foliar moisture content. Many apparently independent crown fires may actually be active crown fires in which the canopy phase is momentarily pushed ahead of the surface phase under the influence of steep slope or strong wind. Few cases of independent crown fire have been documented. Independent crown fires are not addressed because they occur so rarely and because no model of their behavior is available.

FVS/FFE defines the potential for surface fire transition to torching and crowning by indices developed by Scott and Reinhardt (2001). Scott and Reinhardt's method is a culmination of Rothermels' surface and crown fire models, and Van Wagner's model of surface fire transition to crown fire. Three main characteristics of the canopy fuels must be quantified in ordered for the model to run. Those characteristics are canopy bulk density (CBD), canopy base height (CBH), and foliar moisture content (FMC). In FVS/FFE, CBD is defined as the maximum 4.5 meter deep running mean of canopy bulk density for layers 0.3 meters thick. This method is slightly different than the method used by Scott and Reinhardt (2001), and does not necessarily equal canopy load divided by canopy depth. When compared to empirical data this technique better estimates "effective" CBD then stand inventories. FVS/FFE defines CBH as the lowest height above which at least 30 lbs/acre/ft of available canopy fuels is present within a stand. For FMC, FVS/FFE use a default input of 100 percent. According to Scott and Reinhardt (2001), using 100 percent FMC is a reasonable approach given the relative insensitivity of the model to this parameter, and understanding CBH plays a much stronger role in crown fire initiation.

With all the characteristics defined and quantified from the stand data entered in FVS/FFE, crown fire potential can be modeled. In order to have a crown fire, surface fire intensity must first be greater than the critical intensity needed to ignite canopy fuels, or I surface $\geq I$ initiation. If this criterion is not met, then a fire would remain on the surface. If a fire is able to transition to the canopy, potential active crown fire spread can be calculated. Once initiated, CBD is the only factor affecting the critical rate needed for sustained active crown fire (Scott and Reinhardt, 2001). The two indices used to define crown fire hazard are Torching Index (TI) and Crowning Index (CI). TI is defined as the 6.1 meter windspeed at which crown fire is expected to initiate based on Rothermel's surface fire model and Van Wagner's crown fire initiation criteria (Scott and Reinhardt, 2001). When wind speeds are less than the TI, a surface fire is expected. CI is defined as the 6.1 meter wind needed to have an active crown fire, and is based on Rothermel's crown fire spread rate model and Van Wagner's active crown fire spread criteria. Passive crown fire is expected when wind speeds fall within the region between TI and CI.

Environmental Consequences

The following paragraphs describe the direct, indirect, and cumulative effects of the proposed management actions on the wildland fire condition in the Martin Creek area.

Direct and Indirect Effects of Alternative A (No Action)

Alternative A would not treat any areas at risk of stand replacing wildland fire, return or maintain any of the stands to historical fire regimes. Stands within the WUI would not be

thinned nor have fuels treated to provide a safer environment for firefighters and public. The overall result would be increased fire hazard particularly on national forest lands due to the following conditions:

Continued Dense Understory, Ladder Fuel, and Fuel Accumulations

Large-diameter Douglas-fir and larch in most of the drier forest stands would continue to lose vigor due to competition from dense understories of shade-tolerant tree species. This would perpetuate a denser understory. This understory also would serve as ladder fuel that would permit a surface fire to expand into the canopy, thereby killing many of the existing large-diameter trees that would have otherwise survived a surface fire.

Continued Beetle Infestation

While insect-caused mortality is a normal ecosystem process, the objective is for them to function within their historical range across the landscape. Currently, on national forest lands within the Martin Creek project area, 13 percent of the area is at risk for a moderate to high Mountain Pine Beetle outbreak. Moderate to high risk stands could lose the majority of their mature lodgepole pine during an outbreak. Resulting stands would contain high fuel accumulations and not meet desired future conditions for fuel in the analysis area (less than 15 tons/acre). For a detailed discussion of beetle outbreaks, see the *Forest Vegetation* section.

Continued Risk of High-Severity Wildland Fire

Because there would be no fuel treatments to reduce the fuel hazard in Alternative A, the potential for high-severity wildland fire to occur would continue. See Exhibit O-11 for a spatial representation of fire severity across the Martin Creek project area. Many of the stands included in the Proposed Action are conducive to stand-replacement fire. As fire has been effectively suppressed from the Martin Creek area since 1930, and the risk of ignition (lightning or human-caused) is present, a wildland fire could occur at some point in the future. If such a wildland fire were to escape initial suppression efforts and burn into extensive fuel accumulations, especially during dry and windy conditions, it would likely burn with high rates of spread and intensities. With the aerial (ladder) fuels that exist in many of the stands, a fire could reach into the crowns and become a stand-replacement crown fire. The largest threat of stand-replacing fires in the lower elevations is to private property, homes, public safety, and firefighter safety. Additionally, large stand-replacing fires have a number of undesirable consequences, many of which are discussed in other sections of this chapter.

Direct and Indirect Effects to Alternatives B (Proposed Action) and C

Road Access for Fire Suppression

Road management activities affect fire suppression effectiveness. In general, the more access in an area, the more effective fire suppression is in that area. The existing Martin Creek road system provides reasonable access for wildland fire suppression. Mixes of gates, berms, or rocks are used as road closure devices on most of the roads. Gates on maintained roads allow emergency vehicles to respond to a wildland fire without any time delay, thus expediting the suppression process. Barriers that do not allow administrative vehicle access, such as un-maintained roads, berms and rocks, negatively impact fire suppression efforts by reducing the areas accessible by vehicular firefighting equipment. Gates are the most effective road

prohibition device on roads accessing lands adjacent to private lands. Rock and berm barriers should be avoided if possible in the WUI. Alternatives B and C include road berm barriers; the roads scheduled for this activity would have little impact on accessibility to areas needing suppression resources.

Wildland Urban Interface

Consideration was given to selecting treatment areas linked to previously treated stands or areas of natural fuel breaks. These fuel breaks are important to either slow the spread or reduce the intensity of wildland fire esspecially in the WUI, thus increasing the effectiveness of suppression efforts to protect values at risk. Alternative B includes more acres of commercial and non-commercial treatments than Alternative C; therefore, Alternative B would create more effective and contiguous fuels treatments. Alternative C includes the least amount of vegetation/fuels treatments.

The fuel reduction treatments in and adjacent to the WUI are designed to protect primarily private structures and improvements; secondarily, they are designed to protect national forest resource values. Wildland fire can threaten a structure in three ways: direct exposure from flames, radiated heat, and airborne firebrands. The treatments proposed are meant to decrease the probability that airborne firebrands could reach structures. To reduce threat of ignition from firebrands, fuels need to be reduced both near, and at some distance, from structures. Firebrands that result in ignitions can originate from wildland fires that are at a distance of one kilometer or more (Cohen 1999). However, firebrands pose a greater threat the closer the fire is to the structures.

Vegetation Treatments

Some of the units proposed for treatment are large (greater than 40 acres) in order to treat an entire stand that has similar forest and fuels characteristics. These stands are experiencing mountain pine beetle activity that contribute to mortality and increased fuel loading. Other large units are proposed within the WUI to reduce the probability of a high intensity fire moving onto private land and to improve the fire suppression success should a fire burn in the area. Treating areas smaller than 40 acres would not be as effective because dense fuels would be left between treated areas. Firefighter safety may be compromised because the remaining fuel loading in the untreated areas would allow for intense fire behavior.

All action alternatives would reduce the potential for stand-replacing wildland fire to impact resources and the wildland urban interface area. Implementation of any action alternative would modify the behavior of a wildland fire and increase the likelihood that fire suppression efforts would be successful in containing the fire at a small size.

All action alternatives would treat timber stands that are in current Condition Class Departure 2 and 3 for both stand-replacement and mixed-severity historical natural fire regimes. In other words, the action alternatives would treat timber stands that have been moderately and substantially altered from the historical range of fire conditions. Some timber stands in Condition Class Departure 1 are also proposed for treatment in order to maintain their current condition. Implementation of any action alternative could result in modifying the behavior of a wildland fire and could increase the likelihood that fire suppression efforts would be successful in containing the fire at a small size.

Surface and Aerial Fuels

Fuels, weather, and topography influence fire behavior. Fuels are the only factor that management can modify. The fuel treatments proposed by the action alternatives would reduce the fire behavior of future wildland fires to less severe.

Surface Fuel - The post-harvest treatments proposed by the action alternatives would retain large coarse woody debris (LCWD) relative to their historical disturbance regime, seral stage, and biophysical setting. The LCWD would primarily range from nine to 20 or more inches in diameter and 5 to 12 tons per acre scattered on the ground. These amounts, size classes, and distributions of residual LCWD would not increase the predicted low intensity surface fire behavior after harvest. Fire hazard and fire suppression difficulties reach high ratings when large woody fuels exceed 25 to 30 tons per acre, and are combined with small woody fuels of five tons per acre or more (Brown, et al. 2003).

Aerial Fuels - would be aggressively treated and reduced in post-harvest treatment areas. The canopy bulk density and subsequent canopy fuel loads would be reduced by an average of 85 percent and an average of 54 feet for a post treatment canopy base height (see Exhibit O-14). It would be unlikely that the post-treatment areas would produce or sustain crown fire if canopy bulk density and subsequent canopy fuel load were reduced by 50 percent (Agee, et al. 2000). For a spatial display of fire severity represented through Fire Regime and Condition Class, see Exhibit O-11.

Proposed Harvest Treatments: Shelterwood, Seedtree, and Clearcut.

The action alternatives propose regeneration harvest, intermediate harvest (commercial thinning), and post timber harvest fuel reduction (slashing, slash piling, slash pile burning). These methods are used to modify structure and species composition in stands with high tree densities, and/or heavy fuel accumulations, which predispose the stands to high levels of bark beetle attack and stand-replacing wildland fire. This would improve vigor and improve stand resistance to insect attack and stand-replacing wildland fire (see *Forest Vegetation* section). Tree density would be reduced by harvesting trees of lesser vigor, thereby reallocating water, light, and soil resources to the larger, more vigorous trees. The larger diameter, taller, more fire-resistant species (mostly western larch and Douglas-fir) would remain on site Alternative B has 868 acres of commercial treatment; Alternative C has 460 acres of commercial treatment. The alternatives have similar prescriptions; however, in Alternative C the overall acres of commercial harvest are less.

The proposed regeneration and intermediate harvest areas in pre-treatment (existing condition) Fuel Model 10 would be converted to Fuel Model 8 for some units. In some proposed shelterwood units, Fuel Model 8 may also remain an 8 after treatment; crown bulk density would be decreased and canopy base height increased. The following data are representative of the fuel and fire behavior characteristics in proposed seedtree, shelterwood, clearcut, and commercial thin units. Refer to the following table for comparisons between fire behavior in the existing condition and the post treatment environment. Post treatment fire behavior data is modeled one year after treatment as this allows time for disposal of slash debris left from harvest treatments. While canopy base heights and canopy bulk densities reduce torching and crowning potential immediately after treatment surface fire spread rates and flame lengths may not decrease until residual debris left over from harvesting is disposed of.

The proposed harvest treatments may alter fuel conditions as follows:

- Canopy base height would increase, on average, from 4 feet to 54 feet.
- Crown bulk density would decrease, on average, from 0.01 kg/m³ to 0.007 kg/m³
- Surface fuel model would be converted from a 10 to a treated 8.

Table 3-23. FFE Potential Fire Report Outputs for Seedtree Treatment.

	Fuel Scenario						Units
	97th Percentile Weather; Existing Condition			97th Percentile Weather; Post Treatment Condition			
Fuel Model	SW	ST/CC	CT	SW	ST/CC	CT	Fire Behavior Fuel Model
	10	10	8	8	8	8	
Flame Length Surface/Total	3.3/ 3.3	2.9/3.6	3/7	.95/ .95	.9/ .9	.8/ .8	Feet
Canopy Base Height	7	3	3	59	51	7	Feet
Fire Behavior Type	Surface	Passive	Passive	Surface	Surface	Surface	
Torching Index	14.5	0	0	< 480	< 480	127	Miles/Hour
Crowning Index	29	24	15	591	185	45	Miles/Hour
Crown Bulk Density	0.08	0.11	0.18	0.008	0.006	0.04	kg/m³
Expected Stand Mortality	59	66	99	11	11	56	Percent
Total Biomass	131	124	109	85	55	77	Tons per acre

ST – Seedtree, SW – Shelterwood, CC – Clearcut., CT – Commercial Thin

Proposed Precommercial Thinning

Precommercial thinning has been used to effectively reduce the number of fire intolerant species within a stand and to promote overall stand health by reducing the number of stems per acre, but would create a short-term increase in high fire hazard until the slash is piled and burned. If slash is not piled in the precommercial thinning units, moderate fire hazard from trees left on the ground would progressively diminish through slash decomposition over a one to ten year period. Modeling indicated that one year following the treatment fire behavior would move from passive to surface, conversely not precommercial thinning would allow the stand to experience passive fire nearly indefinitely. The treatments would include thinning in existing openings and creating new openings in the dense canopy. Precommercial thinning is included in all action alternatives.

Alternative B has 564 acres of precommercial thinning treatments; Alternative C has 297 acres of precommercial thinning treatments. Piling would occur on some of the precommercial thinning treatments with more emphasis next to private property, roads and natural fuel barriers. These areas would function as effective fuel treatment to increase the likelihood of successful fire suppression efforts.

The following points display some of the differences in post and pre-treatment environments.

- Canopy base height would increase from 1 foot to 6 feet.
- Crown bulk density would decrease from 0.3 kg/m³ to 0.01 kg/m³.
- Surface Fuel Model 8 would be converted to a treated Fuel Model 8.

Table 3-24. FFE Potential Fire Report Outputs for Precommercial Thinning (PCT)

	Fuel Scenario		Units
	97th Percentile Weather; Existing Condition	**97th Percentile Weather; Post Treatment Condition**	
Fuel Model	PCT	PCT	Fire Behavior Fuel Model
	8	8	
Flame Length Surface/ Total	2.7/14	4.3/4.11	feet
Canopy Base Height	1	6	feet
Fire Behavior Type	Passive	Passive	
Torching Index	0	3.9	miles/hour
Crowning Index	10	106	miles/hour
Crown Bulk Density	0.3	0.1	kg/m^3
Expected Stand Mortality	99	99	Percent
Total Biomass	54	47	Tons per acre

PCT – Precommercial Thin

These two results for the treated area mean that the precommercial thinning would cause tree crowns to be higher off the ground, the amount of canopy biomass would be reduced as would the total biomass, and the post-treatment Surface Fuel Model indicates that the forest would be unlikely to support high-intensity wildland fire when compared to the existing condition (i.e., sustained crown fire runs, group torching, fire whirls, and long range spotting).

Summary of the Post-Treatment Fire Environment

The post-treatment areas would result in low to moderate surface fire conditions and would be unlikely to initiate or sustain a crown fire. Expected flame lengths less than four feet, and a predicted surface fire, would be more conducive to fire suppression activities. These two criteria are the thresholds of fire control for ground-based suppression personnel directly attacking the fire. Also, these conditions would substantially reduce the potential for long range and short range spotting from firebrands, which are associated with high fire intensities, torching, crowning, and fire whirls (Rothermel 1983). Fires exhibiting long range spotting pose some of the greatest threats to firefighter safety because they are extremely difficult to control.

Manipulation of the forest structure has been shown numerous times to reduce the severity of wildland fire events (Agee 1996) and fire intensity as evidenced on the Tally Lake Ranger District. Examples include the fires of 1994, the 1999 Swaney Fire, the 2000 Elk Mountain Fire, and the 2007 Brush Creek fire on the Tally Lake Ranger District. During the extreme fire season of 1967, fires within the Flathead National Forest decreased from crown to surface fires when they encountered thinned areas (Cron 1969). The decreased fire intensities from the effective reduction of surface and aerial fuels would enable suppression forces to have a much better chance of controlling the fires (Agee, et al. 2000). This would be the expected result with the activities proposed in this project.

On average the post treatment crown bulk density for commercial treatment is 0.007 kg/m^3. Non-commercial post treatment canopy bulk densities average 0.01 kg/m. In a mixed conifer

forest, Agee (1996) estimated that at canopy bulk density levels below 0.10 kg/m³ crown fire spread was unlikely, but no definitive single threshold is likely to exist.

None of the alternatives can influence the time and place a natural fire may start. Wildland fire is a natural, ongoing process whose time and location can never be precisely predicted by fire behavior science. There would still be untreated areas of high fuel accumulations that could lead to high-intensity fires. Blowdown, beetle-related mortality, and other causes of fuel accumulation would likely continue in the analysis area. However, treated stands would help reduce fire effects for approximately 15 to 20 years; at that time, maintenance fuel reduction treatments may be needed. These periods of effectiveness could be extended by future thinning with simultaneous fuel treatments.

Proposed timber harvest and non-commercial fuel reduction with residual slash disposed of would decrease fireline intensity, reduce potential for large stand-replacing fires, and improve long-term forest health. Besides mostly providing beneficial effects, some harvests may also have negative indirect effects. The most substantial indirect effects of these actions would be:

- Lower stocking levels in harvested stands, which would improve vigor and growth of the remaining stand.
- Possibility of increased blowdown in some intermediate (commercial thinning) harvest units and adjacent to some regeneration harvest units. Unless timely salvage of heavier concentrations of blown down timber occurred, these could lead to fuel accumulations and increased bark beetle risk.
- An increased ability of harvested stands to withstand wildland fire.

Effects Specific to Individual Action Alternatives

Both action alternatives would contribute to the restoration of timber stands that are in a current Condition Class Departure 2 for both the stand-replacement and mixed-severity historical natural fire regimes, but to varying degrees. Maintaining current Condition Class 1 within treatment areas is also a desired objective. Within the entire project area, 3262 acres are represented by mixed severity Condition Class Departure 2 (MSCC2). This represents the portion of the analysis area in need of restoration due to current mountain pine beetle populations, increased tree density, and susceptibility to stand-replacement wildland fire. The Martin Creek project area has 1224 acres in stand-replacement current Condition Class Departure 2 (SRCC2). The SRCC2 stands have departed from their historical fire frequencies by one or more return intervals, and have a large component of dead downed trees from endemic root rot and bark beetle-caused mortality, primarily from the mountain pine beetle epidemic of the 1970s and early 1980s.

Table 3-25. Fire Regime Condition Class by Alternative.

Historic Natural Fire Regime	Existing Condition/ Alternative A*		Alternative B		Alternative C	
	Class I	Class II	Class I	Class II	Class I	Class II
III Mixed - severity	296	3262	647	2914	412	3149
IV Stand-replacement	4796	1224	5002	1026	4926	1101

*Alternative A is the existing condition used for comparison.

The above table illustrates the amount of Condition Class 1 in the existing and post treatment environments. As defined earlier, Condition Class 1 fire regimes are within historical ranges, and the risk of losing key ecosystem components is low. However, there are still benefits to treating these units, even though the Condition Class is not changed. Removing fuel and overstory structure would disrupt the horizontal and vertical continuity of fuel, thus affecting the potential fire behavior. As discussed in the Direct and Indirect Effects to Alternatives B and C above, fire behavior and stand structure would change to support suppression efforts and inhibit crown fire initiation within the treated stands.

To further illustrate the existing condition and percentage of acres converted from Condition Class 2 to Condition Class 1, reference the following tables. In summary, Alternative A is represented by Condition Class 1 on 47 percent of the total area within the Martin Creek area. Comparably, within the Alternative B or the preferred action alternative, the total area represented by Condition Class 1 is increased to 55 percent.

Table 3-26. Percentage of Treated Area by Condition Class.

Alternative	Percentage of area in CC1	Percentage of area in CC2&CC3
A*	47	52
B	55	45
C	50	49

*Alternative A is the existing condition used for comparison.

These project activities would provide effective fuel reduction at the stand level:

- Intermediate harvest;
- Regeneration harvest and intermediate harvest with whole tree yarding and slashing of ladder fuels followed by an underburn or excavator pile and burn;
- Slash/pile/burn or chip and remove fuel for non-commercial fuels reduction treatments;
- Post-harvest underburn

Commercial and non-commercial fuel reduction treatments create a short-term increase in fire hazard (usually through one or two fire seasons) until site preparation and/or hazard reduction burning is accomplished. The treatment of forest residue next to the Intermix Community type of wildland urban interface would be completed as quickly as possible along with the proposed fuel reduction activity.

Although all action alternatives are effective to some degree in reducing fuel hazard, they do vary. In general, the more acres of effective fuel reduction treatment, the better the alternative would be at reducing fuel hazard and subsequent fire behavior characteristics. Alternative B includes more acres of commercial and non-commercial treatments than Alternative C; therefore, Alternative B would create more effective and contiguous fuel reduction treatments. Alternative C includes the least amount of vegetation treatments.

Cumulative Effects

The entire area within the Martin Creek analysis area is considered for the cumulative effects

analysis. All federal and private lands within the analysis area would be included.

Past Activities

Approximately 50 percent of the area has had some level of harvest activity on national forest lands within the Martin Creek area. Some of the recent regeneration harvests still function as effective fuel reduction areas. Even in areas where an intermediate harvest occurred, the crown connectivity has been altered enough to affect the sustainability of crown fire within these stands.

Fire suppression activities have excluded fire from the area since approximately 1930 and have contributed to the accumulation of fuel and the departure from historical fire regimes.

Firewood cutting has an effect along roads open year round and seasonally. Dead larch and Douglas-fir are preferred firewood; however, due to high demand, lodgepole pine and any other dead species are removed. This activity has the potential to reduce coarse downed woody material, snags, and fuel up to about 200 feet from roads. This reduction would be very site specific and have little or no effect on the overall fire behavior for the area.

The vegetative conditions on small private land parcels are highly variable and range from grassland to dense, old growth forest. The effect of private land development has been to convert some forested land to low density forest or grassland and roads. In some cases, the desire of the landowners has been to maintain a forested setting in the immediate vicinity of dwellings and structures that is contiguous with forested public lands. These small private forested areas have not been managed and stands have become densely stocked with large quantities of dead trees. These sites are highly vulnerable to insect and disease outbreaks and wildland fire. Conversely, many private landowners have performed fuels reduction work on their own lands. The proposed treatments in the project would have a cumulative effect with some of the treatments on private lands. In some cases, the treatments may be directly adjacent to each other.

Present Activities and Reasonably Foreseeable Activities

Timber harvest may be occurring on private property. Where timber harvest occurs, the fuel profile is affected by disrupting the vertical and horizontal fuel continuity. During harvest activities, a short term increase in surface fuel loading may occur from residual logging slash. The effects of this would be minimal.

Increased recreation in the area has also increased the potential for human caused fires. In some cases more people may allow for detection of small fires by private parties. The effect of this is also minimal.

Prescribed burning is proposed to aid in the control of reed canary grass on two acres in the project area, two acres immediately adjacent the project area and five acres south of Tally Lake. These treatments will continue on an annual basis until reed canary grass is eliminated or better control methods are developed. The effects of this would be minimal.

The Radnor Resource Management Project is a reasonably foreseeable activity adjacent to the project area and may have fuel treatments that share a common boundary with a proposed fuels treatment in Martin Creek. The cumulative effects of this would be minimal.

Other activities include fire suppression, firewood cutting, private land development, noxious weed control, road maintenance, administrative road use, public recreational use, and small forest products gathering for personal use. These activities are not expected to contribute to or inhibit efforts to achieve desired stand conditions.

Regulatory Framework and Consistency

Action Alternatives B and C are consistent with the following Forest Plan Fire Management Direction (Appendix G, Forest Plan 2001) and fire and fuels direction for all affected Management Areas:

- Use existing fire management literature as reference documents to guide project development, execution, and evaluation.
- Integrate an understanding of the role fire plays in regulating stand structure into the development of silvicultural prescriptions.
- Use existing fire behavior predictive techniques to evaluate prescribed fire application and evaluate emerging wildland fire ignitions.
- Evaluate prescribed fire alternatives from a risk of escape and economic cost/benefit analysis when complex applications are planned.
- Assure that the appropriate suppression response is applied to each wildland fire ignition.

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Air Quality and Smoke Management

Introduction

The primary air quality concerns associated with forest management activities is dust from unpaved roads and smoke from both wildland and prescribed fire. The main air quality concern associated with this project is particulate matter (PM) produced by the prescribed burning of residual fuels from harvest activities. Wood smoke produces particles too small to be seen by the human eye, measuring 10 microns and smaller (one micron equals one millionth of a meter). Larger particles tend to settle out of the air quickly, and are less likely to affect public health. Particles 10 microns and smaller (PM_{10}) may be inhaled deep in the lungs, posing a threat to public health. Particles 2.5 microns and smaller ($PM_{2.5}$) are considered the highest concern for potential health effects.

The basic framework for controlling air pollutants in the United States is the 1955 Clean Air Act (CAA), as amended (42 U.S.C. 7401 et seq.). The CAA was designed to protect and enhance the quality of the nation's air resources. The CAA encourages reasonable federal, state, and local government actions for pollution prevention. State Implementation Plans (SIPs) are developed to implement the provisions of the Clean Air Act. The SIPs describe the actions a state takes to achieve and maintain the National Ambient Air Quality Standards (NAAQS). Under the CAA, the Environmental Protection Agency (EPA) sets standards for air quality to provide both health and visibility protection. The State of Montana has also set standards to help protect air quality.

Smoke from prescribed fire must meet the ambient air quality standards for PM_{10} and $PM_{2.5}$. In Montana, the state standard is the same as the federal NAAQS for PM_{10}, which is 150 $\mu g/m^3$ (micrograms per cubic meter) for the 24-hour average. Montana does not have a standard for $PM_{2.5}$, although the federal NAAQS is 12 $\mu g/m^3$ for the annual arithmetic mean and 35 $\mu g/m^3$ for the 24-hour average. The $PM_{2.5}$ fine particulate matter is the primary cause of visibility impairment although gases also contribute. For more information or a listing of the NAAQS, please see Exhibit J-3.

Information Sources

The evaluation of direct, indirect, and cumulative effects on air quality utilized the most recent and available information and data related to past, present, and reasonably foreseeable events that have occurred or may occur in the air quality analysis area.

The Smoke Impacts Spreadsheet, SIS Version 11-30-2004 (Air Sciences Inc. 2003), was used to estimate PM_{10} and $PM_{2.5}$ emissions and airborne concentrations downwind of prescribed burning. SIS consists of existing accepted models in a spreadsheet format. SIS utilizes Consume 2.1 for pile burning emissions and a basic version of CALPUFF to model smoke dispersion, as well as FOFEM 5.9 to estimate material available for burning.

Analysis Area

The Montana Air Quality Bureau divides the State of Montana into ten airsheds. Airshed 2 is the primary analysis area for assessing the influence of the Martin Creek project activities on air quality because it encompasses the effects of any activities undertaken in the project area (as defined by the Montana/Idaho Airshed Group). Airshed 2 is comprised of Flathead, Lake, Sanders, and the northern portions of Missoula and Powell counties. The Kootenai National Forest, which is entirely in Airshed 1, lies immediately to the west and north of the project area. Airsheds are managed by Airshed Groups composed of the government agencies and timber companies that routinely perform prescribed burns, and with the assistance of National Weather Service meteorologists specifically assigned to the Airshed Group.

Each airshed in northwest Montana is designated as either Class 1 or Class 2 depending on how stringent the air quality standards are for that airshed. Glacier National Park and the Bob Marshall Wilderness Complex are within the Class 1 airshed designation, which has stricter visibility standards than the Class 2 airsheds of the Flathead National Forest and adjacent Kootenai National Forest (See Figure 3-2). The temporal scale of the analysis is only a few days or the time in which it is necessary for smoke from the project activities to dissipate.

Affected Environment

The affected environment for Air Quality is described by the airshed characteristics, the meteorology of the area, and the presence of sensitive air quality areas.

Airshed Characteristics

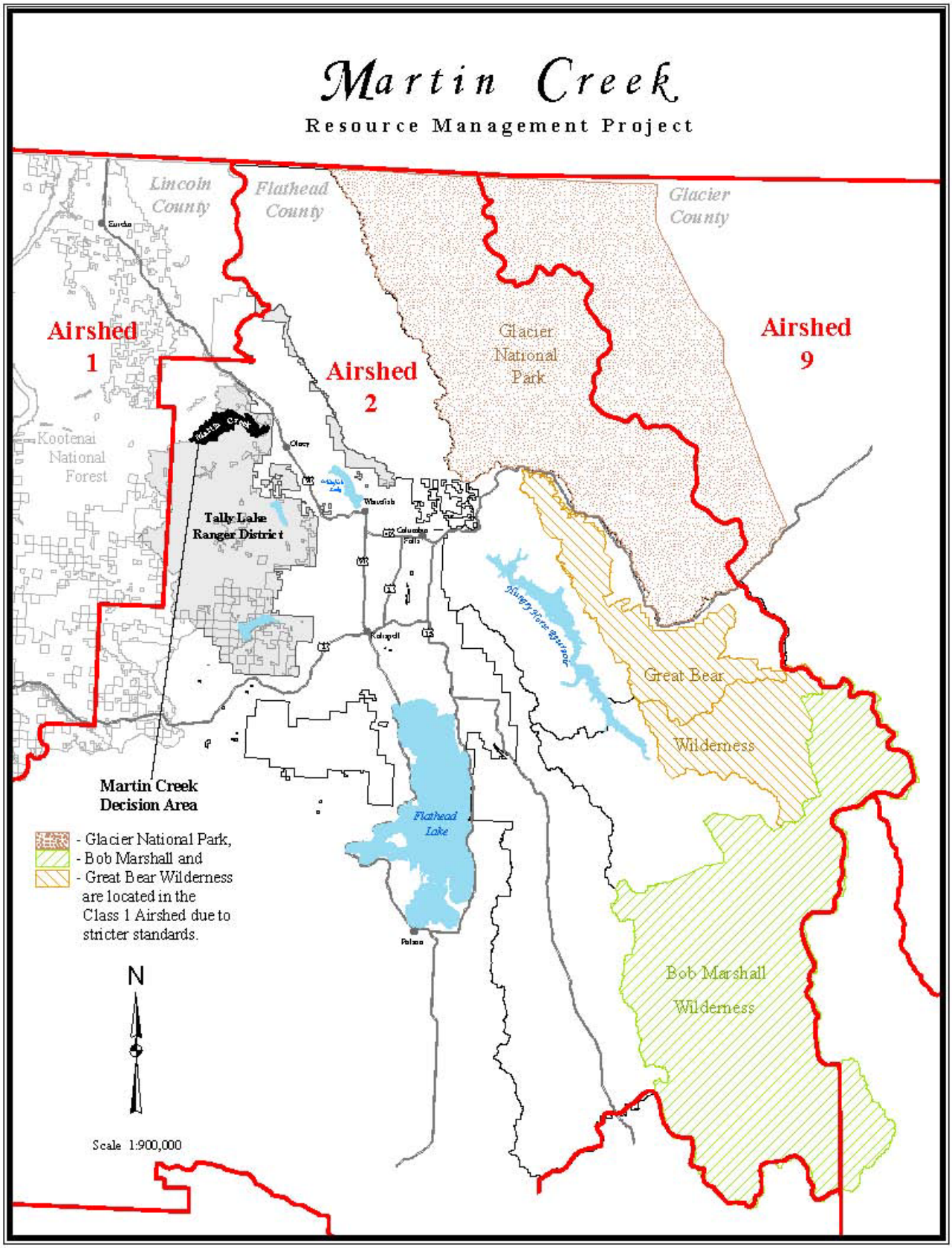
According to air quality reports from the EPA, the air quality of the Flathead River Valley is considered to be good to excellent throughout the year, and meets Montana air quality laws and the Clean Air Act.

Wildland fire has historically influenced the Northern Rockies as evidenced by the burn mosaics of the surrounding forested lands. Wildland fires continue to be a part of the natural forest ecosystem and produce local short-term impairment of air quality.

Air quality may be affected and various amounts of pollutants may occur from the following:

- Prescribed burning in the spring and fall by the Flathead NF, Glacier National Park, Montana Department of Natural Resources and Conservation, and timber and land development companies.
- Prescribed burning by other National Forests, other agencies, and private companies or citizens.
- Wildland fires burning upwind to a distance of two hundred miles depending on the size of the fire.
- Agricultural field burning in the Flathead Valley and Idaho.
- Weather patterns, which help cause degradation when low pressure systems over Idaho pull suspended pollutants (dust and smoke) from large metropolitan airsheds and farms in Oregon, Washington, and Idaho.

Figure 3-2. Air Quality Vicinity Map.



Meteorology

Smoke dispersion is primarily determined by transport winds and mixing height. Transport winds determine the direction of a smoke plume and the speed at which it travels, while mixing height influences the ability of smoke to mix into an air mass. In the spring and summer, solar heating of the earth's surface is much more intense, increasing the amount of warm air contributing to an unstable atmospheric condition. The more unstable the atmosphere the higher the likely mixing height would be, and the greater the dispersion. During the fall and winter, stable atmospheric conditions prevail as cooler air pools in the valley bottoms. Solar heating is not enough to heat this pooled air, so the stable conditions remain, reducing dispersion until a frontal passage scours out the valley air.

Forest Service management of prescribed fire and wildland fire contributes smoke that may cause short-term deterioration of air quality in the area. Managed prescribed fires contribute smoke to the airshed, though prescribed fires tend to produce less smoke than wildland fires of equal size since fuel consumption is typically lower in prescribed burns. On the Flathead National Forest, prescribed burning is generally accomplished when dilution, dispersal, and mixing conditions are considered good to excellent.

Sensitive Areas

The EPA designates communities that do not meet air quality standards (NAAQS) over a period of time as "non-attainment areas." States are then required to develop a plan to control source emissions and ensure future attainment of the standards. The emissions from prescribed fire may be considered as contributing emissions. Three cities in the Flathead Valley are considered sensitive because they are non-attainment areas for PM_{10}: Kalispell, Columbia Falls, and Whitefish. Kalispell is considered an area of concern for carbon monoxide, though not formally designated a non-attainment area for that pollutant. Within Airshed 1, Libby is considered a sensitive area because it is a non-attainment area for PM_{10} and $PM_{2.5.}$

The CAA provides for additional measures "to preserve, protect, and enhance the air quality" in larger National Parks, Wilderness Areas, and other areas of special national significance. These areas are designated Class I Airsheds. Of particular concern under this requirement is visibility or haze. The Prevention of Significant Deterioration (PSD) provisions of the CAA require measures "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreation, scenic, or historic value." Stringent requirements are established for areas designated as Class I areas (42 U.S.C. 7475 (d)(2)(B)). Designation as a Class I area allows only very small increments of new pollution above existing air pollution levels. There are several Class I airsheds in the vicinity. Glacier National Park is located east of the project area, and is the Class I Airshed most vulnerable to project activities affecting air quality since prevailing winds often blow from west to east.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

There would be no direct effects to the air quality or human health from Alternative A. No prescribed burning would occur in this alternative, therefore no prescribed burning smoke emissions would be produced by this alternative. However, the potential of a large-scale wildland fire is greatest with Alternative A, and a large-scale fire could have far greater impacts on air quality than any action alternative. Air quality would not be impacted until a fire escapes initial attack efforts. At that time there would be a higher level of particulate matter released than pile burning because of the greater amount of fuel consumed. The eventual wildland fire would have a much different impact than controlled burning. Pile burning or understory burning impacts usually last for a short period of time, and are managed for the least amount of air quality impacts possible. Air quality from wildland fires could be impacted for weeks, as was experienced in various parts of the Northern Rockies in 1988, 1994, 2000, 2001, 2003 and 2007.

Direct and Indirect Effects of Action Alternatives B (Proposed Action) and C

The indicator used to evaluate the effects of the proposed activities on smoke production was particulate matter less than 2.5 microns in diameter. $PM_{2.5}$ was chosen because while more than 90 percent of the mass of particulate matter produced by wildland fires is less than 10 microns in diameter, 80 to 90 percent is less than 2.5 microns in diameter. These small particles are inhalable and respirable. Respirable suspended particulate matter is that proportion of the total particulate matter that, because of its small size, has an especially long residence time in the atmosphere and penetrates deeply into the lungs. Small smoke particles also scatter visible light and thus reduce visibility (National Wildfire Coordinating Group 2001). The estimated maximum 24 hour concentrations of $PM_{2.5}$ at one mile downwind and the distance from the burn sites where the EPA standards for air quality are met are displayed for the two action alternatives in the following table.

Prescribed burning requires a permit from the Montana DEQ and the burn must be implemented within the regulatory framework. This includes daily approval from the Flathead County Air Quality hotline and the Montana/Idaho Airshed Group. More information on the Montana/Idaho Airshed Group can be found online at www.smokemu.org.

Pile Burning

Pile burning may be used in this project to dispose of slash that resulted from timber harvest, producing direct smoke emissions. For units designated for excavator piling of activity fuels, experience with past projects shows five piles per acre is typical; for units designated for landing piles, one pile per 10 acres is typical; and for units designated as hand piling, 20 piles per acre are assumed.

Smoke emissions vary with combustion efficiency and quantity of fuel burned. Excavator piles and hand piles tend to produce more smoke than other burns because much of the consumption occurs during the inefficient smoldering phase of combustion. Modeling assumed burning would occur over multiple days during the fall until proposed harvest units are completed. Pile burning allows management to control the number of piles burned on any

given day. Potentially, pile burning would be conducted over the course of one to five years after harvest activities for each unit, so impact would not be concentrated. The model projections also assume that moderate smoke dispersion would be experienced as experience shows moderate smoke dispersion is typical. These assumptions, combined with the tendency of SIS to model emissions at the high end of the expected range, means that smoke predictions represent a severe case for pile burning.

Table 3-27. Particulate Matter ($PM_{2.5}$) Generated by Alternative (Exhibit J-1).

Alternative	Pile Burning Treatments (Acres)	Estimated Number of piles burned per day (Landing, Excavator, and Hand piles)	Max. $PM_{2.5}$ Emissions Estimate (tons/ac) within 24 hours of ignition	Max. 24-Hour Average $PM_{2.5}$ Concentration ($\mu g/m^3$) at 1 mile from ignition	Distance in miles where Max. 24-Hour Average $PM_{2.5}$ Concentration is below 35 $\mu g/m^3$
A	0	0	0	0	0
Total Emissions for Alt A: 0 tons					
B Excavator	603	100	1.0090	46	1.6 mi
B Landing	868	10	3.7845	13	0.3 mi
B Handpile	20	100	0.0152	30.0	0.8 mi
Total Emissions for Alt B: 401 tons					
C Excavator	331	100	1.0090	46	1.6 mi.
C Landing	460	10	3.7845	13	0.3 mi
C Handpile	0	0	0	0	N/A
Total Emissions for Alt C: 180 tons					

Assumptions: Excavator units include 5 piles/acre. Handpile units include 20 piles/acre. Landing pile 1 pile per 10 acres harvested. Relevant SIS modeling outputs are found at Exhibit J-1.

Pile burning would occur under each action alternative to treat residual fuels from logging, as well as hand/mechanical piles from precommercial thinning with fuel reduction, and non-commercial fuel reduction; all producing direct smoke emissions. The pile burning would consist primarily of larger landing piles, and moderate size Excavator piles. Landing and Excavator piles would be made up of undesirable larger diameter material generally greater than six inches in diameter, along with tops and branches of harvested trees usually less than five inches in diameter. Smoke emissions from piled forest residue vary with combustion efficiency and quantity of fuel burned. Excavator and landing piles are more compact, easily piled, and have very little dirt lending to a relatively low emission rate in relation to the total acres treated. Hand piles tend to be smaller, more numerous, and have the least amount of mortality to larger mature overstory trees due to less intensity and shorter burn durations. Hand piles are primarily made up of smaller material, generally less than five inches in diameter, with more fine material consisting of sapling size trees, branches, and needles.

The Smoke Impacts Spreadsheet Model (SIS Version 11-30-2004, Air Sciences Inc.) was used to model emissions produced from each of the action alternatives. Estimates for total number of piles, and tonnage of each type of pile for each alternative, were based on best professional judgment and past experience. For the SIS Model, it was assumed that moderate daytime and poor nighttime atmospheric conditions would be experienced. SIS was used to model smoke dispersion and concentrations for each alternative. Each of the action alternatives would produce particulate matter at various levels. Table 3-27 contains the acres of

treatments by alternative, an estimate of the total $PM_{2.5}$ and the maximum predicted 24 hour $PM_{2.5}$ measured in micrograms per cubic meter ($\mu g/m^3$) onsite. An assumption that was used to model scenarios included a wind speed of five miles per hour. This wind speed is considered average for the area based on remote weather station data.

It is unlikely managers would ignite as many piles as modeled, particularly in one day, thus reducing the emissions outputs generated by the models. The modeling represents a worst case scenario. Managers shall ensure all burning would occur under conditions designed for adequate smoke dispersal and in compliance with state and county air quality standards. Potentially, pile burning would be conducted over the course of one to five years after fuel treatment activities, further lowering the concentrated impacts. For all action alternatives, smoke generated from within the area could affect the air quality in parts of northwestern Montana. Potential exists for smoke to drift into the following Class I Airsheds, nonattainment areas, and local communities as displayed in the following table.

Table 3-28. Proximity of Sensitive Airsheds.

Airshed	Approximate distance from Analysis Area
Glacier National Park (Class I)	25 miles East
Bob Marshall Wilderness Complex (Class I)	40 miles Southeast
Intermix Community Type	Within the area
Whitefish (non-attainment)	13 miles Southeast
Columbia Falls (non-attainment)	25 miles Southeast
Kalispell (non-attainment)	25 miles Southeast
Flathead Reservation	50 miles Southeast

The large distances to Class I Airsheds and non-attainment areas make it likely that there would be no detrimental effects to air quality in these areas. Dispersion modeling estimates smoke concentrations would be 1.2 $\mu g/m^3$ when and if smoke from burning excavator piles reached Kalispell or Whitefish, the closest non-attainment areas. Excavator piles produce the most particulate matter of any activity proposed. The federal standard allows for 35 $\mu g/m^3$ for the 24 hour average; 1.2 $\mu g/m^3$ is far below this threshold. In addition, prevailing wind direction (southwest to northeast) would make it highly unlikely that the sensitive airsheds discussed in the table would be impacted.

Cumulative Effects of Alternative A (No Action)

The No Action alternative does not alter the existing condition of the proposed project area, therefore cumulative effects are not anticipated. However, the no action alternative does leave more available fuel within the project area that could contribute to a wildland fire and thus impact air quality, should a fire occur. The action alternatives have proposed areas of treatment that would reduce fuel loading, which could reduce the volume of smoke within those areas given the occurrence of a wildland fire.

Cumulative Effects of Alternatives B (Proposed Action) and C

This section discloses past, present, and reasonably foreseeable effects from federal, state, tribal, and private land fire use activities. The cumulative air resource analysis is unique in

that past impacts to air quality are not usually evident. However, present and foreseeable effects could include impacts from other prescribed forestry burning, agricultural burning, dust from agricultural lands, residential wood combustion, traffic exhaust, road dust, or point sources of pollution. Individual sources of smoke from other agencies are too numerous and variable to list. Because of the complexity and uncertainty of timing associated with other agencies' burning, coordination with the Montana/Idaho State Airshed Group is critical to minimize cumulative air quality impacts within Idaho and Montana.

Timber Management and Fuels Reduction Activities

The cumulative effects on regional air quality due to forest management activities are difficult to quantify. Because prescribed burning reduces fuel loadings, the potential for wildland fires escaping initial attack is reduced. Therefore, the long-term effects of smoke from wildland fires on air quality may be reduced.

As discussed earlier, prescribed burning of forest fuels is a minor contributor of PM emissions when compared to other sources. Under favorable weather conditions, the impacts of all PM contributors are minimized. However, under stagnant atmospheric conditions, smoke from prescribed burns, wildland fires, residential wood burning, road dust due to log hauling, normal public traffic, vehicle exhaust, and other sources of air pollution can create a short-term, unhealthy impact on local air quality.

In late spring, summer, and autumn, slash burning is a common management practice occurring on the Flathead National Forest, other Federal and State land management agencies, and private forest lands. Weather patterns, topography, and fuel characteristics during these burning seasons are the key factors affecting air quality. As previously mentioned, spring burning conditions have the least impact on air quality. Fall burning has the greatest potential to impact air quality. The Montana/Idaho Airshed Group regulates spring, summer, and fall burning by making daily evaluations as to whether or not members may burn, based on local and prevailing weather information and existing air quality conditions.

Smoke from prescribed burning associated with present, proposed, and foreseeable activities, combined with that of other PM producing activities in the region, has the potential to temporarily reduce air quality in the areas of Whitefish, Columbia Falls, and Kalispell. General wind patterns may cause smoke to drift into the Class I Airsheds of Glacier National Park and the Bob Marshall Wilderness Complex. Visibility may be temporarily reduced with prevailing weather influences and dispersion of smoke. Effects would be minimized in the mid- to late-spring because of fewer visitors, higher fuel moistures (less emissions), better smoke dispersion, and reduced impacts from other PM producing activities. These anticipated impacts are considered to be within a reasonable range for these activities, and pose no substantial health or environmental effects.

Private Land Development

Continued development of private land for residences would likely result in periodic smoke production from slash burning associated with home site clearing and burning wood for heat. Cumulative effects could include an increase in both the amount of smoke and duration of days with smoke present. While the Forest Service has no influence over burning which takes place on private land, the conditions resulting from these sources, as well as from wildland fires, would be taken into account when determining whether to ignite any prescribed fire.

Although burns from private landowners (that are nonmembers of the Airshed Cooperative Group) are not tracked by the Monitoring Group, local Ranger District fire managers visually check conditions prior to making the decision to ignite an adjacent prescribed fire area.

Other Activities Possibly Affecting Air Quality

Other foreseeable actions include noxious weed control, road maintenance, road construction, administrative road use, public recreational use, and small forest products gathering for personal use. These activities may include limited burning and road use, but they do not substantially contribute to cumulative effects to air quality due to the minor amount of PM created.

Regulatory Framework and Consistency

Forest wide standards for maintaining air quality are "Coordinate all Forest Service management activities to meet the requirements of the State Implementation Plan, State Smoke Management Plan, and Federal air quality standards" (FNF LRMP, page II-64). There are no specific Forest Plan directions by Management Area for air quality. Whenever prescribed fire is used, Forest Plan Appendix G states, "Esthetic, visual, soil, air, and water quality concerns will dictate fire management direction in some areas."

The Clean Air Act of 1955, as amended (42 U.S.C. 7401 et seq), provides direction to protect and enhance the quality of the nation's air resources and to protect public health and welfare. Section 109 of the Clean Air Act requires the EPA to develop primary air pollution standards to protect human health and secondary standards to protect public welfare. Section 110 requires states to develop State Implementation Plans that identify how the state will attain and maintain national ambient air quality standards and other federal air quality regulations. The State Implementation Plan is made known through the Montana Clean Air Act and implementing regulations. The regulations provide specific guidance on maintenance of air quality, including restrictions on open burning (ARM 16.8.1300). The act created the Montana Air Quality Bureau and provides its regulatory authority to implement and enforce the codified regulations.

To maintain compliance with the various regulations concerning maintenance of air quality, Region One of the Forest Service participates in the Montana/Idaho Airshed Group. The Group is comprised of timber companies and government agencies that commonly conduct prescribed burning, and federal, state, and local air regulators.

The Group has developed a set of smoke management practices intended to maintain compliance with the State air quality standards through a monitoring system for the months of the open burning season that extends from March 1 through November 30. The Montana/Idaho Airshed Group recognizes the current smoke management practices and the Montana airshed coordinating process as Best Available Control Technology (Exhibit J-5) for prescribed burning. The Montana/Idaho Airshed Group shares information and coordinates activities to assure cumulative actions do not result in unacceptable effects on air quality in Montana. By participating in the Montana/Idaho Airshed Group, complying with the Montana Air Quality Bureau, and meeting the requirements of the State Implementation Plan and the Smoke Management Plan, the proposed activities would comply with the Forest Plan and the Clean Air Act.

By treating both natural and activity generated fuels, the proposed activities would meet the objectives of the Forest Plan in which the fuels management program intends to treat fuels to the degree needed to facilitate implementation of the fire protection program and other activities of the Forest Plan. The proposed activities are also consistent with State laws requiring the treatment of slash to reduce the effects of high intensity fires.

Aquatic Resources

Introduction

This section describes existing conditions of aquatic resources and the potential effects of action alternatives. The analysis is broken into the following components.

- Hydrologic Processes
- Aquatic Habitat and Water Quality
- Wetlands
- Fish Populations

Information Sources

All of the information described below is used together to define the condition of aquatic resources and to help predict how proposed activities may affect them. Throughout the analysis, peer reviewed scientific literature is used to support the assessment of existing conditions and to support predictions of project effects. Monitoring data and scientific literature is drawn from subject areas including fisheries science, forest hydrology, fluvial geomorphology, and aquatic ecology.

Much of the information used in this analysis is in the form of spatial data that is presented and/or analyzed using a Geographic Information System (GIS). Some of the key spatial data includes annual precipitation, elevations, geology, soils, watershed boundaries, roads, streams, and fish populations. Field data include stream and fish population surveys, culvert assessments, and road surveys.

Hydrologic Processes

The project area does not contain any water quantity information such as precipitation gages or stream gages. However, there are many surrogates used to describe water quantity such as annual precipitation (from spatial data), stream channel characteristics, Water Erosion Prediction Project (WEPP) model results (Exhibit G-7), and forest disturbance history. In addition, land use activities (primarily road construction) provide insight into how hydrologic processes have been altered, or may be altered by alternatives. Monitoring data and scientific literature are used extensively to draw inference on hydrologic processes and how management activities may affect them.

Aquatic Habitat and Water Quality

Sediment and stream channel conditions are the primary focus of assessment and analysis. To address water quality and aquatic habitat, information is drawn from stream and habitat data such as R1/R4 fish habitat inventories, Designated Monitoring Reaches (DMRs), road and culvert inventories, and WEPP model outputs. Almost 100 percent of stream habitat in Martin Creek was inventoried during 1993 and 1994. In addition, there are three DMRs on Martin Creek, two established in 1997 and one in 2004. Data gathered at these sites follows

protocols developed by the PACFISH/INFISH Biological Opinion (PIBO) Monitoring Program (USDA Forest Service 2013).

Wetlands

Current data include mapped water bodies such as streams, lakes, and ponds. Typically, these types of water bodies have wetland vegetation around them.

Fish Populations

Fish population inventories have been done by the Forest Service and Montana Department of Fish, Wildlife, and Parks (FWP) since 1985. The majority of fish population data have been collected through electrofishing. Electrofishing is typically done during summertime low-flow conditions in small, representative stream reaches (often 100 meters in length). Montana FWP has also collected fish population data in Martin Lakes using gill nets.

Analysis Area

Spatial Bounds for Direct, Indirect, and Cumulative Effects

The spatial bounds of analysis areas are variable, depending on which component of aquatic resources is analyzed. Hydrologic processes, erosion, and sediment delivery are generally addressed at the hillslope scale. Potential effects on aquatic habitat and water quality are addressed at the stream reach or watershed scale, but tier to upland hydrologic and hillslope-scale analyses. The affected environment and direct or indirect effects generally focus on hillslope, stream reach scales, and local fish population scales, while cumulative effects focus on the watershed scale. Each component of the analysis describes the scale at which the direct and indirect effects are being predicted. The Martin Creek project area is defined by the watershed boundary. Hydrologic processes, aquatic habitat, and water quality cumulative effects are addressed within the two fisheries analysis areas. The Upper Martin analysis area encompasses all of Martin Creek watershed above a waterfall 5.8 miles upstream of the mouth. This waterfall is a fish barrier and isolates all fish above the waterfall from every-where else. If any fish emigrate downstream of the waterfall, they cannot return.

The Lower Martin analysis area includes the rest of Martin Creek watershed from the water-fall to its confluence with the Stillwater River. This area also includes Upper and Lower Martin Lakes. The lakes are connected to each other by a small, intermittent stream and the outlet of Lower Martin Lake then connects to Martin Creek. Fish can theoretically move between the lakes and Martin Creek during spring runoff and thus this area is considered one analysis area. The outlet of Martin Creek ends on a bluff right next to the Stillwater River. The stream is forced to drop about 20m in just 2m horizontal distance to reach the Stillwater River, thus this waterfall/cascade are is also a fish barrier. No fish from the Stillwater River can enter into Martin Creek, effectively isolating this area.

Temporal Bounds for Direct, Indirect, and Cumulative Effects

Temporal bounds for aquatic resources range between five up to 50 years, depending on the type and scale of effects. For example, road treatments such as Best Management Practices (BMPs) improvements can reduce sediment delivery within one year, and these benefits can persist for several years. By contrast, forest treatments such as timber harvest can change

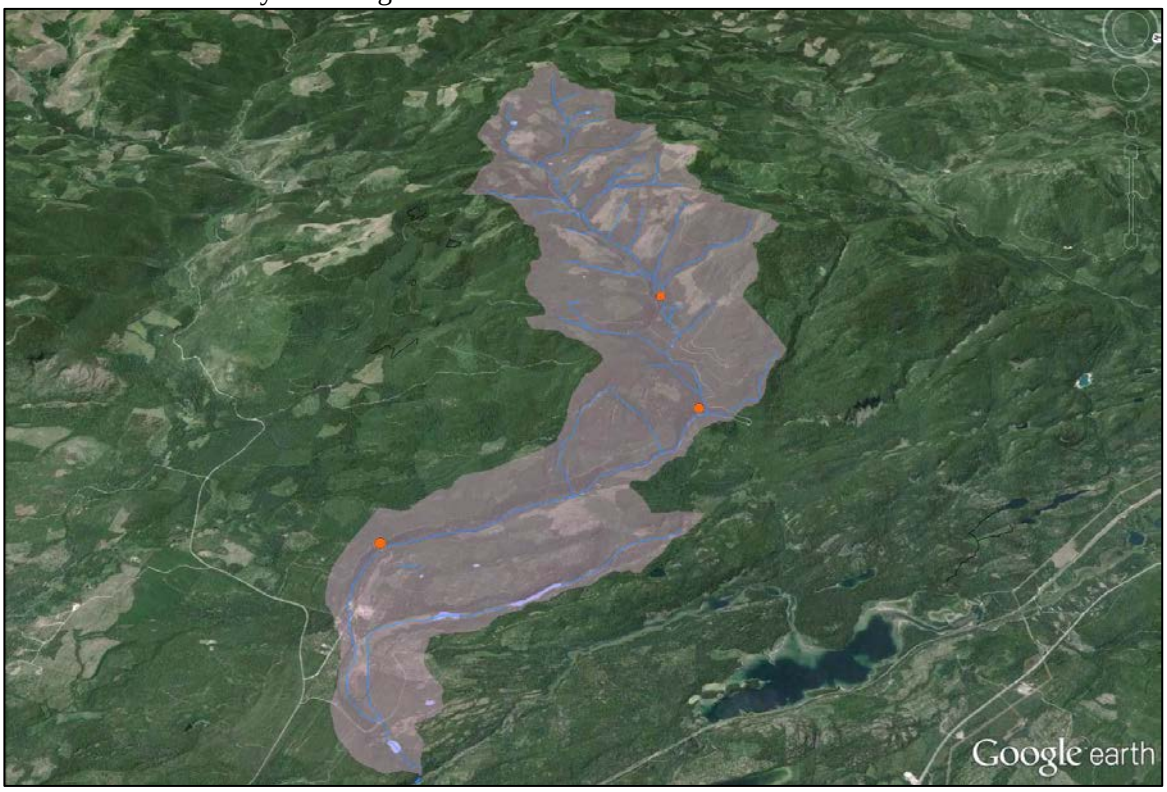
hydrologic processes and disturbance regimes for several decades. Each component of the analysis describes the temporal nature of predicted effects.

Affected Environment

The Martin Creek project lies entirely within the Martin Creek watershed in the Salish Mountains. Martin Creek is a small tributary to the Stillwater River system and generally drains to the southeast. Geologic parent material consists primarily of limestone associated with the Helena formation. Small portions of the lower watershed contain hard meta-sediments of the Empire and Spokane formations. The valley bottom consists of glacial deposits (ground moraine, till, outwash, etc.), stream alluvium, and colluvium. Soils are derived from these deposits and are influenced by volcanic ash.

Hillslope profiles are generally concave and ridge-tops are rounded due to continental glaciation (refer to Figure 3-3). Concave hillslopes generally have low sediment delivery potential, especially where valley bottoms are relatively wide. Streams range from relatively steep colluvial channels with large bed material, to lower gradient alluvial channels dominated by gravels, sands, and silt. One unique feature about the area is that streams contain high levels of calcium carbonate. Concentrations are very high and form extensive precipitate (solid deposits) on stream beds.

Figure 3-3. The Martin Creek Watershed and Project Area Looking West. Martin Creek begins at the headwaters on the west end of the watershed, then flows east where it joins the Stillwater River. DMRs are indicated by the orange dots.



Hydrologic Processes

Average annual precipitation ranges between 20 and 29 inches. Most of this precipitation comes as snow during the winter months. Approximately two-thirds of annual precipitation is lost through evapotranspiration and the rest leaves the watershed as streamflow. Snowpack is likely decreasing over time as a result of changing climate patterns (Mote 2003a). In the Upper Flathead Basin, April 1st Snow Water Equivalent (SWE) is decreasing by roughly 0.10 inches per year on average (Kendall 2011). In addition, snowmelt is likely occurring earlier due to higher spring temperatures and summer stream flows are decreasing (Gillan, et al. 2010; Luce and Holden 2009; Stewart, et al. 2004; Pederson, et al. 2010). Most recently, declines in average annual stream flow in the northwest are being attributed to decreases in lower troposphere winter westerlies that result in less winter precipitation (Luce, et al. 2013). In the Flathead Basin, average annual discharge is decreasing, based on streamflow data at gaging stations (Exhibit G-1).

A portion of snowfall is intercepted by the forest canopy, and excess snow reaches the ground. Where timber harvests, insect infestations, and/or wildland fires have removed portions of the canopy, more snow reaches the ground. Timber harvest in the Martin Creek watershed began in the early 1950s, most often with regeneration treatments. During the last 25 years, approximately 1486 acres have been harvested or about 14 percent of the watershed. Many past harvests are in excess of 1500 feet wide, which can cause net losses in snow pack due to wind scour and associated sublimation (Stegman 1996; Troendle and Leaf 1980). This can reduce the amount of water available for soil moisture, transpiration, and ultimately streamflow. Small clearcuts, generally less than five tree heights wide, can cause snow to accumulate from adjacent stands and increase average snow water equivalent within the clearings and ultimately increase annual yield (Troendle 1983). In the Martin Creek watershed, sublimation losses from the larger harvest units likely offset any savings from reduced interception and transpiration. Many of these stands have re-grown so wind scour and sublimation have likely decreased since harvest. In addition, the relatively low average annual precipitation reduces the potential for water yield increases from vegetation removal (Bosch and Hewlett 1982).

Like most forested areas, infiltration capacities far exceed rainfall intensity associated with most storms. As a result, the dominant runoff process is saturation overland flow (Dunne and Leopold 1978), which is the dominant runoff generation process in forested catchments. Snowmelt within the Martin Creek project area typically begins in April and peak discharge occurs in May or June. The Martin Creek watershed is elongated and very narrow. Relative to other catchments on the Flathead National Forest, it has a low relief ratio and low elongation ratio (Table 3-29). These characteristics combined with relatively low annual precipitation indicate that Martin Creek is hydrologically inefficient, meaning that storm and annual hydrographs are relatively flat, but longer in duration (Chopra, et al. 2005). Therefore, annual peak flow and stormflow in Martin Creek are relatively low, but the duration of higher flows may be longer compared to more circular watersheds at similar elevations. Bankfull channel dimensions of Martin Creek appear to be within reference ranges (Exhibit G-2) which indicates that flow regimes are within the natural range of variability.

The Martin Creek watershed includes two lakes (Upper and Lower Martin Lakes) and a few very small ponds in the headwaters.

Table 3-29. Martin Creek Watershed Characteristics.

Parameter	Value
Area (square miles)	16.8
Highest Elevation (feet)	6000
Lowest Elevation (feet)	3200
Relief (feet)	2800
Length (miles)	11.9
Relief Ratio (relief divided by length)	0.04
Elongation Ratio*	0.14
Average Annual Precipitation (inches)	20-29

*Average watershed width divided by the length.

Roads are present throughout the Martin Creek watershed, and these features can change surface and sub-surface hydrologic patterns, a process sometimes referred to as hillslope hydrology. Roads prisms can concentrate runoff with their nearly impervious surfaces and can intercept subsurface flow, routing concentrated water flows through ditches. If ditch water is connected to streams, the drainage density of the catchment (miles of stream per square mile) can increase and consequently increase peak flows (Luce and Wemple 2001) at small scales. Sub-surface flow intercepted by roads is converted to surface water, which can reach streams more rapidly.

The concentrated water resulting from the presence of roads, both on the surface and in the saturated soil, can lead to mass failure. These effects have been documented in areas of high precipitation in the Pacific Northwest (Jordan, et al. 2010, Dutton, et al. 2005; Tague and Band 2001; Wemple, et al. 2001; Luce 2002; McGuire and McDonnell 2010). However, mass wasting effects have not been documented in the project area due to relatively gentle topography, low precipitation, and relatively stable soils.

Aquatic Habitat and Water Quality

Aquatic habitat and water quality in forested catchments is primarily a function of stream channel condition, riparian health, and sediment delivery processes from upstream sources. There are three permanent monitoring sites in the Martin Creek watershed. The lowest site is maintained by the PIBO monitoring team (USDA Forest Service 2013), and measurements are taken every five years. This site was surveyed in 2004 and 2009. Because this site is located on the lower end of the watershed, it provides a signature of upstream watershed processes and land management effects. Two additional sites are maintained by the Tally Lake Ranger District, both of which are upstream of the lowest site (Figure 3-3). Aquatic habitat data were collected at these sites in 2009. Data from all these sites indicates that Martin Creek has relatively stable banks and dense riparian vegetation (Exhibit G-16).

Recent assessments of stream channel conditions on the FNF indicate that streams in managed and referenced watersheds are similar in terms of dimensions, bank stability, the amount of woody material, and the health of riparian vegetation (Kendall 2010 and Kendall 2012). However, streams in managed watersheds tend to have slightly higher levels of fine sediment, which may be due to past and/or present management activities, higher levels of woody material, or a combination of both. In managed watersheds, median particle size tends to be smaller, percent fines tend to be higher, and residual pool depths tend to be shallower com-

pared to reference watersheds (Kendall 2010 and Kendall 2012). In most cases, sediment is the primary concern for most projects, unless existing or proposed management activities directly affect riparian ecosystems and streams.

One way to gauge the degree of management induced sedimentation in streams is to compare their sediment characteristics to reference streams (Kershner, et al. 2004; Woodsmith and Buffington 1996). Median particle size and percent fines can be expressed as a function of stream power and shear stress indices to gage the degree of sediment supply (Flores, et al. 2006; Jackson and Sturm 2002; Woodsmith and Buffington 1996). Figures 3-4 and 3-5 display median particle sizes at three sites in Martin Creek as a function of stream power indices (Exhibits G-3 and G-3a). This data suggests that fine sediment levels in Martin Creek are elevated. However, this information may be misleading because calcium carbonate deposits on the streambeds limit natural stream sorting of bed material. When pebble counts are conducted, the results are strongly skewed toward finer material. Therefore, pebble count data are interpreted with caution in terms of the land use impacts on stream sediment. In addition, the distribution of sediment sizes is bimodal, which provides further evidence of poor sorting. This makes it difficult to draw conclusions about land management effects with a high degree of confidence. By contrast, residual pool depths at all three sites appear to be well within reference ranges (Figure 3-6), which provides evidence that land use activities are not necessarily affecting stream habitat to a measurable degree.

It is important to recognize that data from Martin Creek, shown in Figures 3-4 to 3-6 below, represents a snapshot in time. Residual pool depth, median particle size, and percent fines certainly fluctuate annually due to precipitation and flow variability, as well as sediment supply and transport rates.

Figure 3-4. Martin Creek Median Particle Sizes Compared to Reference Streams as a Function of a Stream Power Index (bankfull width x depth x slope).

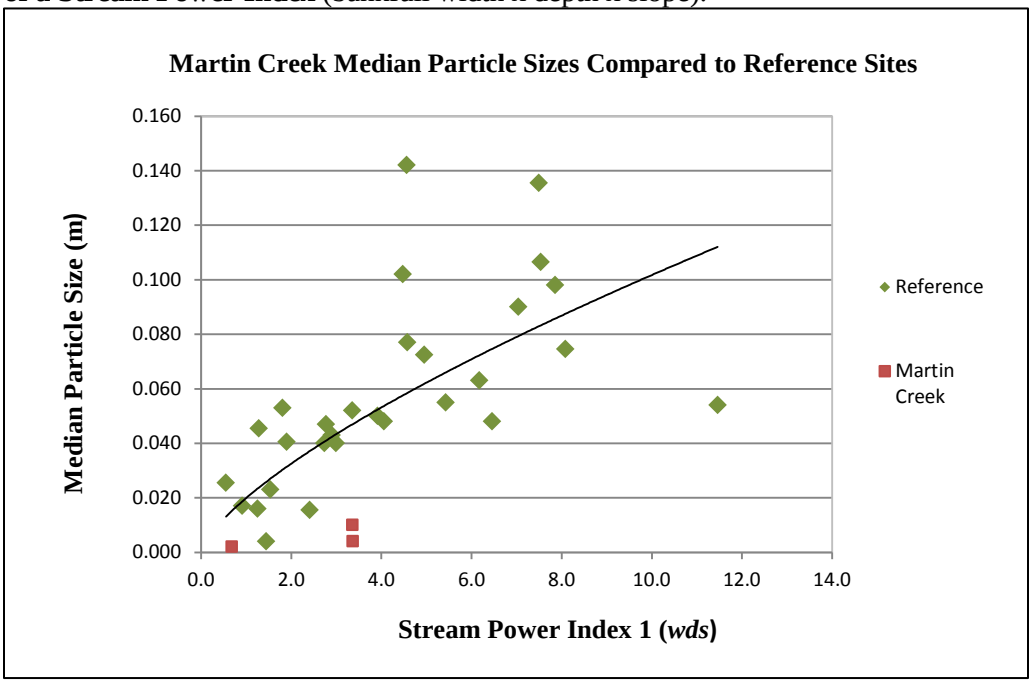


Figure 3-5. Martin Creek Median Particle Sizes Compared to Reference Streams as a Function of a Shear Stress Index. The shear stress index is the product of bankfull depth and channel gradient.

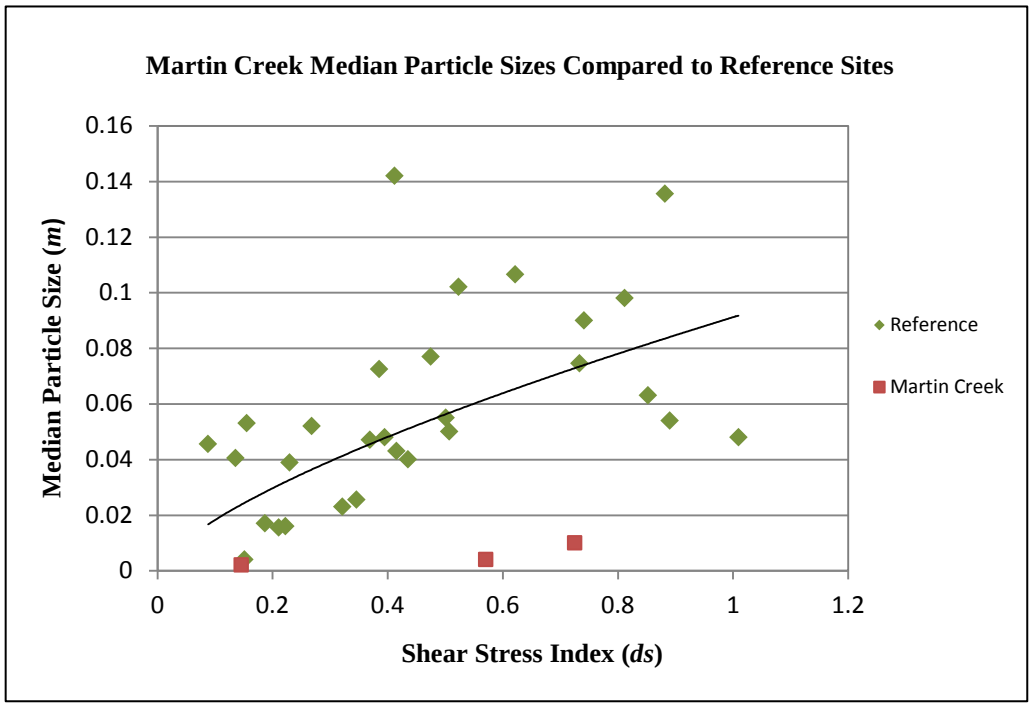
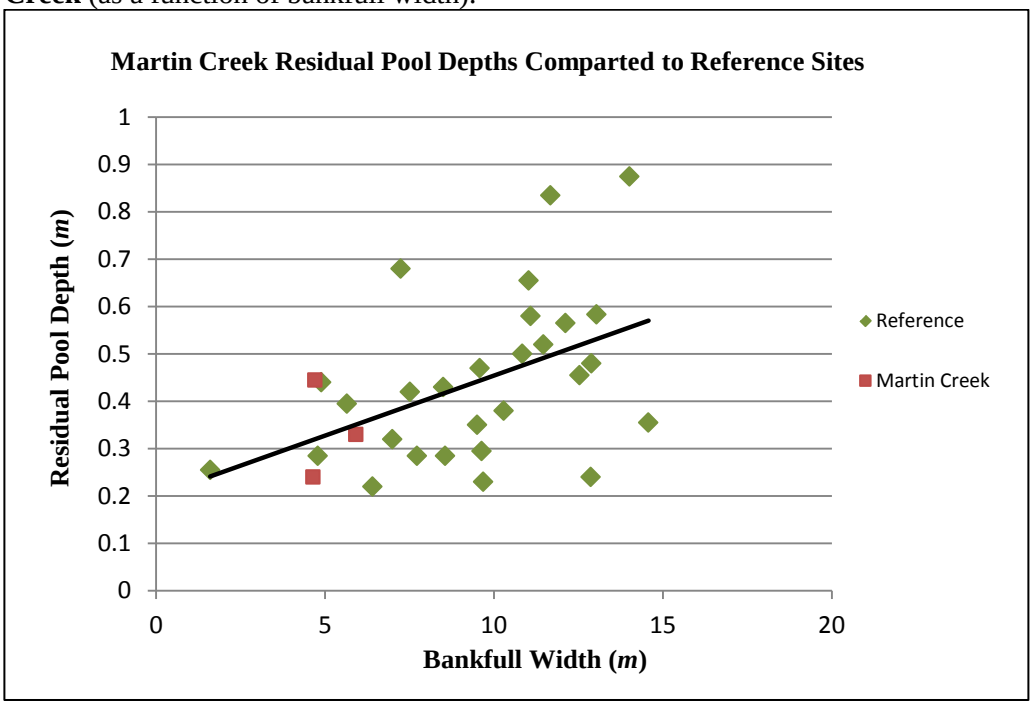


Figure 3-6. Residual Pool Depths of Reference Streams and Three Monitoring Sites in Martin Creek (as a function of bankfull width).



Lower Martin Creek (below the falls) has about 5.8 miles of fish habitat in the main stem and there is also roughly 1.1 miles of fish habitat in the intermittent outlet stream from Lower Martin Lake. Approximately 4.6 miles of habitat was inventoried in 1993 and there are two DMRs, each of which has been monitored twice to date. Table 3-30 presents available data at these sites. The 1993 inventory provides information on both percentage fine sediment and median particle size (D_{50}), but since the exact locations of the pebble counts cannot be located, it is not utilized for monitoring trends. Archer, et al. (2004) provided information on the sample size needed to detect change at p=0.10 confidence of avoiding Type I and II error. The number of pebble counts in the two DMRs means that any change over 20 percent is statistically significant. Variations less than 20 percent are assumed to be natural heterogeneity and not a statistically significant trend.

Table 3-30. Sediment Data in Lower Martin Creek.

Reach*	Survey	No. of pebble counts	% Fine Sediments	D_{50}	Comment
1. 1.5% gradient	1993 inventory	39	81.5%	2-6 mm	
	2004 DMR 2009 DMR	4 4	No Data No Data	2 mm 2 mm	
2. 2.5% gradient	1993 inventory	2	51.3%	2-6 mm	
	1997 DMR 2009 DMR	1 4	38.0% 47.8%	6-8 mm 8-12 mm	Statistically significant change

*Exhibit G-17 displays a map of the stream reaches.

Based on the above information, it is assumed Lower Martin Creek, especially reach 1, has considerable fine sediment. There has been no change in reach 1 over the years. As discussed previously, the calcium carbonate deposits skew the pebble count results toward finer material.

All 4.7 miles of fish habitat in Upper Martin Creek were inventoried in 1994. Surveyors divided the stream into five reaches and collected 22 pebble counts. Upper Martin Creek also has two DMRs, both in reach 4 but not at the same location. Neither DMR has been replicated yet. The available sediment data is provided in Table 3-31.

Table 3-31. Available Data Regarding Sediments in Upper Martin Creek. No information is available for reach 6 (short reach).

Reach*	Survey	No. of pebble counts	% Fine Sediments	D_{50}
3. 8% gradient	1994 inventory	3	44.2%	6-75mm
4. 1.2-1.7% gradient	1994 inventory 1997 DMR #1 2009 DMR #2	11 1 4	51.9% 29.4% 64.0%	2-6mm 16-24mm 2-6mm
5. 3-4% gradient	1994 inventory	7	36.4%	6-75mm
7. 6% gradient	1994 inventory	1	15%	150-300mm

*Exhibit G-17 displays a map of the stream reaches.

The available data in Upper Martin Creek strongly suggests relatively high levels of fine sediment. Just like Lower Martin Creek, these reaches have alkaline water with considerable calcium carbonate deposits. Lacking any trend data, it is difficult to determine the degree that management activities may have contributed to this condition.

Roads are a likely a sediment source in the project area. Currently, there are 65.8 total miles of road and 42 stream crossing sites. Total road density is roughly 3.9 miles per square mile. Approximately 6.7 miles of road are located within Riparian Habitat Conservation Areas (RHCAs). The number of crossings is an important indicator of potential sedimentation because sediment can enter the stream network directly at these locations. Stream crossing density (crossings/square mile) has been correlated with elevated fine sediment in streams (Schnackenberg and MacDonald 1998). A recent study in Montana was done on the Lolo National Forest and determined that 100 percent of sediment delivered to streams from roads comes from just 6 percent of drain points (Cissel et al. 2013). In other words, the vast majority of road related sediment typically comes from a very small percentage of the road system. This study also estimated the amount of delivered material is roughly 0.5 percent of background sediment yield.

A stream crossing inventory was completed in 2012 at 42 sites (Exhibit G-7). The purpose was to gather physical data for input into the WEPP model to generate sediment delivery estimates. WEPP model runs (Exhibit G-7) estimate these crossings produce roughly 0.85 tons of sediment annually. This equates to roughly 0.6 cubic yards. Roughly 68 percent of total sediment production is generated at crossings on Road 910. There is a short reach of Martin Creek that is actively eroding into the fillslope of Road 910. This is likely due to poor road placement, combined with lateral stream movement.

A 2010 inventory examined the condition of culverts in the Martin Creek watershed (Exhibit G-5). Four culverts were determined to need upgrades (replacement) and five in need of improvements. Culverts that constrict but otherwise pass water force the downstream channel to adjust to increased stream power. The channel typically erodes downward and a waterfall forms at the culvert outlet. Some locations may continue to erode in the future, others are now stabilized.

Historic logging practices may have caused some sedimentation in the past, but this is no longer a concern. Roughly 95 percent of Lower Martin Creek watershed is on National Forest system lands. Timber harvest practices on NFS lands have left RHCAs un-harvested since 1994. Retention of riparian vegetation has been found successful in trapping overland sediments before they reach stream channels (USDA Forest Service 1995c).

In 2011, the Martin Creek watershed was assessed by an interdisciplinary team in support of the Watershed Condition Framework. This watershed was determined to be in Class 1 condition, Functioning (USDA Forest Service 2011e).

The water quality beneficial use classification within the project area is B-1. B-1 waters are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

Wetlands

In this analysis, the term wetland is used as a generic term to describe riparian ecosystems associated with lakes, ponds, springs, seeps, fens, and ephemeral pools. In the Martin Creek watershed (and project area), there are several wetland ecosystems. The larger ones surround Martin Lakes and there are a few smaller wetlands near the headwaters of the Martin Creek watershed. Typically, small riparian ecosystems associated with ponds, springs, seeps, fens, and ephemeral pools are too small to be mapped. These areas are typically found during project implementation.

Fish Populations

Historically, Martin Creek was fishless because of a migration barrier near its confluence with the Stillwater River (Exhibit G-6). There are no bull trout in Martin Creek, and no designated Critical Habitat (Exhibit G-11). At present, there are two distinct fish populations in the project area, separated by Martin Falls. Lower Martin Creek has been repeatedly inventoried since 1994 and only nonnative brook trout have been found in the main stem. Electrofishing inventories indicate roughly 1120 age 1+ brook trout in Lower Martin Creek (no confidence interval available). Given there is about 5.8 miles of fish habitat, this is a lower than normal density of brook trout as compared to other streams on Tally Lake Ranger District. This may be due to limited primary production due to calcium carbonate deposits in the stream. Because there are over 1000 individuals, the population is assumed to be viable.

Montana FWP chemically treated in 2005 the upper and lower Martin Lakes along with a half mile of the outlet stream to remove non-native fish. Subsequent monitoring by Montana FWP determined the project was a success. These water bodies were stocked later the same year with westslope cutthroat trout. Montana FWP recently reported that both lakes presently contain exclusively westslope cutthroat trout. No information is available on the population size or structure. Both lakes are stocked nearly annually with fingerling trout, typically from Murray Springs Trout Hatchery. There is no spawning habitat for cutthroat trout by these lakes and the population is maintained solely by stocking. By definition, this is not a viable population of native fish but rather a put-and-take recreational fishery. The stream between Upper and Lower Martin Lake is intermittent and presumed fishless under most flow conditions. However the outlet below Lower Martin Lake is perennial and a 2009 inventory collected low numbers of both cutthroat trout and brook trout. The cutthroat trout are presumed emigrants from Lower Martin Lake.

In Upper Martin Creek (upstream from Martin Falls), electrofishing inventories have found only cutthroat trout and no other species. These fish are not genetically pure cutthroat. A sample of 25 fish collected in 2001 found their genetic materials are 69 percent westslope cutthroat trout, 29 percent Yellowstone cutthroat trout, and two percent rainbow trout. A state-wide Memorandum of Understanding (Montana FWP 2007) has agreed that any cutthroat trout more than 10 percent introgressed (hybridized) are no longer worthy of conservation measures. Therefore, the Upper Martin Creek population is a large population but they are not technically westslope cutthroat trout. Upper Martin Creek has about 4.7 miles of fish habitat. The tributaries are essentially fishless with the exception of one tributary having about 20 meters of habitat near the mouth. As of 2011, the population is estimated to have 2217 age 1+ cutthroat trout (2017 to 2421 at 95 percent confidence interval). This is a fairly

high density of fish compared to others on the Tally Lake Ranger District and a viable population.

Environmental Consequences

Proposed activities of the action alternatives that have the potential to affect aquatic resources are summarized in Table 3-32. These proposed activities are the focus of the following aquatics analysis.

Table 3-32. Summary of Activities by Alternative.

Alt	Timber Harvest (acres)	Precommercial Thinning (acres)	New Temporary Road Construction (miles)	New Road Construction (miles)	Road Closures (miles)	Culvert Replacements	Road BMPs (miles)
Alt A	0	0	0.0	0.0	0	0	0
Alt B	868	564	0.9	3.1	2.9	4	44
Alt C	460	297	0.6	0.3	4.8	4	41

Direct, Indirect, and Cumulative Effects of Alternative A (No Action)

In the No-Action Alternative, resource conditions described in the *Affected Environment* section above would persist. Timber harvest and thinning would not occur, which may reduce resiliency of forested vegetation in those stands (Grant, et al. 2013). Road improvements and culvert upgrades would not occur. Roads that are not upgraded to BMP standards would continue producing sediment at rates described in the affected environment. Eroding fillslopes along Road 910 would not be stabilized and chronic sedimentation would continue to impact aquatic habitat and water quality. Problem culverts and high risk culverts would remain and the risk to aquatic habitat and water quality would persist. No new road construction and associated erosion would occur.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Direct and indirect effects of the action alternatives are discussed below in terms of hydrologic processes, aquatic habitat, water quality, wetlands, and fish populations. The spatial and temporal scales of predicted effects are described by each component of the analysis. In general, the effects of Alternatives B and C are very similar, so they are discussed in the same section. Effects are broken out by individual alternatives where measurable differences are expected.

Hydrologic Processes

Forest canopy removal affects hillslope hydrology in three ways. First, canopy interception of rain and snow is decreased and more moisture reaches the ground. The interception component is more substantial at higher elevations where precipitation is dominated by snow. Secondly, transpiration demand is reduced because water is no longer transferred to the atmosphere from the soil. Finally, snow redistribution and melt processes may be changed depending on the type and scale of silvicultural treatments. Where timber harvests occur, Snow Water Equivalent (SWE) would increase due to interception savings and snow redistri-

bution from adjacent stands (Troendle 1983). In addition, snow may melt earlier in these treatment units due to increased solar radiation, especially on southerly aspects (Troendle 1983; Megahan 1983). Higher SWE associated with forest canopy removal can be counteracted by higher rates of sublimation caused by exposure to wind and sunlight (Stegman 1996).

Treatment areas range between 1 and 114 acres in area, and most are several hundred feet across. Because many of the treatment areas are relatively large, SWE may only increase in the smaller units. Gains in SWE caused by harvest may be offset by snow sublimation in larger shelterwood, seed tree, and clearcut units greater than five tree heights across (Stegman 1996, Troendle and Leaf 1980).

Proposed precommercial thinning in Alternatives B and C is likely to increase soil moisture, which would likely be used by remaining trees. Thinning is not expected to affect water yield because little forest cover is removed and total proposed treatment acres are small. In addition, average annual precipitation in the project area is relatively low (25-30 inches) which lowers the potential for water yield increases (Bosch and Hewlett 1982). Thinning is likely to reduce water stress of remaining trees (Grant, et al. 2013) and increase forest resiliency to disturbance events such as insect, disease, and wildland fire.

In the context of climate change, reductions in forest canopy may have hydrologic benefits, depending on the type of silvicultural treatments. Recent studies indicate snowpack is decreasing and streamflow regimes are changing as a result of climate change (Mote 2003b; Gillan, et al. 2010; Luce and Holden 2009; Stewart, et al. 2004; Pederson, et al. 2010; Kendall 2011). Increases in drought frequency and severity will increase tree mortality and reduce streamflow (Vose, et al. 2012). Timber harvest and especially thinning would reduce the demand for water and reduce water stress, especially during dry years and drought periods. Many forest disturbances such as wildland fire, insects, and disease are related to water stress. As the climate warms, the frequency and magnitude of these forest disturbance events are likely to increase (Grant, et al. 2013). The silvicultural treatments that focus on basal area reduction from below (particularly thinning) would reduce water stress and allow stands to be more resilient to disturbance.

Temporary road construction would decrease local water infiltration and increase surface runoff. These effects would generally be limited to the road prisms. Road closures would likely result in more ground cover on the road surfaces and enhance water infiltration. Culvert upgrades would increase hydraulic capacity and reduce the risk of failure during large storm events and snowmelt. Road BMPs would improve water drainage and minimize the effects of treated roads on hydrologic processes. Construction of permanent roads would intercept and concentrate shallow sub-surface flow at the hillslope scale. Storm driven infiltration would be reduced and subsequent surface runoff would increase. These effects would be limited to the hillslope scale and would persist as long as the roads remain on the landscape.

Aquatic Habitat and Water Quality

Because the action alternatives focus primarily on vegetation and road management, sediment is the primary concern and is the focus of analysis. Sediment in streams can degrade macroinvertebrate and aquatic habitat by filling interstitial spaces and pools, and decrease intergravel dissolved oxygen concentrations; both of which impact the aquatic ecosystem (Mac-

Donald, et al. 1991; Meehan 1991). Sediment is also a vehicle for nutrients, and increased nutrient loading (particularly nitrogen and phosphorus) can stimulate algae growth (Meehan 1991). This can increase primary production in stream environments, but may also contribute to eutrophication (reduced oxygen).

Some proposed activities have the potential to cause sediment delivery into the Martin Creek stream network. These include temporary road construction, permanent road construction, and culvert upgrades. Estimates of this potential sediment production from the action alternatives are presented in Table 3-33. Potential sediment production from road construction was estimated using the WEPP Road Model. Potential sediment production associated with culvert upgrades is based on several assumptions related to excavation and culvert size (Exhibit G-7). Sediment savings associated with road BMP improvements were estimated based on a 75 percent reduction in current sediment delivery rates near stream crossings. Estimates of sediment delivery from timber harvest activities are not included because no commercial activities are proposed within RHCAs, which are highly effective in trapping sediment (USDA Forest Service 1995c; Gardner 2004; Litschert and MacDonald 2009). Some precommercial thinning is proposed within RHCAs; although to protect large woody debris recruitment, no thinning would take place within 50 feet of any water body. This activity does not disturb the ground and has no erosion potential. Precommercial thinning is expected to benefit forested vegetation within RHCAs by enhancing the health and resilience of remaining trees.

Table 3-33. Potential Sediment Production by Alternative.*

Potential Activity Generated Sediment	Potential Sediment (tons)		
	Alt. A	Alt. B	Alt. C
Temporary Road Construction[1]	0.00	0.07	0.00
Permanent Road Construction	0.00	0.11	0.03
Culvert Upgrades	0.00	2.00	2.00
Current Road System (at or near crossings)[2]	0.85	0.00	0.00
Streambank Erosion near NFS Road 910	2.70	0.00	0.00
Net Sediment Production	**3.55**	**2.18**	**2.03**

*This table does not include potential sediment that may result from failure of undersized culverts. It is estimated that culvert failure would produce at least twice the amount of sediment as replacement (Exhibit G-7).
[1]Sediment delivery estimates for proposed temporary and permanent roads are very low due to stream proximity and/or hillslope gradient.
[2] Field observations of road crossings on the proposed haul route indicate that lack of drainage structures is causing road erosion. Installation or upgrade or structures would eliminate or reduce sediment delivery substantially.

Alternatives B and C are likely to produce small amounts of sediment in the short-term (one to two years), but in the longer term (two to ten years) would reduce sedimentation compared to the No-Action Alternative (Table 3-33). Design criteria to minimize disturbance include working only during low flows, bypassing water and utilizing straw bales or burlap screens to trap sediments. Replacing of stream crossings would result in a short-term sediment increase. In the long term, it is probable that this action could prevent catastrophic failures which could potentially double the amount of sediment delivery. Upgrading roads with BMPs is extremely effective in preventing sediment delivery. The latest audit report completed by Montana DNRC found that BMPs are adequate in protecting water quality 97.8 percent of the time on

Federal Lands in Montana (Exhibit G-14). Adequate protection is defined as forest practices that do not result in sediment delivery to streams or draws.

Temporary roads are proposed in both action alternatives. The highest potential for erosion would be immediately following construction, and then gradually subside as soil particles settle. Once project activities are complete, these roads would be re-contoured to the original hillslope gradient to facilitate optimum recovery. New specified roads H and I are generally located near ridges far from streams. The WEPP model predicts very low levels of potential sediment delivery because these proposed roads are generally a long distance from streams and/or they are located on gentle slopes (Table 3-33). Even though the model is predicting small amounts of delivered sediment, field observations have determined that RHCAs are very effective in trapping sediment from hillslope sources (Gardner 2004).

Approximately 0.65 tons of sediment is estimated from roads on the haul route (Exhibit G-7), which is a large portion of the 0.85 total amount of sediment contributed from all existing roads. Simple BMP improvements would reduce sediment delivery substantially. The current estimate in Table 3-33 is based on the assumption that BMPs would eliminate chronic sediment delivery during the next several years. Proposed BMP work includes installing drain dips, blading the road and clearing ditches. Because this activity is in close proximity to Martin Creek, a small amount of sediment may reach streams during the next precipitation event after BMP work. For the majority of the length, there is dense riparian vegetation between the road and the stream, which should trap most of the sediment created during this action. Over the long-term, BMP application, stream crossing improvements, and culvert upgrades would substantially reduce road erosion and potential sediment delivery. Tables 3-34 and 3-35 and Figure 2-2mmarize specific work that would be completed at road crossings. Exhibit G-5 includes more detailed information about these sites.

Table 3-34. Stream Crossings to be Improved in Action Alternatives.

Road Number	2010 Culvert Survey Number	Issue Identified	Description of Work
2989B	6	Erosion on road surface. Brushed in.	Clean inlet, BMP road – Drain Dips, cross drains etc.
2955	10	Partially plugged with wood	Clean outlet of pipe.
5315	2	Erosion on road.	BMP road – Drain Dips, cross drains etc.
9875	16	Some road scour. Brushed in.	Clear inlet and outlet, BMP road - Drain Dips, cross drains etc.
2989	7	Erosion on road. Water may be undercutting culvert.	BMP road - Drain Dips, cross drains etc. Check to be sure pipe is capturing all of water.

Table 3-35. Culverts to be Upgraded in Action Alternatives.

Road Number	2010 Culvert Survey Number	Issue Identified	Description of Work
910	29	Undersized culvert	Upgrade to appropriate size
910	8	Undersized culvert	Upgrade to appropriate size
2989	9	Undersized culvert	Upgrade to appropriate size
9875	15	Undersized culvert	Upgrade to appropriate size

At four locations on Road 910 totaling approximately 50 to 75 feet, large rock material would be placed along the base of the road fillslope to prevent Martin Creek from scouring the material and causing sedimentation. This work would help stabilize the road prism and prevent further stream degradation. The rock material would crowd the stream channel and force the stream away from the road. During low flow, there is no harm but during the following spring runoff, the natural (unarmored) stream bank on the far side away from the road would scour and erode. The District Fisheries Biologist estimates that one to two cubic yards of stream banks may erode to accommodate the channel shift away from the road prism (Exhibit G-6). The erosion would be gradual but sustained throughout the spring runoff and then subside completely during low flow. The moist riparian area would facilitate quick vegetation growth and the bank would stabilize by late summer and would no long be a sediment source. In the long-term, this activity would probably prevent sections of Road 910 from being washed out during a large runoff event and depositing substantial amount of sediment into Martin Creek.

The recreational access site to Upper Martin Lake would be modified to provide users easier access to the lake. The steep hillslope path would have standard trail structures installed that would provide for safe use and minimize the potential for future sedimentation into the lake. There is no potential for erosion during project implementation and the net result is slightly less chronic erosion in Upper Martin Lake but no measurable change to fish habitat in the lake.

Wetlands

In both action alternatives, wetlands would be protected by RHCA designation. RHCAs are already designated for mapped water bodies in the project area. In many cases, wetlands are found during layout of harvest units. When this occurs, aquatic resource specialists are consulted and appropriate RHCA widths are applied to provide protection. Wetland features less than one acre have a 50 foot RHCA and features greater than one acre have a 150 foot RHCA (USDA 1995c).

Fish Populations

In Lower Martin Creek, implementation of Alternative B or C may result in a short-term increase of sediment to fish habitat (with Alternative B increasing slightly more than Alternative C), but would most likely result in a net reduction in sediment delivery during the next several years (Table 3-33). Any short-term sediment that may enter fish habitat is not expected to have any effect on brook trout viability. Brook trout would not experience decreased reproductive success during the short timeframe of sedimentation. Over the long term, Alternatives B and C defer a potential larger sedimentation pulse that could result from failure of under-sized culverts. While this protects brook trout growth and survival, implementation of Alternative B or C is not essential to maintain brook trout viability. Brook trout are likely to remain in low density in any alternative for the analysis timeframe. There are no reasonably foreseeable actions that would change the brook trout fishery of Lower Martin Creek. The cutthroat trout population in Martin Lakes would be unchanged by either Alternative B or C. These alternatives propose work on the angler access trail at end of Road 2872C to halt erosion. However, existing erosion is too small in scale to affect fish habitat in the lake. Recreational angling on the lakes may be somewhat reduced due to installation of a berm on Road 9629 in Alternative C. Most anglers access the lakes from the east side off

Road 2872 but scoping responses revealed that at least a few anglers chose to access the lakes from Road 2972C. Closing these seasonally-opened roads would mean longer walks for those anglers which could reduce total angling pressure. But ultimately this does not matter to the stocked fishery in the lakes. The lakes are a put-and-take fishery and there is no natural reproduction. Any loss of recreational harvest means more fish would live longer and die of natural causes. These are considered surplus fish since they cannot reproduce and the population technically is unviable without regular stocking. Since it is reasonably foreseeable the Montana FWP would continue to stock these lakes, no change is anticipated to this population during the analysis timeframe.

In Upper Martin Creek above the falls, Alternatives B or C may result in a very slight improvement in fish habitat with reductions of sedimentation, but the amount of change would probably not be large enough for statistical confidence. Therefore, it is assumed the hybridized cutthroat trout of Upper Martin Creek would remain unchanged if Alternatives B or C were implemented. The habitat change is probably not large enough to result in increased viability or population size. For more information on fish populations please see Exhibit G-6.

Cumulative Effects of Alternatives B and C

Cumulative impacts can result when the effects of one activity are added to or interact with other activities in a particular place and within a particular timeframe. It is the combination of these effects that are referred to as cumulative effects. The potential cumulative effects associated with the action alternatives are analyzed at two different scales. For hydrologic processes, aquatic habitat, and water quality, the cumulative effects are discussed at the watershed scale; in this case the Martin Creek watershed. For fish populations, cumulative effects are discussed in Upper Martin Creek and Lower Martin Creek to address the two distinct fish populations. Past, present, and reasonably foreseeable land use activities are discussed for each area to evaluate potential cumulative effects of the action alternatives. In addition to this relatively general cumulative effects analysis, specific land uses identified on the cumulative effects worksheet (Exhibit G-15) are discussed.

Martin Creek Watershed (Hydrologic Processes, Aquatic Habitat and Water Quality, and Wetlands)

Past management activities in the Martin Creek watershed include road management activities, timber harvest, silviculture, fuels management, and fire management. The vast majority of these uses have occurred on National Forest lands, which occupy 97 percent of the watershed.

Future management activities in the Martin Creek watershed are likely to be the same as the past and present. Direct, indirect, and cumulative effects of the action alternatives on aquatic resources are expected to be beneficial overall. The action alternatives are expected to result in a net reduction in sediment delivery. In addition, culvert upgrades would reduce the risk of failure and associated sedimentation.

Given the past, present, and reasonably foreseeable actions in Martin Creek, it is highly unlikely that the action alternatives would contribute to long-term cumulative impacts on hydrologic processes, aquatic habitat, water quality, or wetlands. Alternative C is even more unlikely to cumulative impacts than Alternative B. Vegetation management activities are

likely to have a cumulative benefit to the watershed during the next several years in terms of forest disturbance and resilience. Alternative B is more likely to have cumulative benefits than Alternative C due to a greater amount of treatment acres. Road improvements (BMPs) are likely to last at least a decade into the future, which would maintain good watershed conditions and quality aquatic habitat.

The small amount of private land near the mouth of Martin Creek has several small buildings, roads, and driveways. Common land uses include timber harvest, fuels management, and agriculture. It is unknown how much activity will occur on these lands in the foreseeable future. However, these private lands are located on flat ground and have little potential to impact aquatic resources.

Upper and Lower Martin Creek Watersheds (Fish Populations)

The brook trout population in Lower Martin Creek, the hybridized cutthroat in Upper Martin Creek, and the cutthroat populations in Upper and Lower Martin Lakes are expected to remain in their current condition, as described in the *Affected Environment* of this section. The action alternatives are expected to provide an overall benefit to aquatic habitat due to road BMPs (sediment reduction) and culvert upgrades. However, these effects on habitat are not likely to produce a measureable fish population response in the Upper or Lower Martin Creek analysis areas.

Forest Service Land Uses

The following discussions highlight specific land uses on Forest Service land that have the potential to contribute to cumulative effects on aquatic resources. These land uses are identified on the cumulative effects worksheet for aquatic resources (Exhibit G-15).

Wildland Fire Suppression- Since about 1940, the Forest Service and State of Montana have actively suppressed wildland fires. These agencies will continue to suppress wildland fires in the Martin Creek watershed. Suppression activities have the potential to impact aquatic resources primarily through ground disturbance and associated sedimentation. After a fire is extinguished, fire lines and other ground disturbances are rehabilitated to prevent erosion and sedimentation. It is impossible to predict when and where a wildland fire may occur.

Fishing and Fish Stocking- Fishing will continue in the Martin Creek watershed, primarily at Martin Lakes. These lakes are stocked each year by Montana FWP. A small amount of fishing will likely continue in lower Martin Creek, which is not expected to have measurable impacts on the brook trout population.

Road Maintenance and BMPs- Road maintenance is likely to continue into the future, but the majority would take place prior to implementing this project. Culvert upgrades, drainage improvements, and other road improvements are expected to maintain effectiveness during the next ten years. Given current budget levels, it is unlikely additional road maintenance and BMPs would occur any time in the foreseeable future.

Beaver Control- Trapping of beavers and destruction of beaver dams occurred up to the 1990s on all ownerships. This activity may continue to take place on private property, but not on Forest Service lands in the foreseeable future.

Reed Canarygrass Control- Control of reed canarygrass is being proposed on three sites, one located in the project area, one immediately adjacent to the project area, and one south of Tally Lake. The treatments would likely include prescribed burning, mowing, application of herbicides, and coverings with black plastic sheets. This project could be implemented as soon as the spring of 2015. Potential effects of this activity in the Martin Creek watershed would be improved wetland function at the treatment site.

Timber Harvest- Approximately 5394 acres of land have been harvested to some degree on National Forest System land since the 1950s within the analysis area. Past timber harvest has ranged from individual tree removals to complete clearcuts. These areas have regenerated very well into new forests. No timber harvest activities beyond this project are expected in the foreseeable future.

Prescribed Burning- Fire has been prescribed in the past as a method to reduce fuel loading, prepare sites for reforestation, and to include fire as an ecosystem process in areas after timber harvest activities. This has occurred on approximately 275 acres. Prescribed fire without timber harvest was used on approximately 48 acres in 2001 to reduce fuels and improve big game forage conditions. No additional prescribed fire beyond this project is expected in the foreseeable future.

Road Construction- Approximately 64 miles of road have been built on Forest Service land since the beginning of the last century within the analysis area. As described in the affected environment, roads can have a variety of direct, indirect, and cumulative effects on aquatic resources. The effects of past and present road construction are captured in the *Affected Environment*. No road construction beyond this project is expected in the foreseeable future.

Road Decommissioning- Roads have been removed from the transportation system and rendered undrivable to improve wildlife security and landscape hydrologic function, and reduce maintenance costs. Approximately 1.2 miles have been decommissioned in the project area. These roads were decommissioned with the 2000 Good Creek Record of Decision (Exhibit U-5. Future road decommissioning beyond this project is not expected in the foreseeable future.

Road Maintenance- Roads designated for motorized use by the public are maintained with safety as a high priority. This primarily involves repairing drainage features and clearing of live and down vegetation. Some roads have been closed and are maintained at a lower level. There are currently approximately 64.2 miles of road under USFS jurisdiction within the project area; of which 45.2 miles are open year-long, 8.9 miles are open seasonally, and 39.9 are closed yearlong. Given current budget levels, it is unlikely that additional road maintenance would occur any time in the foreseeable future.

Removal of Non-Native Fish- The Montana Department of Fish, Wildlife, and Parks in 2005 chemically treated the upper and lower Martin Lakes along with a half mile of the outlet stream to remove non-native fish. Subsequent monitoring by FWP determined the project was a success. These water bodies were stocked later the same year with westslope cutthroat trout. Stocking of westslope cutthroat is expected to continue into the foreseeable future.

Non-Forest Service Land Uses and Actions

The following land uses on non-Forest Service lands that have the potential to contribute to cumulative effects are described below.

Private Land Development- A limited amount of construction of driveways, buildings, and other improvements on private land within the project area has been occurring for decades and will continue. The amount of development has been minimal due to the small amount of private land available in the project area. Most of the development is in the form of private primary or secondary residences on single lots near the intersection of the Good Creek and Martin Creek roads. The Forest Service is not aware of any plans for further development in the foreseeable future.

Timber Harvest- A very limited amount of timber harvest has occurred in the past on the 80 acres of private property. An estimated 50 percent of this land has experienced intermediate harvest methods over the past 50 years, some as recently as 4 to 5 years ago. No timber harvesting on private property is currently observed. Lands owned by private individuals are not expected to have any timber harvest in the foreseeable future.

Wood Products Manufacturing- A small, family-owned sawmill operated on private property for approximately 20 years, ending in the early 2000s. The Forest Service is not aware of any plans to manufacture wood products on private lands any time in the foreseeable future.

Fuels Reduction- Removal of live and dead vegetation for the purpose of reducing wildland fire intensity has been accomplished on private property within the project area. This activity is expected to continue. The extent of fuel reduction on private property is not known but is primarily limited to areas immediately adjacent to structures. The Forest Service is not aware of any fuel reduction plans on private lands any time in the foreseeable future.

Agriculture- A minor amount of land on private property has been used and will continue to be used for agricultural purposes. The Forest Service is not aware of any plans to expand agricultural land uses on private lands in the foreseeable future.

Regulatory Framework and Consistency

Management and protection of water resources on National Forest System lands is regulated by the Federal Water Pollution Control Act (Clean Water Act), the Streamside Management Zone Law, Federal Executive Orders, Forest Plan direction, and Forest Service Policy.

Clean Water Act

Section 313 of the Clean Water Act requires that Federal agencies comply with all substantive and procedural requirements related to water quality. Under Section 303 of the Clean Water Act, states have the primary responsibility to develop and implement water quality programs, which include developing water quality standards and Best Management Practices (BMPs). State water quality standards are based on the water quality necessary to protect beneficial uses.

Environmental Protection Agency policy requires each state to implement an anti-degradation policy. Under this policy, water quality must be maintained to fully support existing benefi-

cial uses. Existing water quality that is higher than the established standards must be maintained at the existing level unless a change in water quality is justifiable due to social and/or economic reasons (CFR Vol. 48, No. 217, 131.12, Nov. 8, 1983; Montana Water Quality Act, Section 75-5.)

Water quality standards (Section 303(c)) established in Montana are based on their beneficial uses. Common beneficial uses include drinking (after conventional treatment), bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

Federal agency compliance with pollution control is addressed through Section 313 of the Clean Water Act, Executive Order 12580 (Jan. 23, 1987), National Nonpoint Source Policy (Dec. 12, 1984), USDA Nonpoint Source Water Quality Policy (Dec. 5, 1986) and the Environmental Protection Agency in their guidance "Nonpoint Source Controls and Water Quality Standards" (Aug. 19, 1987). In order to comply with State and local nonpoint pollution controls, the Forest Service implements BMPs (Exhibit G-12) to control non-point source pollution. BMPs are the primary mechanisms that to achieve water quality standards in forested environments.

BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution producing activities to reduce or eliminate introduction of pollutants into receiving waters. Usually, BMPs are applied as a system rather than a single practice. BMPs are selected by site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility. The Forest Plan emphasizes the application of BMPs "to protect or improve the quality of the water source" (p. II-40).

Endangered Species Act

The U.S. Fish and Wildlife Service has determined bull trout are a threatened species as defined by the Endangered Species Act (ESA). Bull trout are the only listed fish species on the Flathead National Forest. ESA requires a Biological Assessment for major federal actions and consultation with the U.S. Fish and Wildlife Service if the action could potentially affect bull trout. A Biological Assessment has been prepared and is available in Exhibit G-11 of the Project File.

Montana Streamside Management Zone (SMZ) Law

The purpose of the Montana Streamside Management Zone Law is to protect the quality and quantity of forest waters and to conserve the integrity of Montana streamside zones. The law prohibits clear cutting, burning, equipment operation, road construction, slash disposal, or use of toxic material within at least 50 feet of any stream, lake, or other body of water. The Department of Natural Resources and Conservation (DNRC) must approve any exceptions to these prohibited practices. SMZs are typically nested within Riparian Habitat Conservation Areas (RHCAs) that are defined in the forest plan. RHCAs are larger and provide additional protection of streams and other water bodies.

Wetlands and Floodplains

Wetlands and floodplains are protected under Executive Orders 11990 and 11988, respectively. All wetlands and riparian zones would have RHCAs and SMZs around them to meet

Forest Plan direction and Montana Streamside Management Zone Law. Therefore, all alternatives would meet the requirements of these Executive Orders.

Forest Plan Direction

Originally adopted in 1986, the Flathead National Forest Land and Resource Management Plan is the primary document that establishes management standards and guidelines governing activity on National Forest System lands within the boundaries of the Flathead National Forest. The Forest Plan provides a variety of management direction related to aquatic resources. Much of this direction is based on the Clean Water Act, National Forest Management Act, Endangered Species Act, and Forest Service Policy. The most relevant direction in the forest plan related to the aquatics resource is the Inland Native Fish Strategy (INFISH) (USDA 1995c). INFISH standards place a greater emphasis on protection of fish habitat than earlier standards in the Forest Plan. Numerous priority watersheds were established to recover bull trout, but none are identified in the Martin Creek analysis area. INFISH discourages timber harvest within RHCAs but does recognize harvest may be appropriate in some situations as long as it does not retard riparian objectives. Action alternatives propose pre-commercial thinning within RHCAs, but not within 50 feet of the stream. All action alternatives defer any timber management in RHCAs. Therefore, all action alternatives comply with INFISH (Exhibit G-4).

This forest plan also identifies cutthroat trout and bull trout as management indicator species for all other fish species and prohibits unacceptable fish losses. Losses of individual fish may occur but it is unacceptable when viability substantially decreases or an entire population is lost. There are no bull trout or pure-strain cutthroat in the project area with the exception of the stocked cutthroat trout in Martin Lakes. The hybridized cutthroat in Upper Martin Creek are not technically considered cutthroat because they are genetically compromised. In conclusion, the action alternatives do not cause unacceptable fish losses.

Forest Service Policy

The Regional Forester has determined that westslope cutthroat trout are a sensitive species. The Forest Service seeks to protect their habitat and prevent population declines that would lead to protection by ESA. A biological evaluation is required for the action alternatives and is available in Project File Exhibit G-8. The cutthroat trout population in Upper Martin Creek is too hybridized to be considered westslope cutthroat trout. Genetically pure cutthroat trout are found in Martin Lakes.

Best Management Practices

Best Management Practices (BMPs) are the primary mechanism used by land management agencies to achieve State water quality standards. BMPs are practices that have been adopted to minimize non-point source water pollution from forest practices. While not required by regulation, the use of BMPs has been widely accepted by the Forest Service, the State of Montana, forest products industry, family forests, tribal governments, and other agencies. BMPs include, but are not limited to, structural, and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution producing activities to reduce or eliminate the introduction of pollutants into receiving waters.

BMP audits have occurred on the Flathead National Forest and other Federal ownerships from since 1990. Audits are used to determine if BMPs are properly applied and effective. From 1990 to 2012 (the last year summarized data was available), BMPs have been audited or monitored on 122 individual federal sites.

The use of BMPs has proven to be an effective tool in limiting non-point source pollution from forest harvesting activities. The Forestry Practices Program coordinated by DNRC leads a biennial audit of the application and effectiveness of BMPs at selected sites. When the first audit was conducted in 1990, 78 percent of practices met or exceeded BMP standards on all ownerships. In the same year, only 53 percent of high risk practices met or exceeded BMP standards. During the past several years, implementation and effectiveness of BMPs have improved dramatically. The 2010 BMP Audits determined that 97 percent of practices met or exceeded BMP requirements on all land ownerships (Exhibit U-3ca). The 2012 audits revealed that 98 percent of applied practices met or exceeded BMP requirements on all ownerships (Exhibit U-3c). The audit reports in Exhibits U-3c and U-3ca contain a variety of statistical information about BMP application and effectiveness on all ownerships where forest management occurs.

Permitting

All required permits would be acquired prior to project implementation. Where work is needed within a stream and/or floodplain, the Forest Service would acquire a joint permit (commonly referred to as a 124 permit) from the Montana Department of Fish, Wildlife, and Parks. This permit ensures compliance with applicable State and Federal laws that relate to protection of streams, wetlands, floodplains, and other water-related features.

Regulatory Consistency

In conclusion, all of the proposed alternatives are consistent with the Federal Water Pollution Control Act (Clean Water Act), Endangered Species Act, the Streamside Management Zone Law, Federal Executive Orders, Forest Plan direction, and Forest Service Policy.

Soils

Introduction

This section discusses the components of the soil resource that could be affected by the proposed activities. They are:

- Soil productivity
- Soil erosion
- Mass failure

Effects to the watershed resource as a whole are discussed in the *Aquatic Resources* section.

Soil Productivity

Soil productivity is the ability of the soil to supply the water and nutrients needed to sustain plant growth. Variables that influence soil productivity include physical soil characteristics, organic matter, and soil biological activity.

Physical Soil Characteristics

Physical soil characteristics include soil depth, pore space, and bulk density. Changes in these occur when ground-based equipment makes repeated passes over the soil (Lull 1959). These activities can compact soils and, if soils are wet enough, cause rutting and puddling. These changes to physical soil characteristics reduce the pore space volume and water holding capacity. Physical changes may reduce infiltration rates, slow soil drainage, impede root growth and reduce plant-available water and nutrients. Physical soil disturbances also decrease gas exchange which affects both plants and soil biota.

Organic Matter

Organic matter in its various forms contributes to soil productivity. Humus is decomposed organic matter. Duff and litter are partially decomposed leaves, needles, and twigs on the surface of soils. Large woody debris consists of woody stems greater than three inches in diameter (Harvey, et al. 1994). All organic matter provides water and nutrients for soil organisms and plants. Garrison and Moore (1998) found 85 to 90 percent of the total nutrients in most coniferous trees are contained in the branches, twigs, and foliage. Prescott and Laiho (2002) found the contribution of nutrients from large woody debris to be relatively minor.

Soil Biological Activity

Soil organisms, including fungi and bacteria, drive the nutrient cycling process by decomposing organic matter and mineralizing nutrients. Soil organisms depend on organic matter to carry out their life processes. Decomposed large woody debris provides important habitat for the survival of mycorrhizae fungi. These fungi form a symbiotic relationship with tree roots, increasing water and nutrient uptake by the trees and the fungi (Perry, et al. 1990).

Soil Erosion

Soil erosion is the movement of soil particles by water, wind, or ice. In forested sites on steep slopes, water is the most common cause of soil erosion. Erosion is infrequent on undisturbed forest soils for two reasons: 1) abundant organic matter on the soil surface that reduces raindrop impact and overland flow; and 2) the surface soil below the organic layer is by nature porous, allowing water to infiltrate into and through the soil profile (Goldman, et al. 1986).

Soil erosion can occur when the surface soil is compacted or when the loose surface soil and its protective layer of organic material are changed by management activities. Compaction, rutting, and puddling reduce infiltration and tend to channel and concentrate water. As a result, run off (overland flow) and soil erosion are increased. Natural occurrences such as wildland fire remove organic matter from the soil surface. When organic matter is removed, soil pores can be plugged by impact from raindrops resulting in overland flow and increased rates of soil erosion.

Mass Failure

Mass failures can be caused by natural or man-made disturbances. Mass failures can result from sequences of natural events, such as wildland fire followed by high-intensity precipitation. Some areas are prone to mass failures because of the nature of the bedrock geology or soil. Management activities can also saturate a soil by channeling water and concentrating it onto a limited area, for example, below a road culvert or a rutted skid trail. Disturbances associated with mass failures cause long-term changes in soil productivity.

Information Sources

Forest Service Manual Section 2550 and the Region 1 Supplement 2500-99-1 (Exhibit H-1) provide direction for maintaining soil quality. Numerous bulk density samples have been taken from the FNF in areas that were managed for timber production. Statistical analyses of bulk density measurements establish their validity in determining the effects of mechanized vegetation management (Exhibit H-2 and H-3).

A study of soil moisture trends on the FNF (Exhibit H-4) demonstrates the annual period when soils are sufficiently dry (soil moisture less than field capacity) to reduce DSD. Literature has been cited that documents the effectiveness of design criteria proposed to reduce anticipated DSD from the Martin Creek Resource Management Project. In addition, monitoring reports for activities on soils similar to those in the Martin Creek area (Exhibits H-5 through H-15) were used to estimate the effects of the proposed activities. Information gathered in field investigations was used to determine cumulative effects. Forms containing field soil disturbance survey data are located in the project file (Exhibit H-16).

The soils in the project area are described in the updated landtype report (USDA Forest Service 1983). Landtypes provide the basis for the soil analysis. All soils are classified according to Soil Taxonomy, a national system used to classify and group soils. Classification allows soils to be grouped to permit the largest number and the most precise predictions possible about responses to use and management (USDA Natural Resources Conservation

Service 1999). This system allows for monitoring results from one taxonomic unit to be related to other, similar taxonomic units.

Past timber harvest and site preparation data was assembled from the Forest Service Activity Tracking System (FACTS).

Predicted detrimental conditions from proposed temporary roads are calculated based on average width by class. All temporary roads are estimated to average 22 feet in width resulting in 2.7 acres of detrimental disturbance per mile. All associated impacts from temporary road construction and closure are attributed to the related harvest units.

Analysis Area

The analysis area forms the boundary for the direct, indirect, and cumulative effects soils analysis. It consists of the proposed treatment units for the Martin Creek project. This analysis area was selected because that is where the effects of implementing the proposed activities would occur. The effects on soils would not extend beyond the cutting units, burn units, or thinning units proposed for treatment.

Affected Environment

In order to determine the existing condition of soils within the proposed activity areas, field investigations were conducted to assess if and how existing soil condition was affected by past management activities or other dispersed activities (e.g., off-highway vehicle travel and firewood cutting). In addition, areas within proposed activity areas that would require design criteria to address conditions such as sensitive soils that are wet, steep, or had evidence of past harvest that caused compaction, displacement, rutting, puddling, or soil erosion were identified.

Most soils on the FNF, including those within the project area, have a surface that formed in volcanic ash loess and thus are similarly classified. Since most soil quality monitoring on the FNF has occurred on soils that have a volcanic ash surface, there are a large number of both quantitative bulk density measurements and qualitative ratings that relate to the soils in the project area. This information has two valuable implications: 1) we can estimate the amount of DSD that exists from past management activities by doing transects and observing the amount of visible DSD present and 2) we can estimate the amount of DSD to expect from proposed management activities on given soil types and thus estimate the effects on the soil resource.

Soil Disturbance Evaluations

Establishment of existing condition for DSD levels in proposed treatment units followed the approach outlined in the Region 1 Soil/NEPA technical guide (USDA Forest Service 2011) (Exhibit H-17). When initial observations showed potential for existing DSD to be in excess of two percent of the activity area, the Forest Soil Disturbance Monitoring Protocol (SDMP) (USDA Forest Service 2009) was utilized. This protocol provides a method for systematically quantifying soil conditions based on visual indicators.

The Forest Soil Scientist determines which visual classes represent DSD based on the characteristics of the soils within the project area. For the Martin Creek area, where soil depths and water holding capacities are generally favorable, visual soil disturbance class 3 corresponds to DSD. Some instances of class 2 were judged detrimental due to compounding factors.

All SDMP surveys were conducted using an 80 percent confidence interval. The margin of error around each estimate is plus or minus 5 percent. Sample size is determined automatically on the electronic SDMP field form (Exhibit H-16). Information gathered during field investigations is also used in the determination of cumulative effects.

Table 3-36 summarizes the results of the existing condition surveys for proposed action units. In units with multiple past activities, these activities did not spatially overlap with one another. Areas proposed for hand treatment (units 100 to 140) were not surveyed as this activity would not contribute any additional DSD.

Table 3-36. Proposed Action Existing Condition Information.

Unit	Unit Acres	FACTS Past Entry Type	Past Entry Year	% DSD
1	9.4	-	-	0%
6	17.8	-	-	0%
7	26.0	-	-	0%
9	102.9	-	-	3%
10	69.3	Liberation Cut	1961	6%
11	23.6	Liberation Cut	1961	10%
13	27.9	-	-	0%
14	40.1	-	-	0%
16	48.8	-	-	0%
17	41.8	-	-	0%
18	54.5	-	-	0%
21	23.5	-	-	0%
22	47.0	-	-	0%
23	11.9	-	-	0%
24	48.2	-	-	0%
25	5.6	-	-	0%
27	6.1	-	-	0%
28	20.4	-	-	0%
30	7.4	-	-	0%
31	5.6	-	-	0%
33	9.1	-	-	0%
37	13.8	-	-	0%
38	12.1	-	-	0%
39	33.7	-	-	0%
43	59.9	Clearcut – Dozer Pile	1952	3%
49	36.2	Liberation Cut – Dozer Pile	1972	6%
55	13.6	Precommercial Thin	1981	3%
59	34.4	Liberation Cut	1962	11%
60	16.5	Precommercial Thin	1970	3%
100	48.0	Clearcut	1979	-
101	113.7	Clearcut – Dozer Pile	1964	-

Unit	Unit Acres	FACTS Past Entry Type	Past Entry Year	% DSD
103	28.4	Seed Tree Seed Cut – Dozer Pile	1978	-
104	23.7	Seed Tree Seed Cut – Dozer Pile	1979	-
105	36.2	Seed Tree Seed Cut – Dozer Pile	1980	-
108	46.9	Clearcut	1980	-
114	64.0	Seed Tree Seed Cut – Dozer Pile	1972	-
124	57.6	Group Selection	1975	-
129	57.3	Liberation Cut	1972	-
134	16.8	Seed Tree Seed Cut	1992	-
135	12.4	Seed Tree Cut	1993	-
136	16.1	Shelterwood Cut	1993	-
137	1.6	Seed Tree Cut – Dozer Pile	1994	-
138	25.9	Seed Tree Cut – Excavator Pile	1991	-
139	7.2	Clearcut	1994	-
140	8.4	Seed Tree Cut – Dozer Pile	1994	-

Field surveys found evidence of past disturbance within some units that have no database record of past harvest activity. In these cases, the above table provides the existing DSD information. Units that had database records of past activities but had no measured DSD might have recovered or were logged in a manner that minimized disturbance.

Trends

Soil quality in the Martin Creek area is stable to trending upward. Past activities were minimal and were completed up to 60 years ago. Literature indicates that disturbed soils improve by means of bioturbation, freeze/thaw cycles, wet/dry cycles, and organic matter additions, all of which naturally occur in the project area. These natural processes effectively ameliorate compacted soils over time (Lull 1959). Compaction recovery rates are highly variable with an expected range of 10 to 70 years (Gonsior 1983).

Most disturbed soils have abundant organic matter and roots throughout the upper soil layers. In addition, the pre-harvest surveys of proposed units show that many old disturbances are no longer detrimental; indicating they are recovering and soil quality is trending upward.

Landtypes and Interpretations

Table 3-37 lists landtype map units for the proposed mechanical treatment units (USDA Natural Resources Conservation Service 1998). The dominant soils in the project area are typified by the following characteristics:

- Rocky subsoil horizons
- High rates of infiltration
- Moderate relative productivity

Table 3-37. Proposed Mechanical Treatment Units Landtypes.

Landtype	Acres	Productivity	Sensitive	Surface Erosion Risk	Soil Features
26A-9	340.9	High	N	Moderate	Very gravelly silt loam surface texture
23-8	299.3	High	N	Moderate	Very gravelly silt loam and loam surface textures
57-8	196.5	Moderate	N	Moderate	Severe displacement sensitivity
28-7	181.2	Moderate	N	Moderate	Extremely gravelly loamy sand
57-9	164.1	Moderate	N	Moderate	Severe displacement sensitivity
26A-8	94.6	High	N	Moderate	Very gravelly silt loam surface texture
23-9	46.9	High	N	Moderate	Very gravelly silt loam and loam surface textures
26A-7	46.4	High	N	Moderate	Very gravelly silt loam surface texture
76	29.6	Low	N	Moderate	Rock outcrop and very gravelly silt loam surface texture
26C-7	18.5	High	N	Moderate	Very gravelly silt loam surface texture
26C-8	2.1	High	N	Moderate	Very gravelly silt loam surface texture
27-7	1.8	Moderate	N	Moderate	Extremely cobbly loamy sand
14-3	1.4	Moderate	Y	Moderate	Lacustrine substratum, low bearing strength

Productivity

Productivity of the soils in the Martin Creek area is dominantly high. All soils within the proposed units, with the exception of a few small, shallow, rocky inclusions, support forest vegetation.

Erosion Risk

The dominant erosion risk for all soils is moderate. This is due to relatively gentle slopes and soils with high infiltration rates. The high rock fragment content of most subsurface horizons also promotes water movement through the soils. Runoff from these soils is uncommon.

Sensitive Soils

Landtype 14-3 has potential for slow movement of water into compacted skid trails or landings. This characteristic results in the potential for overland flow that causes soil erosion and sediment. Tractor operation should be carefully managed and confined to periods when soil is frozen or snow covered. Skyline harvest would not adversely affect these soils.

Adequate and well-maintained surface drainage is necessary on all roads and skid trails that cross these soils. Temporary roads would exhibit low strength and be subject to rutting when wet, increasing the potential for sediment delivery to connected streams.

Mass Failure

The mass failure hazard rating for the project area is dominantly low. None of the affected landtypes have increased potential for mass failure.

Environmental Consequences

Introduction

The analysis of effects for soils assumes that all design criteria outlined in Chapter 2 would be effectively implemented. The analysis will show the expected amount of soil disturbance resulting from the implementation of the action alternatives and describe the risk that the expected amount of disturbance would be exceeded. The proposed harvest systems and design criteria have been implemented in previous projects and monitored for effectivenes. These monitoring reports are located in the project file (Exhibits H-5 through H-15).

The soil analysis process is described in the Soil Analysis Guideline contained in the project file (Exhibit H-19). Cumulative effects are discussed in terms of the activity areas. The Forest Service Manual (FSM) R-1 Supplement No. 2500-99-1 defines an activity area as a land area affected by a management activity to which soil quality standards are applied. An example of an activity area is a harvest unit or burn unit. Soil quality standards do not apply outside of an activity area. Effects to the watershed resource as a whole are discussed in the Aquatic Resources section.

The soils analysis is based on the current soil condition, as determined from field data collection, along with predicted changes in soil condition caused by implementation of the proposed management activities. Detrimental disturbances are defined as the condition where established soil quality standards are not met and the result is a significant change in soil productivity. The FSM states that at least 85 percent of an activity area must have soil that is in satisfactory condition.

The FSM defines the Regional Soil Quality Guidelines in terms of DSD, which includes:

- Compaction
- Rutting
- Displacement
- Severely-burned Soil
- Surface Erosion
- Soil Mass Movement (Mass Failures)

It is important to consider that not all soil disturbances are detrimental. Our past monitoring of projects on the FNF suggests that some soil disturbances create bulk density below the levels that inhibit root growth (Exhibit H-2). Research by Powers, et al. (2005) showed that increased bulk density on coarse textured soils resulted in increased production capacity because of associated increases soil water holding capacity. They also noted that increases in bulk density were not reflected in site production if an understory was absent. In other words, reducing competition from forbs, brush, and trees can leave more abundant resources for the remaining vegetation, even if soil bulk density increases.

Direct and Indirect Effects of Alternative A (No Action)

Alternative A provides a baseline to evaluate the effects of the action alternatives. The effects on soils are discussed as changes over time on soil productivity, soil erosion, and mass failures.

Soil Productivity

Alternative A would not cause short-term effects on the soil resource over and above the existing condition. No additional road building, timber harvest, prescribed burning, or fuels reduction would disrupt natural soil processes.

Physical Soil Characteristics

Alternative A would not cause soil compaction, rutting, puddling, or soil displacement. Undisturbed soils would remain so. Soil productivity in areas where past timber management compacted soils would slowly improve as plant roots, soil organisms, and freeze-thaw events loosen the soil. Most soil disturbances would recover after 70 years (Gonsior 1983). Sites that are slightly compacted would recover in fewer than 70 years. Displaced, rutted, and puddled soils would have reduced productivity for a longer time than compacted soils.

Organic Matter

With implementation of Alternative A, standing dead trees would eventually fall over and contribute coarse woody debris. Needles and branches would remain on the site and fall to the ground. Soil organisms would decompose the organic materials thus adding humus to the soil. Nutrients associated with this material would slowly become available for plant growth. As the tree canopies close in and shade the soil surface, decomposition rates would slow, allowing organic matter and nutrients to accumulate on the soil surface. This process would continue until another major disturbance, such as fire or a windstorm, opens the tree canopy and speeds up the recycling process again.

Soil Organisms

Microorganism populations would fluctuate with natural fluctuations in microclimate and organic matter. These changes would be in response to natural events such as wildland fire, blowdown, insects and disease mortality, and other sources of natural vegetation mortality. Any changes would be buffered by the capability of soil microbial communities to adapt to changing conditions on very short time scales (Schmidt, et al. 2007).

Soil Erosion

Alternative A would allow any current soil erosion to decrease as vegetation returns to soils that lack plant cover. Wildland fires could cause a short-term increase in soil erosion. Soil erosion rates would fluctuate with natural changes in vegetation.

Mass Failures

Alternative A would not change the risk of mass failures within the project area. All slopes are considered stable. Mass failures are very unlikely.

<u>Direct and Indirect Effects of Alternatives B and C</u>

Soil Productivity

The following paragraphs are based on our intent to maintain soil quality by designing the skid trails and landings so they occupy less than 15 percent of each activity area and to use

site preparation methods that minimize DSD. In addition, implementation of design criteria has the potential to further reduce soil impacts.

Physical Soil Characteristics

Ground based harvesting would cause direct and indirect effects on soil physical characteristics within the boundaries of proposed activity areas. Most detrimental effects would be concentrated on skid trails, landings, and temporary roads within or associated with proposed timber harvest units. Minimizing the area occupied by these features to reduce the detrimental effects on soil productivity from changes in physical soil properties is recommended (Page-Dumroese 1993, Garland 1997, Williamson and Nielson 2000).

Skid trails and landings would be laid out to occupy less than 15 percent of the activity unit. Calculations demonstrate that spacing skid trails 75 and 100 feet apart limit detrimental disturbance to less than 15 percent of the activity area (Exhibit H-18). Garland (1997) noted that designated skid trails spaced 100 feet apart impact 11 percent of the harvest area. Monitoring of soil conditions on the FNF after timber harvest consistently shows less than 15 percent DSD from ground based timber harvest operations that use designated skid trails (Exhibits H-8, H-9, H-11, H-13, H-14, and H-15).

In addition to using designated skid trails and landings, there is potential to reduce soil effects further by limiting equipment operation, to the extent possible, on skid trails when the soils are drier than field moisture capacity. McNabb, et al. (2001) and Startsev and McNabb (2001) found that soil compaction is reduced when soils are drier than field capacity. Williamson and Nielson (2000) noted that rutting and puddling are most often associated with logging on soils that are wet. Soil moisture monitoring on the FNF showed that soils are drier than field capacity during the summer dry period which begins in early summer and often lasts through October (Exhibit H-4). Most summer logging would occur when soils are drier than field capacity. Thus, by operating on low soil moisture conditions, we have the potential to reduce the amount of detrimental disturbance on skid trails.

Han (2006) showed that heavy slash was effective for buffering the effect of equipment operation on mineral soil. Thus if cut-to-length systems are used and heavy slash is maintained on the skid trails, detrimental effects could be reduced. The same research noted that cut-to-length harvesting systems, which stay on designated skid trails, create soil disturbance on about 10 percent of the harvested area. Han, et al. (2006) noted that logging when soils are drier than field moisture capacity reduced the amount of compaction associated with cut-to-length logging. Monitoring on two timber sales on the FNF showed that 15 units logged using a cut-to-length system with a log forwarder all met the soil quality standards with less than 15 percent DSD (Exhibits H-6, H-10, and H-12).

Skyline timber harvest would cause direct and indirect effects on soil physical characteristics within the boundaries of the proposed activity areas. These effects would be less than those from ground-based operations. McIver and Starr (2000) found that skyline yarding disturbed two to eight percent of the soil in a unit. Alexander and Poff (1985) state that skyline yarding disturbs from 10 to 40 percent of activity areas. However, this study did not differentiate between detrimental and non-detrimental disturbance. Monitoring results on the FNF show skyline yarding had consistent levels of detrimental disturbance less than 15 percent of an activity area.

Monitoring of skyline units on the Riffin Sale on the Tally Lake Ranger District showed seven to nine percent detrimental disturbance on ash-cap, glacial till soils, which included the effects from falling and pre-bunching logs with a tracked feller-buncher and a broadcast burn after the harvest (Exhibit H-14). Pre-bunching of logs with a feller-buncher is roughly equivalent to following skyline yarding with site preparation by an excavator. The Doogan Dog Sale Units 6A and 6B were skyline yarded and then broadcast burned. Monitoring showed they had nine percent detrimental impacts, which included impacts from an old road at the bottom of the unit (Exhibit H-12).

Excavator piling of logging slash minimizes changes to physical soil properties from mechanical slash treatments. All mechanical slash piling would be accomplished with excavators. This method reduces the aerial extent of detrimental soil impacts from the site preparation activities (USDA Forest Service 1992). Excavator effects have been monitored at the project level on the FNF since the early 1990s. In a detailed study, approximately 200 bulk density samples were collected where excavators worked. Those samples exhibited minor increases in soil bulk density (Exhibit H-3). In addition, when they are used on slopes less than 45 percent, displacement of the topsoil is rare.

Precommercial thinning would typically reduce tree densities to within a target range. Reductions would be accomplished by cutting with chainsaws. Cut saplings would be left on site. No DSD would result from the hand cutting of saplings. Also, no DSD would result from the hand piling of cut saplings where proposed.

Permanent Road Construction- Although impacts on soils from system road construction fall outside of established analysis areas, they are discussed and reviewed for potential soil stability concerns. New system roads are discussed to provide extent of impacts but are considered dedicated lands. Construction would result in a loss of soil productivity from a corresponding 8.4 acres. Road construction would result in soil displacement, compaction, and erosion in the proposed locations.

Recreation Improvement Proposals- Once constructed, these features would remain part of the permanent developed recreation and trail system and would no longer be applied toward the Regional Soil Quality Standards. Construction of these sites would result in minor, short-term amounts of displacement, compaction, and erosion.

Improved drainage through maintenance would greatly reduce negative trail-soil interactions. Effective rehabilitation of user-created trail segments would greatly reduce current negative effects to the soil resource. New construction of trail segments would not result in any net loss of productive soils due to commensurate rehabilitation of abandoned segment.

Wildlife Habitat Enhancement Proposals- Shrub planting and shrub slashing would have no negative effects to the soil resource. System road berm installation would result in minor amounts of soil displacement and erosion on the permanent transportation system.

Summary

Local monitoring and literature indicates that Regional Soil Quality Standards can be met by using designated skid trails. Additional protection of the soil resource would be afforded by operating ground-based equipment when soils are dry or operating equipment on a dense slash mat. Cut-to-length harvesting also meets the Regional Soil Quality Standards as indicated by

both local monitoring and literature. Literature and local monitoring on soils similar to those in the project area indicate that skyline logging would meet the Regional Soil Quality Standards. The effects from skyline yarding would impact less soil than ground-based equipment when used on the appropriate slopes. Excavators used to treat slash minimize detrimental disturbance levels. Excavator piling was monitored on the FNF and was determined to have caused few detrimental impacts (Exhibit H-3). When excavator piling was used in combination with ground-based logging systems, Region 1 Soil Quality Standards were met.

Organic Matter

All proposed treatments would leave varying amounts of soil organic matter (SOM) on the site. Reduced SOM can be associated with reduced soil nutrient levels.

The total amount of nutrients on a site would likely be reduced where SOM would be removed or displaced. However, plant available nutrients mineralized from organic matter would increase due to increased incoming solar radiation and soil moisture. These conditions accelerate the decomposition of the remaining SOM and the release of plant-available nutrients in the treated stands (Harvey, et al. 1994). After project implementation, competition between trees would be reduced because fewer trees would remain on the sites. This situation could result in more available nutrients and water for the remaining trees (Donner and Running 1986). Powers, et al. (2005) discussed this possibility along with the result that remaining trees exhibit increased growth, vigor, and disease resistance.

One must also consider that nutrients stored in the soil and SOM are not the only nutrients available to the forest vegetation. Jurgenson, et al. (1981) studied logging followed by low severity slash burning in northwestern Montana. The authors concluded there would be no long-term depletion of nitrogen reserves because lost nitrogen would be more than replenished by inputs from precipitation and by biological nitrogen fixation over a rotation of 100 to 150 years.

Regeneration treatments would remove the most live vegetation and have the potential to remove more amounts of organic matter than intermediate harvests. Units could also be logged with whole tree yarding, which would remove some branches and needles from the stand to the landing for disposal. All harvest prescriptions would leave a portion of the existing stand on the site. The proposed treatments are described in detail in Chapter 2 of this document. Remaining living trees in stands would serve as potential nutrient sources on the site.

Commercial thinning would leave a large portion of the existing stand on site, which would maintain more organic matter on the site than the seed tree, clearcut, and shelterwood treatments.

Precommercial thinning units would be treated by hand. Units within the wildland/urban interface would have slash hand piled in all or a portion of the unit. Organic matter would not be removed and there would be no measureable ground disturbance associated with this activity. Hand piled slash would be burned. The amount of area disturbed by burning hand piles would be less than 10 feet in diameter and they would burn with low amounts of heat. The amount of nutrients lost during burning would be minor. Ash from burned hand piles would contain nutrients available to emergent vegetation.

Excavator piling and burning would be used for all mechanical site preparation work. This proposed site preparation activity would reduce organic material on sites while reducing hazardous fuel loads. A variety of organic material would remain on the site after project implementation.

Summary

All proposed units would leave live vegetation. In proposed regeneration treatment units, slashed and unmerchantable material would likely remain on the site until most of the needles fall off prior to burning or broadcast burning of the material. In addition, much of the living grass, forb, and shrub components would be left behind in all of the proposed units. Many live trees would remain on all of the sites with the fewest trees left on the proposed clearcut and seed tree harvest units. The material that remains in all of the units would provide an active, microorganism-rich organic layer on the soil surface.

Soil Microorganisms

Jurgenson, et al. (1977) note that post-fire recovery of soil microorganisms occurs rapidly, frequently resulting in population levels greater than before the fire. Borchers and Perry (1990) discussed the important role that less disturbed areas of soil play in inoculating soil lacking or having reduced populations of soil microorganisms. They also state that unburned areas within burns, adjacent undisturbed areas, large woody debris, and soils that have only minor amounts of disturbance contain propagules for fungi, bacteria, and other soil organisms and that these propagules can be freely dispersed by wind, animals, and other agents.

The variety of organic matter left on the proposed harvest areas would benefit soil microorganisms by providing substrate and habitat. All alternatives would leave both dead and live trees. All alternatives and all proposed activity areas would have less than 15 percent of the area detrimentally disturbed. Many areas would be undisturbed by equipment. These areas would be a source of propagules in disturbed sites. The amounts of live and dead trees to be left in the proposed harvest areas are described in Chapter 2.

Soil compaction, puddling, and rutting reduce the ability of soils to exchange oxygen and carbon dioxide thus, affecting soil microorganism survival. Favorable habitat for soil organisms would be maintained because all proposed harvest areas would be designed to reduce soil disturbance to meet Regional soil guidelines.

Summary

Because the amount of detrimental physical soil changes would be minimized and because organic matter in various forms would remain on the proposed units, the effects to soil microorganisms would be minor. Soil microorganisms are mobile. They can quickly recolonize disturbed sites from adjacent, undisturbed sites. A variety of organic matter would remain on all sites, including living trees and other forest vegetation. In addition, the organic layer on the soil surface would be retained over at least 85 percent of the area, providing habitat and nutrients for soil microorganisms.

Soil Erosion

A risk of soil erosion would be minimized where it exists by implementing the following management practices:

- Reducing the area where equipment operates;
- Locating landings on relatively flat ground with proper drainage;
- Locating skid trails on slopes less than 35 percent that have soils with a low or moderate erosion hazard; and
- Using erosion control features such as water bars, seeding, replanting, and slash placement.

Erosion from the permanent transportation system has direct effects on water quality, but is not a component of the soil quality assessment process. These effects are evaluated in the *Aquatic Resources* section.

Precommercial thinning- Soil erosion would be unlikely to occur as a result of the hand treatments. Thinned material would add cover to the soil surface, reducing the risk of erosion. Hand piling would not increase risk of soil erosion.

Regeneration treatments and commercial thinning- Management activities that leave organic matter on the soil surface reduce soil erosion. Watershed Erosion Prediction Project (WEPP) model results (Exhibit H-21) demonstrate that the typical erosion control measures used on skid trails would reduce erosion rates on a 30 percent gradient linear trail by 80 percent when slash provides 50 percent cover on the trail and water bars reduce slope length to 50 feet. These measures also reduce the probability of soil erosion by three percent.

WEPP model results estimate the potential soil erosion rate from commercial treatment units at a maximum 0.15 tons/acre (Table 3-38). By way of comparison, the average annual erosion on Montana cropland during the period 1982 through 2007 was 8.2 tons/acre/year (USDA Natural Resources Conservation Service 2010). A ton of soil spread across an acre would be as thick as a dime.

Table 3-38. Potential Erosion - Commercial Treatments.

Alternative	Potential Erosion Rate (tons/ac)	Potential Total Erosion (tons)
A	0	0
B	0.15	127.6
C	0.11	48.2

Temporary Road Construction- All newly constructed temporary roads would be reclaimed after use. Reclamation of new temporary roads would include re-contouring the entire road template to natural ground contour and to the extent feasible, placing the top soil back on the soil surface. These restoration activities would not ameliorate the soil damage immediately, but they would improve soil conditions compared to a temporary road. The establishment of vegetation and associated additions of organic matter would encourage recovery. Recontouring would provide a suitable seed bed for native forest vegetation while increasing soil hydraulic conductivity, organic matter, total carbon, and total nitrogen (Lloyd, et al. 2013). These conditions would likely accelerate the recovery of the soil productivity.

Erosion is expected from temporary road construction and re-construction where native surfaces are exposed to rainfall impact and overland flow. Some areas would likely have short-term increases of soil erosion above two tons/acre/year. Erosion rates would decrease as roads are obliterated immediately following use.

WEPP model results estimate the potential amount of soil erosion from temporary road construction and use (Table 3-39) at a maximum of 1.4 tons/acre/year over the three year sale contract period. These figures represent total erosion from all segments for the anticipated duration of use in all action alternatives (Exhibit H-21).

Table 3-39. Potential Erosion - Temporary Roads.

Alternative	Potential Erosion Rate (tons/acre/year)	Temporary Road Acres	Potential Total Erosion (tons)
A	0	0	0
B	1.3	2.1	8.4
C	1.3	1.5	5.6

Permanent Road Construction- Erosion is expected from permanent road construction where native surfaces are exposed to rainfall impact and overland flow. Approximately 80 percent of total accumulated road erosion occurs within the first year after construction (FAO 1998). Road erosion and sediment yield typically decline after construction (Jones, et al. 2000; Switalski, et al. 2004)

Aquatic Habitat and Water Quality Improvement Proposals- Road stabilization efforts would reduce the potential for road fill erosion. Culvert replacements and improvements would cause some short-term soil erosion the construction phase but would result in improved road drainage and a reduction of road failure risk during high flow events.

Mass Failures

High rates of slope stability were observed during field investigations of all proposed activity areas. These areas are well-suited for the proposed management activities.

The proposed tractor harvest treatments are planned for areas with slopes less than 40 percent, which greatly reduces the risk of mass wasting. The occurrence of any mass wasting activity as a result of implementation of any of the proposed actions is unlikely.

Cumulative Effects

Region 1 soil quality standards would be met when combining the existing and predicted impacts of activities to minimize soil impacts to less than 15 percent of the activity areas (Table 3-40). All units in the Alternative B would meet this standard and result in potential soil impacts affecting up to 85 acres proposed for treatment.

All units in Alternative C would meet Region 1 soil quality standards and result in potential soil impacts affecting up to 44 acres proposed for treatment.

Table 3-41 displays the total acres of predicted detrimental soil disturbance and land conversion expected from the proposed activities. The action alternatives are designed to reduce the amount of detrimental soil disturbance by implementing the design criteria described in *Chapter 2*.

Table 3-40. Cumulative Effects Summary.

Activity Area	Existing Condition DSD%	Potential DSD% Increase				Cumulative DSD%	
		Management Activities		Temporary Roads			
		Alt B	Alt C	Alt B	Alt C	Alt B	Alt C
1	0	10	-	0	-	10	-
6	0	5	-	4	-	9	-
7	0	10	8	3	3	13	11
9	3	6	6	0	0	9	9
10	6	6-8	-	0	-	12-14	-
11	10	3	2	0	0	13	12
13	0	10	-	0	-	10	-
14	0	10	-	0	-	10	-
16	0	10	-	0	-	10	-
17	0	10	-	0	-	10	-
18	0	10	-	0	-	10	-
21	0	2	-	0	-	2	-
22	0	5	-	0	-	5	-
23	0	10	10	0	0	10	10
24	0	10	8	0	0	10	8
25	0	5	2	0	0	5	2
27	0	2	2	0	0	2	2
28	0	10	6	0	0	10	6
30	0	5	5	3	3	8	8
31	0	10	10	3	3	13	13
33	0	5	5	0	0	5	5
37	0	10	10	0	0	10	10
38	0	10	10	0	0	10	10
39	0	10	10	0	0	10	10
43	3	6	6	0	0	9	9
49	6	6	6	0	0	12	12
55	3	6	6	0	0	9	9
59	11	2	2	0	0	13	13
60	3	2-3	2-3	5	5	11-12	11-12
100	X	0	0	0	0	X	X
101	X	0	0	0	0	X	X
103	X	0	0	0	0	X	X
104	X	0	0	0	0	X	X
105	X	0	0	0	0	X	X
108	X	0	0	0	0	X	X
114	X	0	0	0	0	X	X
124	X	0	0	0	0	X	X
129	X	0	0	0	0	X	X
134	X	0	0	0	0	X	X
135	X	0	0	0	0	X	X
136	X	0	0	0	0	X	X
137	X	0	0	0	0	X	X
138	X	0	0	0	0	X	X
139	X	0	0	0	0	X	X
140	X	0	0	0	0	X	X

Table 3-41. Detrimental Soil Disturbance by Alternative.

Description	Alternative B	Alternative C
Acres Commercial Treatment	867	459
Acres Detrimental Disturbance From Past Activities	18	14
Acres Cumulative Detrimental Disturbance	84-85	44
Acres Converted to Permanent Transportation System	8	1

Past, Present, and Reasonably Foreseeable Actions

Past activities that affect soils include timber harvest and its associated activities. In addition, road and trail construction have also occurred. These are the main activities that disturb soils in the Martin Creek area.

Timber Harvest - Past timber harvest has ranged from individual tree removals to complete clearcuts. These areas have regenerated into new forests.

Existing soil disturbance found in units with some evidence of past harvest activity ranged from three to eleven percent. The impacts to soils observed and recorded during numerous field visits (Exhibit H-16) are displayed under existing conditions in Table 3-36. Past impacts to soils are fairly low because much of the older logging disturbance was either minimal to begin with or had a recovery trend over the past approximately 80 years. Some of the steep terrain of the area that requires skyline logging has had little to no past impacts.

Road Construction - Approximately 64 miles of road have been built on federal land since the beginning of the last century. Road construction removes soil from the productive land base.

Trail Construction - Trail construction, like road construction, removes soil from the productive land base.

Precommercial Thinning - About 2200 acres of sapling-sized stands have been thinned since the 1960s. Past precommercial thinning did not use tracked or wheeled equipment and thus does not compact, displace, or otherwise cause detrimental soil disturbance.

Wildland Fire - Wildland fire creates a temporary increase in erosion. All past wildland fires in the Martin Creek area are currently vegetated and thus are assumed there were no lasting detrimental impacts to the soil resource. No remaining evidence of soil damage from previous wildland fires was noted within proposed treatment units although plentiful charcoal and fire scarred snags were found.

Wildland Fire Suppression - Since about 1940, the Forest Service and State of Montana have actively suppressed wildland fires. These agencies would continue to suppress wildland fires. As a result of this fire suppression, soils have been detrimentally disturbed by the construction of fire lines and other features constructed to control wildland fires. After a fire is extinguished, fire lines and other soil disturbances are rehabilitated. This activity does not totally restore soil quality, but it does begin the process leading towards improved soil quality.

Private Land Development - A limited amount of construction of driveways, buildings, and other improvements on private land within the project area has been occurring for decades

and will continue. The rate of development on private land has been stable. This activity is not considered as part of the soil analysis because it occurs off lands managed by the Forest Service and the effects of private land management do not affect the soils on lands managed by the Forest Service.

Noxious Weed Treatment - The Forest Service, Flathead County, and private citizens have conducted weed treatments for many years. This activity would continue. This treatment has a positive effect on soils by increasing the cover of desirable plants. These plants provide more ground cover than most weeds, thus reducing the risk of soil erosion and encouraging the development of soils that are rich in organic matter and better able to cycle nutrients.

Firewood Gathering - This dispersed activity has little effect on soils. A small amount of soil compaction may occur but, given the size of the analysis area, its effect is not measurable. Firewood cutting could reduce the amount of large woody debris available for future recruitment. This would most likely occur adjacent to roads where firewood cutting is allowed. Within those areas, the future soil productivity could be reduced. It is not possible to estimate the effect of firewood gathering on soils in the analysis area.

Snowmobiling - This activity would continue to occur. Snowmobiling is not as popular on the Tally Lake Ranger District as other parts of the Forest. Small areas of soil disturbance could result if snowmobiles operate where there is shallow snow cover. The effect is more likely to result in soil erosion if the slopes are 50 percent or greater. Effects on soil productivity would be limited to the areas disturbed and would occur only if erosion of the nutrient rich topsoil occurred. The result of snowmobiling across the analysis area would be difficult to measure.

Camping/Boating - Dispersed camping typically takes place on already established compacted areas, such as on closed roads. This effect is not included in the cumulative effects analysis. The limited amount of boating has no effect on the soil resource.

Driving, Motorcycle and ATV Riding - Driving and sightseeing on open Forest roads would continue. Many trails in the project area have been and would continue to be open to motorcycles. These activities have no measurable effect on soil productivity in the analysis area. They can increase soil erosion from the roads and trails where they occur.

Mountain Biking - This activity has occurred and would continue to occur on both trails and roadways. This activity has no measurable effect on soil productivity in the analysis area. It can increase soil erosion from the trails where it occurs.

Hiking - This activity has no measurable effect on soil productivity.

Road and Trail Maintenance - These activities have no effect on soil productivity in the analysis area. It would reduce the amount of erosion from the road or trail surface.

Revegetation and Reforestation - These activities would improve soil conditions by adding organic matter to the soil and by loosening compacted soils.

Installing BMPs - This activity would reduce erosion from the road system. This effects water quality and the drivability of the roads, but has little or no effect on soil productivity.

Contrasting Effects of Proposed Action with Past Actions

The estimated level of detrimental disturbance from this proposed project is less than that associated with harvest activities prior to 1990. During the past two decades, the level of concern for maintaining soil productivity has increased, which has been followed by implementation of management practices that protect the soil. These changes include:

- The use of excavators instead of dozers for mechanical site preparation;
- Use of designated skid trails;
- Operating when soils are dry or when winter conditions would protect soil productivity;
- Use of log forwarder systems; and
- Use of slash layers to reduce effects on skid trails.

In addition, timber sales are audited for compliance with BMPs and are monitored as specified in the NEPA decision, both of which contribute to making the end result better than it was in the past.

Duration of Effects

Displacement, the loss of topsoil, is a long-term and perhaps a permanent loss of soil productivity. However, management practices outlined in the design criteria in Chapter 2 of this EA would reduce the amount of displacement and all other detrimental impacts to within the Region 1 guidelines.

Compaction may last from 10 to 70 years (Gonsior 1983). Monitoring of 30 year old activities within this project area had around four percent detrimental soil disturbance, indicating significant recovery of compacted soils has occurred.

Reductions in organic matter content reverse quickly as vegetation grows. Organic debris accumulates on the surface and roots grow and are decomposed in the soil. These organic materials break down and release nutrients and improve the quality of the soil by improving structure and reducing compaction and other detrimental soil disturbances. Loss of organic matter is a short-term change lasting about 10 years once vegetation returns to the soil.

Light and moderate severity burned areas have minor effects well within the natural range of variability for wildland fire. Areas burned under conditions that produce light or moderate burn severity would vegetate quickly due to viable seeds or roots that could produce more plants and the complement of microorganisms and nutrients remaining on site (Ryan and Noste 1983).

Changes in soil microorganisms are not permanent. Recovery would occur as soon as organic matter is present in the soil, which could be immediately after the proposed management is carried out.

Soil erosion would be controlled through the use of erosion control measures. In addition, bare soils would naturally recover or be revegetated with native seed. Any erosion that occurs would be short-lived, most likely occurring during the time between the soil disturbance and the implementation of erosion control measures.

Effects of Ongoing and Reasonably Foreseeable Activities

Most ongoing and foreseeable activities would not overlap with either action alternative in both time and space. Specifically, their effects do not overlap in space as they occur outside of the proposed activity areas.

Combined Effects from Past, Proposed, Ongoing, and Foreseeable Activities

Several proposed units in the action alternatives would have cumulative effects from the combination of past and proposed activities. These effects are displayed in Table 3-40. All proposed activities associated with the action alternatives would meet the soil quality standards with the implementation of the design criteria for soils described in Chapter 2.

Design criteria are necessary to reduce predicted potential cumulative effects to within the soil quality standards in the following units: 10, 11, 59, and 60.

Post-implementation monitoring would be performed to determine if selected units were meeting Region 1 Soil Quality Standards. The Sale Administrator would monitor all units during management activities to assure that skid trails meet specified spacing requirements and that soil conditions in either winter or summer are adequate to minimize effects.

If monitoring results show detrimental soil disturbance in excess of 15 percent, specified restoration activities would occur to move the units back towards improved condition. Additional units that were treated in a similar fashion would be monitored at this time as well. Restoration efforts would be undertaken on these units if post-implementation monitoring indicates that detrimental soil disturbances for these units exceed 15 percent. Restoration activities to improve soil conditions would include lightly ripping heavily used skid trails and landings. The goal would be to reduce soil compaction and meet the direction provided in Region 1 Supplement 2500-99-1. Several studies discuss the effectiveness of ripping as a soil restoration activity. Studies cited by Froehlich and McNabb (1983) showed up to 39 percent improved seedling survival and growth after tilling compacted soils.

Dick, et al. (1988) found subsoiling (tilling) restored biological processes that were reduced by soil compaction. In general, tilling or scarifying a compacted soil improves productivity by reducing the resistance of soil to root penetration and providing improved soil drainage and aeration to enhance seedling establishment and tree growth (Bulmer 1998). These conditions also improve the environment for soil microorganisms. Soil restoration is not the immediate result of ripping, planting, or any other activity. The goal of soil restoration is to create favorable conditions for impaired soils to begin the recovery process.

Regulatory Framework and Consistency

The soil analysis indicates that all alternatives and all activities proposed by the alternatives would meet the Region 1 Soil Quality Standards through the implementation of management practices outlined in Chapter 2 and restoration of landings and heavily used skid trails, if needed, to reduce the total amount of detrimental soil impacts. All Forest Plan management direction would be met by the proposed alternatives.

Flathead National Forest Plan Management Direction - Forest wide standards for soil resources, page II-46, are as follows:

- Ensure that all resource management activities will maintain soil productivity and minimize erosion through implementation of:
  - Management direction presented in the Landtype Guidelines,
  - Erosion Prevention Standards (Engineering Handbook Supplement), and
- Design or modify all management practices as necessary to protect land productivity.

Regional guidance is available from the Region 1 Forest Service Manual for Soil Management FSM 2500-99-1 (USDA Forest Service 1999). Region 1 policy states "Design new activities that do not create detrimental soil conditions on more than 15 percent of an activity area. In areas where less than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 15 percent."

The National Forest Management Act requires that Forest Service regulations implementing NFMA specify guidelines to insure that timber will be harvested from National Forest System lands only where "soil, slope, or other watershed conditions will not be irreversibly damaged" 16 USC 1604(g)(3)(E)(i). Region 1 Regional Soil Quality Standards identified as Forest Service Manual (FSM) R-1 Supplement 2500-99-01 were set forth to meet the direction of NFMA to manage Forest Service lands without permanent impairment of land productivity and to maintain or improve soil quality.

Wildlife
Introduction

The wildlife section of this chapter is divided into sections for various habitats and groups of species. Old growth and snags and downed wood are unique habitats that fulfill key habitat components and general habitat requirements for many wildlife species. These habitats will be analyzed in two separate sections. Canada lynx and grizzly bears are threatened species occurring in the project area. Sensitive species identified for the Flathead National Forest occurring in or potentially occurring in the project area include the bald eagle, boreal toad, fisher, gray wolf, northern bog lemming, Townsend's big-eared bat, and wolverine, among others. Neotropical migratory birds are addressed in a separate section that includes an analysis of riparian habitats. Even though it is no longer a sensitive species for the Flathead National Forest, the northern goshawk is analyzed in the section on old growth habitat.

Wildlife species in this area have evolved in ecosystems influenced by wildland fire, insects, and disease. The proposed project contains several kinds of activities that can affect wildlife use: 1) timber harvest; 2) sapling thinning; 3) tree and shrub planting; 4) shrub slashing; 5) road and trail construction; and 6) road rehabilitation and culvert replacement. Life history information, including relevant habitat and population information, can be found for these species in the 2014 Flathead National Forest Evaluation and Compliance with National Forest Management Act Requirements to Provide for Diversity of Animal Communities (Exhibit Rg-1).

Tables 3-42 and 3-43 were used to determine which species to carry forward into the analysis. Species were selected for detailed analysis if they are Flathead National Forest Management Indicator Species (MIS) that are present in the project area or their known habitats are likely to be affected by the proposed actions. The spatial extent of effects analysis for this project varies between species, as detailed in the sections that follow.

Table 3-42. Presence and Status of Wildlife Management Indicator Species and Habitats In and Near the Martin Creek Resource Management Project, Flathead National Forest (Exhibit sections Q, Rb, Rd, Rg, Rn, Rr, Rs, and Rt).

Wildlife Species	Status	Presence in Stillwater Subbasin	Presence in Martin Creek Drainage
Bald Eagle	Sensitive; MIS	Yes	Yes
Bighorn Sheep	Sensitive; MIS	No	No
Black-backed Woodpecker	Sensitive; MIS	Yes	Yes
Boreal Owl	MIS	Yes	Yes
Boreal Toad	Sensitive; MIS	Yes	Yes
Canada Lynx	Threatened; MIS	Yes	Yes
Common Loon	Sensitive; MIS	Yes	No
Elk, Mule Deer, and White-tailed Deer	MIS	Yes	Yes
Fisher	Sensitive; MIS	Yes	Yes
Flammulated Owl	Sensitive; MIS	Probable	Unlikely

Wildlife Species	Status	Presence in Stillwater Subbasin	Presence in Martin Creek Drainage
Gray Wolf	Sensitive; MIS	Yes	Yes
Grizzly Bear	Threatened; MIS	Yes	Yes
Harlequin Duck	Sensitive; MIS	Yes	Possible
Northern Bog Lemming	Sensitive; MIS	Yes	Probable
Northern Goshawk	MIS	Yes	Yes
Northern Leopard Frog	Sensitive; MIS	Possible	Possible
Peregrine Falcon	Sensitive; MIS	Yes	Yes
Townsend's Big-eared Bat	Sensitive; MIS	Probable	Probable
Wolverine	Sensitive; MIS	Yes	Yes
Neotropical Migratory Birds		Yes	Yes
Old Growth Associated Species		Yes	Yes
Riparian Habitat Species		Yes	Yes
Snag and Down Wood Habitat Species		Yes	Yes

MIS = Management Indicator Species.

Table 3-43. Species-Specific Habitat Occurrence and Other Issues Related to the Martin Creek Resource Management Project Affected Area, Flathead National Forest (Exhibit sections Q, Rb, Rd, Rg, Rn, Rr, Rs, and Rt)**.**

Wildlife Species	Comments Related to the Project Area and Wildlife Analysis Area
Bald Eagle	No potential or known nesting habitat in the Martin Creek drainage. Active bald eagle nesting within the larger Martin/Radnor Wildlife Analysis Area. Fish, waterfowl, and carrion provide food in the area.
Bighorn Sheep	There are no herds that are resident on the Flathead National Forest (FNF), but bighorns that are believed to be resident in surrounding areas are sometimes seen on the FNF. Closest known bighorn population is the Ten Lakes Herd (resident on the Kootenai National Forest and north into Canada), occasionally observed from Mount Thompson Seton to Tuchuck Mountain on the FNF.
Black-backed Woodpecker	Observed in high numbers in the 2007 Brush Creek Fire Area 5 miles south of the Martin Creek drainage until about 2012. A large wildfire could make the bulk of the larger Martin/Radnor Wildlife Analysis Area ideal for this species.
Boreal Owl	Potential habitat in many mature and old growth forests in the Martin/Radnor Wildlife Analysis Area. Detected in and near the area by call-back and nest-box surveys.
Canada Lynx	Potential habitat throughout the Martin Creek drainage and the larger Martin Stillwater Lynx Analysis Unit. The western ¾ of the LAU is designated as Critical Habitat for lynx. Records of lynx occurrence in and near the area. Snowshoe hares are abundant.
Common Loon	Nests successfully on Upper Stillwater Lake, Middle Stillwater Lake, Finger Lake, and Dog Lake. No potential nesting or feeding habitat in the Martin Creek drainage. Closest downstream nesting is on Lower Stillwater Lake, two river miles southeast of the drainage.
Elk, Mule Deer, and White-tailed Deer	The Martin Creek drainage is used seasonally by elk, mule deer, and white-tailed deer and year-round by moose. No deer or elk winter range occurs in the drainage but it does occur 0.5 to 3 miles to the north in the larger Martin/Radnor Wildlife Analysis Area. Elk hunting-season security areas appear to be sufficient.

Wildlife Species	Comments Related to the Project Area and Wildlife Analysis Area
Fisher	Potential habitat is spread across the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area. Reported in and near the area and monitoring efforts are ongoing.
Flammulated Owl	Single-story ponderosa pine or drier Douglas-fir old forest with open understory is rare in the Martin Creek drainage but scattered across the larger Martin/Radnor Wildlife Analysis Area. Recorded in Douglas-fir stands 12 miles southwest of the analysis area on the Kootenai National Forest and possibly 13 miles southeast in the Logan Creek drainage.
Gray Wolf	Wolves from the Sunday Creek and Lazy Creek packs appear to occasionally make use of the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area, although denning has not been identified within the drainage.
Grizzly Bear	Scattered reports of grizzles in the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area, apparently foraging or traveling. High-quality feeding habitat is naturally not abundant. Denning habitat may occur in the higher elevations.
Harlequin Duck	Closest suspected reproduction is about 4 miles to the east. The Martin/Radnor Wildlife Analysis Area appears to support potential nesting habitat.
Northern Bog Lemming	Found in the Bowen Creek drainage 3.5 miles to the southwest of the Martin Creek drainage and also 3 miles to the north and northwest in scattered wetlands in the Sunday Creek drainage on Kootenai National Forest lands. Possible habitat scattered across the larger Martin/Radnor Wildlife Analysis Area.
Northern Goshawk	Goshawks and their nests are observed across the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area, which appears to provide several potential goshawk home ranges.
Northern Leopard Frog	Very rare in Western Montana. Not known on the Flathead National Forest although it is likely they occurred historically. Closest reports are near Eureka, MT, and west of Kalispell, MT. Possible habitat scattered across the larger Martin/Radnor Wildlife Analysis Area.
Peregrine Falcon	No known potential tall cliff nesting habitat in the Martin Creek drainage. Possibility for peregrines nesting in the larger Martin/Radnor Wildlife Analysis Area to feed in the martin Creek drainage. Closest known nesting 12 miles to the southeast.
Townsend's Big-eared Bat	Snags, bridges, and abandoned buildings in the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area may provide roosting habitat; wetlands and forests may provide feeding habitat. Found 3 miles NW and 4 miles west of the Analysis Area during bat surveys.
Western (Boreal) Toad	Scattered observations of adults in the Martin Creek drainage. Known and potential breeding in several ponds, wetlands, and ditches. Upland habitat for adults throughout the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area.
Wolverine	Not expected to be a resident in the Martin Creek drainage nor the larger Martin/Radnor Wildlife Analysis Area. Occasionally reported along the divide to the north and west of the Analysis Area, apparently traveling to higher quality habitat.
Neotropical Migratory Birds	Well-distributed and diverse habitat exists throughout the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area for a suite of Neotropical migratory birds.
Old Growth Associated Species	Old growth and other mature forests are well distributed across Forest Service land in both the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area.
Riparian Habitat Species	Well-distributed and diverse habitat for a suite of riparian wildlife species across the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area.
Snag and Downed Wood Habitat Species	Large snags and current and future down wood are well-distributed across Forest Service land in both the Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area, although somewhat sparse on some areas of non-Forest Service land.

The criteria used to determine which species to not carry forward for further analysis included lack of habitat in the analysis area and lack of effects to the habitat of a species from any of the alternatives (Table 3-44). Prior to the preparation of this document, a review was conducted of District and Forest wildlife records, the U.S. Fish and Wildlife Service (USFWS) list of Federally Threatened and Endangered species on the Flathead National Forest (Exhibit Rt-1), the Forest Service Region 1 Sensitive Species List (Exhibit Rs-1), and the Montana Fish, Wildlife, and Parks website (Exhibit Rg-4).

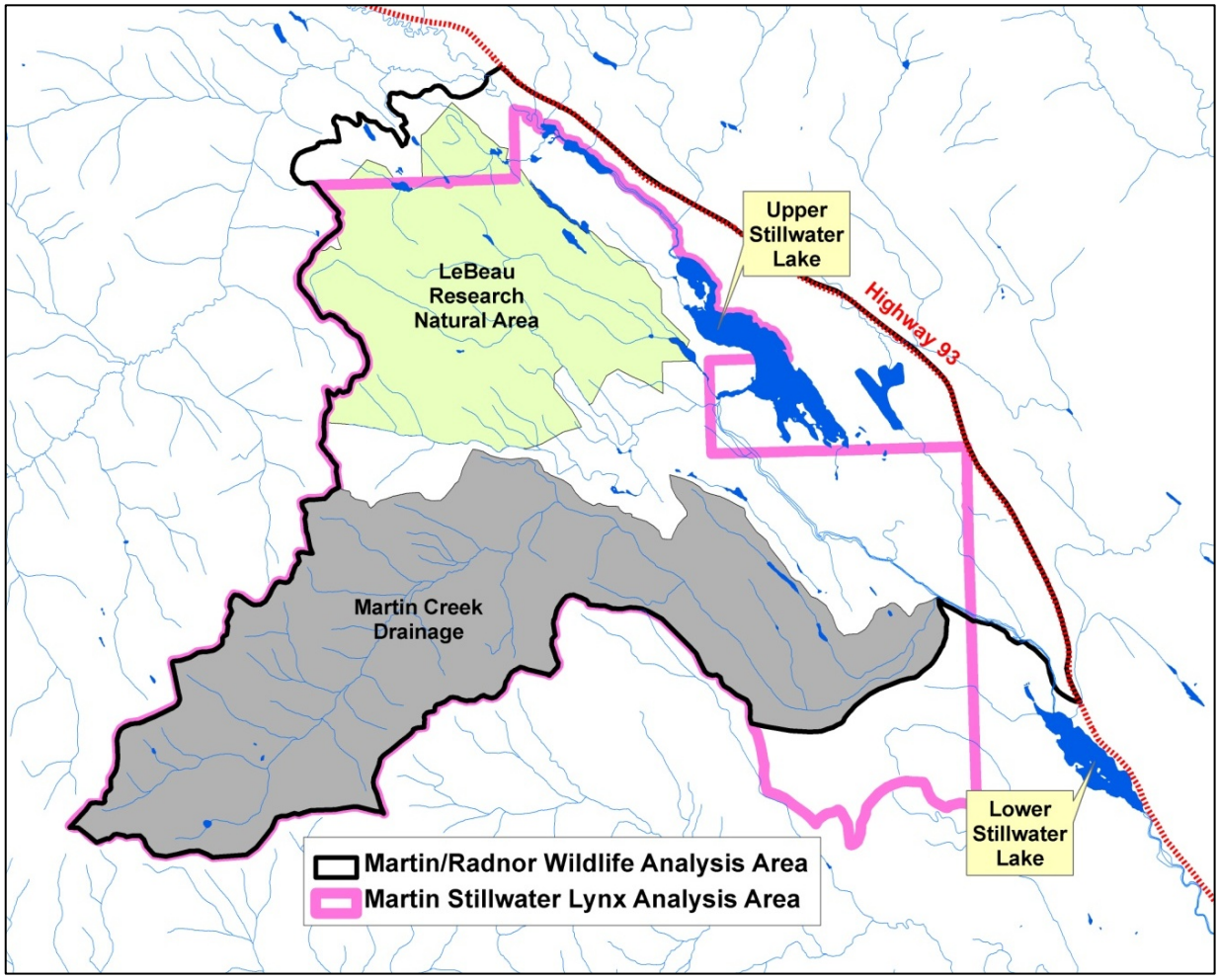
Table 3-44. Species and Rationale for Not Being Included in the Detailed Effects Analysis for the Martin Creek Resource Management Project. See Exhibit Rg-1 for additional information.

Species	Rationale
Bighorn Sheep	Closest known habitat use is over 25 miles north of the Martin Creek drainage. This project would have no impact upon this species because it is not located in the vicinity of any resident herds of bighorn sheep nor is it in a linkage area between populations. Therefore, all of the alternatives would have no impact on Bighorn sheep (Exhibit Rs-23).
Common Loon	No potential loon nesting or feeding habitat in the Martin Creek drainage and no potential for effects on the 250-acre Lower Stillwater Lake, two river miles southeast of the drainage. Therefore, all of the alternatives would have no impact on common loons (Exhibit Rs-21).

As described in the individual sections, the evaluation of direct, indirect, and cumulative effects on wildlife species and habitats used the best available science and records of wildlife use of habitats within and close to the analysis area. For all species and habitats except for Canada lynx, this area encompasses the Martin Creek drainage and neighboring lands that drain into the Stillwater River (Figure 3-7). A similar area, the Martin Stillwater Lynx Analysis Unit, was used for lynx. Applicable past, present, and reasonably foreseeable events described in the Introduction section of Chapter 3 were considered during the evaluation of the affected environment and for the analysis of effects. The condition of the affected environment, together with applicable reasonably foreseeable events as described in the above-mentioned section, were considered during the analysis of the environmental effects of the alternatives. The listed events that are not specifically analyzed or mentioned in the following discussion were considered to have no potential effect or negligible effects on wildlife or their habitats.

The Forest Plan's Amendment 21 Record of Decision (USDA Forest Service 1999a) stated that it was appropriate to focus limited resources on programmatic efforts to evaluate and monitor the effects of management actions on the habitat of those species for which population viability is a particular concern. The Flathead National Forest has monitored sensitive species and reported on their status in a document which is updated annually (2014 Flathead National Forest evaluation and compliance with NFMA requirements to provide for diversity of animal communities; Exhibit Rg-1). The Flathead Forest has also published a Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2010 (Exhibit Rg-8). This monitoring report also addresses forest birds and old-growth forests; live trees, snags, and coarse woody debris retention; and vegetation composition, structure, and landscape pattern. In some cases, monitoring has been conducted by the Forest Service and in other cases monitoring has been conducted by research scientists or personnel from other agencies and private organizations. The sources of monitoring data are identified in the sections that follow.

Figure 3-7. Wildlife Analysis Areas for the Martin Creek Resource Management Project.



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Old Growth Habitat

Introduction

Old growth forests are typically distinguished by: 1) large trees for the species and site; 2) accumulations of large snags and fallen trees; 3) decay or breakage of tree tops, boles, or roots; 4) multiple canopy layers; 5) wide variation in tree size and spacing; and 6) canopy gaps and understory patchiness (Helms 1998). This structure and extensive diversity provide habitat for many plant and animal species. Snags, downed logs, rotting wood, fungi, mosses, lichens, and green tree canopy are essential for innumerable species of wildlife and plants (Carey 1996). Interior habitat shelters wildlife and plants and provides protection from predators, competitors, and parasites. Closed-canopy forest reduces snow depths, insulates plants and animals from cold winds, and provides protection from predators. Open understories or patches of open canopy provide foraging opportunities for prey and predatory species alike. For this project, "Old-Growth Forest Types of the Western Montana Zone" were used as the criteria to identify stands that qualify as old growth habitat (Green, et al. 2011; Exhibits Q-1, Q-2, and Q-5).

Old growth stands provide key habitat for a wide variety of wildlife species. Amendment 21 to the Forest Plan listed 31 old growth associated wildlife species, including some sensitive wildlife species (Exhibit Rs-1) and Neotropical migratory birds (Exhibit Rn-2). See Exhibits Q-4 and Q-6 for a list of these species, their habitat associations, and their presence in the Martin/Radnor Wildlife Analysis Area. Amendment 21 also named threatened, endangered, and sensitive wildlife species as Management Indicator Species (MIS), several of which represent the spectrum of old growth habitats on the Flathead National Forest (Exhibit Rg-2). Many wildlife species require specific attributes of old growth for habitat needs such as nesting, denning, security, and foraging habitat. Some old growth associated wildlife species seem to need only a portion of their home range to be in old growth. Examples include the Canada lynx, northern goshawk, American marten, pileated woodpecker, and bald eagle. The southern red-backed vole, chestnut-backed chickadee, winter wren, brown creeper, Swainson's thrush, varied thrush, hermit thrush, northern flying squirrel, and other species have relatively small home range sizes (less than 100 acres), but it is unknown how much of their home ranges must be in old growth habitat.

Many types of disturbances, such as timber harvest, fuel reduction, road construction, blowdown, wildland fire, or insect or disease outbreaks, can affect old growth habitat and old growth associated species in both positive and negative ways. This is well illustrated by the pileated woodpecker, a "keystone" species, which provides second-hand nesting structures for numerous old growth species such as boreal owls, kestrels, and flying squirrels (McClelland and McClelland 1999, Aubry and Raley 2002). A disturbance can reduce living tree canopy cover to levels below that needed by the pileated woodpecker's main food source, carpenter ants, forcing the pileated to forage and possibly nest elsewhere. Carpenter ants, which live mostly in standing and downed dead wood, can drastically reduce populations of species such as spruce budworm (Torgersen 1996), the most widely distributed and destructive defoliator of coniferous forests in Western North America. In the Northern Rockies, disturbances that

create openings can destroy old growth habitat while allowing for regeneration of western larch, the tree species that provides some of the best cavity nesting habitat.

Timber harvest, wildland fire, or insect outbreaks in stands immediately adjacent to old growth often negatively affect old growth and associated species, but may have some positive effects. They can reduce the effective size of old growth stands by altering interior habitats (Russell and Jones 2001). Weather-related effects have been found to penetrate over 165 feet into a stand; the invasion of exotic plants and penetration by predators and nest parasites may extend 1500 feet or more (Lidicker and Koenig 1996). On the other hand, adjacent management can accelerate regeneration, reduce the risk of insect infestation, and increase the diversity of future buffering canopy. Roads can cause substantial edge effects on forested stands; sometimes more than the harvest areas they access (Reed, et al. 1996; Bate, et al. 2007). Roads that are open to the public expose many important wildlife habitat features in old growth and other forested stands to loss through firewood gathering, increased wildland fire risk, hunting, and trapping.

Timber harvest or wildland fire can remove forested cover that provides habitat linkages that appear essential for the functioning of metapopulations (Lidicker and Koenig 1996; Witmer, et al. 1998). Strips of riparian old growth, as well as forested ridges and saddles, are important travel corridors for many old growth associated species. Riparian corridors are particularly important for species such as fishers, harlequin ducks, and a variety of Neotropical migrant birds.

Some effects of these disturbance agents are seen most clearly at the stand level and may affect old growth species in positive or negative ways. For example, opening the understory for stand management or fuel reduction can have negative short-term effects on many old growth dependent species such as the pileated woodpecker, red-backed vole, or golden-crowned kinglet. Conversely, the resultant open-canopy forests tend to favor species such as the flammulated owl, northern goshawk, Hammond's flycatcher, and various nuthatches. Opening the tree canopy can also result in new regeneration of shade-intolerant tree species such as western larch, which the pileated woodpecker prefers for nesting. Reducing downed wood and snags can remove habitat features that are essential to many species, particularly marten, fisher, and pileated woodpeckers (Witmer, et al. 1998; Bull, et al. 2005), while high amounts of downed woody material can slow or prevent regeneration of trees. In addition, accumulations of smaller logs and branches can substantially increase the probability of intense wildland fire, which can remove all or most of the large living trees, snags, and other elements that define old growth.

The old growth stage of forest development is temporary, as are other forest stages. This increases the importance of maintaining and managing late-seral stands that are nearing old growth habitat conditions (Green, et al. 1992 [updated 2011]; Exhibits Q-1 and Q-2).

Information Sources

The definition of old growth habitat (Green, et al. 2011; Exhibit Q-1) includes considerations such as tree age, size, stand structure, and downed logs. Data used in this analysis included extensive old growth field surveys; aerial photography; stand exams (FSVeg database); field surveys of snags and downed logs; wildlife monitoring and observations (Exhibit Q-6); aerial photographs; the FACTS activity tracking database; the R1 Vegetation Map; and data sets for

features such as old growth habitat, general forest attributes, slope, aspect, habitat types, insects and disease, past timber harvest and wildland fires, and road locations. For more information, see project record Section Q and Exhibit Rg-9. Population diversity concerns at the Flathead National Forest and larger scales are assessed in Exhibit Rg-1. Exhibit Q-10 details compliance with attributes of the Flathead Forest Plan related to old growth habitats. See also the sections on *Forest Vegetation* and on *Snags and Downed Wood Habitat* in this chapter for more information about forest conditions, understory vegetation, noxious weeds, snags, and downed logs.

Analysis Area

The analysis area for old growth associated wildlife species is the Martin/Radnor Wildlife Analysis Area (Figure 3-8, below). At approximately 42.4 square miles (about 27,000 acres), it is large enough to include the home range of numerous wildlife species that use old growth habitats and to represent the effects of wildland fires, natural tree mortality, timber harvest, fuel reduction, and firewood cutting across the landscape. It is sufficiently large to evaluate the ability of the habitat to support populations of wildlife and plant species using old growth habitats, but small enough to not obscure the effects of the alternatives. All of the actions proposed in the alternatives that could directly or indirectly affect old growth associated species are contained within this area. No known or suspected population sinks for these species occur in or near the area. An assessment at multiple scales was also conducted to address population diversity concerns (Exhibit Rg-1). See also Exhibits Q-3, Q-11, Rd-9, Rg-3, Rs-6, Rs-16, Rs-18, and Rs-20 for Region-wide assessments of some key old growth associated species**.** The temporal scale of the effects analysis extends 100 years into the future, enough time for some mature stands to develop into old growth habitat and for snag and downed wood habitat to develop as well.

Affected Environment

Population Status

Numerous wildlife species make use of old growth habitat in the Martin/Radnor Wildlife Analysis Area. Exhibits Q-4 and Q-6 display occupation by old growth associated species and provides more information about these species' habitat components, population trends, and risk factors. Old Growth Management Indicator Species (OGMIS) habitat was designated throughout this area before the Forest Plan Amendment 21 decision of January 1999 (Exhibit Q-10). Monitoring results and other sightings suggest that these species are relatively common (Exhibit Q-6). The Avian Science Center (ASC) at the University of Montana conducted habitat and distribution surveys for individual species including flammulated owls, goshawks, and black-backed woodpeckers just near the Martin drainage from 1994 to 2008. For other information about the monitoring of these and other bird species, see the section in this chapter on *Neotropical Migratory Birds and Riparian Habitat*.

Specific to the northern goshawk, the species is considered globally secure. In Montana, the population is considered potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas and has a conservation status rank of S3 (Exhibit Q-11). Breeding goshawks and their habitat appear abundant and well-distributed across USFS Region One (Kowalski 2006; Samson 2006; updated in Bush

and Lundberg 2008), and each National Forest appears to have more than enough habitat to maintain a minimum viable population (Samson 2006). USFS Region One biologists conducted a field survey of goshawks during the spring and summer of 2005. The primary purpose of the survey was to use a statistically based approach to define the distribution of goshawks. The results of this survey indicated that the goshawk was relatively common and well-distributed across Region One (Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2010, Item #19, Exhibit Rg-8).

Habitat

Across the Interior Columbia River Basin (Quigley, et al. 1996) and the Pacific Northwest (Strittholt, et al. 2006) old forests have declined by 27 to 72 percent over the past 100 years and large residual trees and snags have decreased by 20 percent. Fire exclusion and timber harvest have altered the structure and composition of forests throughout the Basin, resulting in a 60 percent increase in susceptibility to insects, disease, and stand-replacing wildland fires. These changes have contributed to declining habitat conditions for numerous species of wildlife associated with old growth forests.

This same trend was found for all sub-basins across the Flathead National Forest, despite their relatively high level of ecological integrity (Quigley, et al. 1996; USDA Forest Service 1999a). A current estimate is that 11.6 percent of the Flathead National Forest provides old growth habitat (90 percent Confidence Interval of 9.6 to 13.8 percent; Exhibit Rg-8, as defined by Green, et al. (1992, updated 2011; Exhibit Q-1). Forest Inventory and Analysis (FIA) data were used for this estimate after removing all plots within fire perimeters since 2003. The Amendment 21 analysis (1998) looked at available data sources to assess historical old-growth conditions and historical variability. Historical old-growth conditions were estimated to vary widely over time at irregular intervals, in response to weather patterns, vegetation, and fuel conditions. Variability by forest type and position on the landscape (high versus low elevation) were also noted. It was estimated in Amendment 21 that old growth across the forest was from 15 to 60 percent of the land base historically. Since the adoption of Forest Plan Amendment 21 in 1999, there has been no harvest of old growth habitat so changes that have occurred in that timeframe are due to natural processes such as wildland fire, insect outbreaks, and growth of trees. For more information about old growth habitat conditions within the Flathead National Forest, see the Final Environmental Impact Statement for the Forest Plan, Amendment 21 (USDA Forest Service 1999a) and Exhibit Rg-1. Also see the reporting done for Forest Plan Monitoring Items 68 and 69 (Exhibit Rg-8).

The NFS lands in the Martin/Radnor Wildlife Analysis Area that appear to be old growth habitat are displayed in Table 3-45 and Figure 3-8. (Exhibit Q-5), as defined in Green, et al. (2011; Exhibit Q-1). This is presented as a range because not all of it has been field verified in recent years (Exhibit Q-2). However, the majority was field reviewed and determined to be old growth habitat for FNF LRMP Amendment 21 (1999). Since that time, there have been no stand-replacing fires or widespread insect epidemics or other disturbances in this area that are likely to have made these stands no longer able to function as old growth habitat. See the *Forest Vegetation* section of this chapter for more information about stands containing larger trees and other features typical of old growth habitat.

Figure 3-8. Old Growth Habitat and Areas Approaching Old Growth Habitat, Martin Creek Drainage and Martin/Radnor Wildlife Analysis Area.

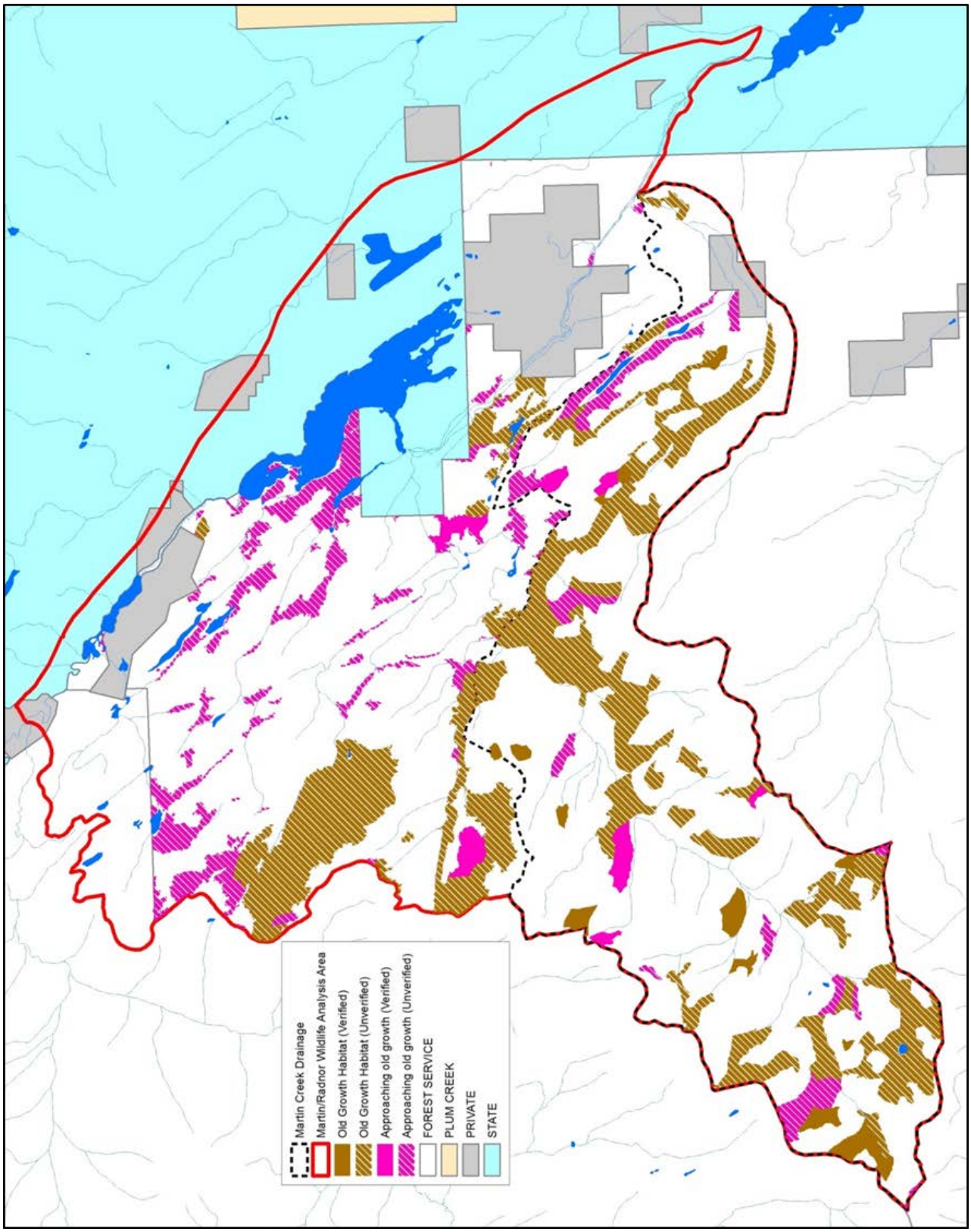

Table 3-45. Old Growth Habitat Across the Martin Creek Drainage and the Martin/Radnor Wildlife Analysis Area (Exhibit Q-5).

	Old Growth Habitat Acres	Percent of Land on All Ownerships	Percent of the USFS Land Capable of Producing Old Growth Habitat
Martin Creek Drainage	267 to 2415 ac	2.5 to 22.5%	2.5 to 23.0%
Martin/Radnor Wildlife Analysis Area	271 to 3718 ac	1.8 to 15.6%	1.4 to 18.8%

Between 127 and 568 acres in Martin Creek drainage and 239 to 1595 acres in the larger Martin/Radnor Analysis Area are Forest Service lands that appear at this time to be moving toward old growth habitat (Exhibit Q-5). These areas contain an older, larger overstory tree layer and numerous snags and downed logs. They are expected to develop a full complement of old growth characteristics (Exhibit Q-1) far sooner than most other stands. However, in many stands, dense understories and mid-story canopies (that are largely the result of wildland fire suppression) increase the risk of stand-replacing wildland fire in the remaining old growth habitat.

About 60 years of regeneration harvesting on all ownerships have altered the spatial distribution of old forested habitats as well as their internal integrity and forested connectivity. Currently, there are 35 separate patches of old growth habitat, averaging 106 acres in size (Exhibit Q-5). The largest intact patch, in the LeBeau Research Natural Area, is nearly 1100 acres. Primarily due to past logging activity, many of the existing old growth forest stands across the Martin/Radnor Wildlife Analysis Area are abutted by high contrast edge (Exhibit Q-12), totaling over 37 miles in length. This has created areas of blowdown and reduced the "interior integrity" of these stands, decreasing (though not negating) their value as old growth habitat.

Many forested connections between old growth patches have been narrowed or severed by past timber harvest (Exhibit Rg-7). All patches of old growth habitat are connected via pole-sized or older forested habitat, although some of the connections are narrow. The LeBeau Research Natural Area and areas near Upper Stillwater Lake support large areas of continuous forested cover. The Martin Creek drainage is considerably more fragmented than the rest of the Martin/Radnor Analysis Area, particularly the upper third of the drainage and an area south and southeast of Martin Falls. Scattered across these two areas are patches of early-seral/structural stage habitat that require travels of as much as 1.5 miles to cross in some directions (Exhibit Rg-7). Connectivity cover is most persistent along riparian zones. Landscape-wide data based on ecological sub-region data metrics for connectivity appear to illustrate local trends in the distances between patches of younger stands and between patches of older forests (Exhibit Q-9).

The network of roads in the Martin/Radnor Wildlife Analysis Area makes old growth dependent species vulnerable to road mortality, trapping, firewood cutting, and other disturbance. See the *Snag and Downed Woody Material Wildlife Habitat* in this chapter for additional information.

Additional information about the ability of components of old growth to provide habitat for wildlife species can be found in other sections of this chapter such as *Forest Vegetation*, *Snags and Downed Wood Habitat*; *Threatened Wildlife Species*, and *Sensitive Wildlife Species*.

Old Growth Habitat and Associates

The pileated woodpecker and barred owl are not MIS species on the FNF and the northern goshawk and boreal owl are no longer sensitive species. However, Amendment 21 of the Forest Plan states that former old growth MIS would continue to be assessed at the project level and the goshawk appears to be a species of particular interest. Table 3-46 provides habitat information for these five species. For more information, see Exhibits Q-3, Q-4, Rd-9, and Rg-3.

Table 3-46. Species that are Either No Longer Management Indicator Species or Sensitive Species but that are Assessed at the Project Level for Old Growth Habitat.

Species	Observed in Project Area	Old Growth Associate	Relevant Habitat Findings
Pileated Wood-pecker	X	X	Late successional coniferous or deciduous forest; younger forests that have large down logs and standing dead trees, especially western larch and ponderosa pine with heart trot. Maintain large areas with at least 50% of area having >60% crown closure.
Barred Owl	X	X	Large, unfragmented blocks of mature and old forests, especially near riparian areas and typically of mixed deciduous-coniferous composi-tion.
Boreal Owl	X	X	Late successional subalpine forest mosaic with snags and downed logs and with open canopy areas for foraging.
Marten	X	X	Late successional coniferous forests with high canopy cover in montane and subalpine areas.
Northern Goshawk	X	X	Mature conifer forests with relatively dense canopy, many large trees, and sparse undergrowth.

The Forest Service Region One's analysis for goshawks used a home range size of 5000 acres that includes nesting habitat, post-fledging habitat, and feeding habitat (USDA Forest Service 2007b). Applying this method plus new findings in Beier and Ingraldi (2012) and Reynolds et al. (2012), the Martin/Radnor Wildlife Analysis Area provides five potential goshawk home ranges (Exhibit Q-11). At the FNF scale there are 3828 acres, 34,449 acres, and 560,749 acres meeting modeling criteria for nest, post-fledging, and foraging habitat, respec-tively. Samson (2006) showed that the Forests and the Region as a whole had not reached a 20 to 30 percent low threshold of historic habitat remaining on the landscape, and that forest-ed ecosystems are more extensive now than in historic times (Exhibit Rg-1).

Well distributed across the analysis area, 4225 acres were formerly designated to meet the habitat needs of pileated woodpeckers and barred owls in approximately four home ranges; for marten, 1676 acres were designated in one home range, although most of this overlapped with pileated woodpecker/barred owl habitat (Exhibit Q-3). For more information about habitats specific to these three species, see Exhibits Q-3, Rd-9, and Rg-3. The boreal owl is a cavity nester that uses a range of mature forest types above 4200 feet elevation, including subalpine fir, spruce, lodgepole, mixed conifer, and Douglas-fir (Hayward and Verner 1994, Hayward 1997). About 45 percent of the project area is above this elevation and can support these habitats. Thus, habitat for the boreal owl is characterized by that of old growth and other late-seral forests and that for snag and downed wood habitat. This small owl has a system of long distance dispersal that results in high genetic connectivity and minimal genetic

structuring of its populations, regardless of the habitat matrix with which they are associated (Koopman, et al. 2007).

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No actions, such as timber harvest, fuel reduction, or road construction, are proposed with this alternative. This would leave existing old growth habitat plus other developing stands across the analysis area to continue with relatively natural processes. Barring future disturbance, old growth associated species and communities would eventually return to much of the area, and succession would progress until a late seral or "old growth" structure again develops in approximately 100 years or more. However, Alternative A would not reduce the risk of old growth stands to loss from insect, disease, or stand-replacement wildland fire. No change in the current condition of goshawk habitat would occur. In the long-term, late seral stands used by goshawks for nesting would be more likely to burn in high intensity wildland fires, as insects and disease continue to kill trees and "ladder fuels" continue to grow into the tree canopy. No road openings or additional yearlong road closures are planned with implementation of this or any alternative, leaving snag and downed wood habitat vulnerable to firewood cutting along open roads as shown below in the Chapter 3 section on Snags and Downed Wood Habitat. About half of these road miles access old growth habitat or other mature forests that appear to be moving toward old growth habitat.

Direct and Indirect Effects Common to all Action Alternatives (B and C)

Some effects would be common to all action alternatives. Precommercial thinning on 297 to 564 acres would have little short-term effect on old-growth associated wildlife. In many stands, this would increase tree species diversity and thus make future old growth stands and connecting forests more diverse and resilient. In addition, shrubs would be planted if funding is available, shrub slashing may occur in other areas, and seeding would occur if needed on disturbed sites. These actions would enhance feeding, nesting, and hiding cover for a wide variety of wildlife species that also use old growth habitats. Timber harvest and fuel reduction would reduce the risk of loss of current and future old growth stands from future wildland fire or insect outbreak. Activities may have direct effects on individual animals. Noise from the various proposed activities may impact juvenile dispersal, cause premature displacement of young, or cause young to be prematurely abandoned. This would be expected to be limited. The short segment of proposed trail construction would pass through an area of mature forests that appears to be moving toward old growth habitat, which may require the felling of a small number of smaller trees. Other changes in public motorized access would be beneficial to many species that use old growth habitat, as discussed in the section on *Snags and Downed Wood Habitat* in this chapter.

Except as described below for snag and downed wood habitats, other aspects of the project, such as road rehabilitation, culvert replacement, and roadwork along Martin Creek would not have measurable effects on old growth habitat or old growth associated wildlife species.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Timber Harvest in Old Growth Habitat and Other Mature Late-seral Stands

In both action alternatives, no timber harvest would occur in existing old growth habitat or in areas suspected to be existing old growth habitat (Exhibit Q-7). In Alternative B, shelterwood harvest would occur in 103 acres of mature late-seral forests that appear to be moving toward old growth conditions (Units 6, 7, 22, and 23) (Table 3.47). In Alternative C, this would occur in 12 acres (Unit 23). Harvesting these stands would delay future old growth recruitment.

Table 3-47. Acres of Timber Harvest in Old Growth, Possible Old Growth, and Recruitment Old Growth, by Alternative (Exhibit Q-7).

Alternative	Old Growth Habitat	Possible Old Growth Habitat	Mature Forests that Appear to be Moving Toward Old Growth	Total Acres
A	0	0	0	0
B	0	0	103	103
C	0	0	12	12

New High-Contrast Edge

New high-contrast edge would be created when stands adjacent to old growth habitat are converted from a late or mid-seral/structural stage to an early seral/structural stage (Chen, et al. 1992; Harper, et al. 2005; Exhibit Q-12). Removing intact mature forest directly adjacent to 2.2 miles of old growth habitat in Alternative B would cause the loss or reduction of a variety of habitat features in approximately 79 acres (Table 3-48). In seven units (1, 6, 10, 14, 21, and 23), areas of old growth along these edges would be expected to blow down due to soil and topography factors and currently intact buffering provided by trees in the proposed units. Four other proposed units would also be adjacent to old growth habitat, but high levels of recent mortality in the larger trees are already allowing edge effects to occur (Exhibit Q-12).

Table 3-48. New Abrupt Edge on Old Growth Habitat (Exhibit Q-12).

Alt.	Change			Units Creating New Abrupt Edge on Old Growth Habitat	Units Likely to Generate Blowdown
	Feet	Miles	Acres *		
B	+ 11,540	+ 2.2	79	1, 6, 10, 14, 21, 22, 24, 33, 37, 38	1, 6, 10, 14, 21, 22, 33 (7 units)
C	+ 3,310	+ 0.6	23	37, 38	(All such units dropped, reshaped, or changed to commercial thin)

* Assumes that these effects penetrate 300 feet into the old growth habitat.

During development of Alternative C, most of the units that would create high contrast edge on old growth habitat were dropped, their boundaries were pulled back from old growth stand boundaries, or they were changed to commercial thins. In Alternative C, no remaining units would likely cause much blowdown in adjacent old growth. In many cases, dropping or reshaping of units was done to also meet other wildlife concerns such as forested connectivity or wetland buffering (Exhibit Q-12).

Forested Connectivity

Although longer alternate routes would persist, regeneration harvest in 15 units in Alternative B would sever or substantially narrow forested connections as shown in Table 3-49 (Exhibit Rg-7). This is mostly because the upper part of the Martin Creek drainage was left fragmented by past timber harvest. Connectivity would be interrupted between riparian and upland habitats by additional units in Alternative B. Changing Silvicultural prescriptions or dropping whole or partial units during the development of Alternative C addressed most of the concerns about forested connectivity (Exhibit Rg-7).

Table 3-49. Proposed Units that would Sever or Considerably Narrow Important Forested Connections (Exhibit Rg-7).

	Alternative	
	B	**C**
Units affecting forested connectivity between old growth habitat areas	14, 16, 17, 21, 22, 30, 31, and 39	(None)
Units affecting forested ridgeline connectivity	14, 16, 17, 24, 28, 38, and 39	38
Units narrowing forested riparian connectivity to 300 feet or less	9, 11, 21, 22, 24, 25, 30, and 33	11 and 33

See Exhibit Rg-7 for maps and details. In all action alternatives, leaving larger-diameter snag and downed-wood “legacy material” as required by the Forest Plan's Amendment 21 would improve the ability for recovering stands to provide connectivity.

Road Construction and Use

In Alternative B, 0.6 miles of road construction would affect old growth and mature habitats that appear to be approaching old growth conditions (Table 3-50 and Exhibit Q-7). This would require the harvest of approximately 0.6 acres of old growth habitat and the felling of hazard trees along the road corridors. See Exhibit Q-7 for details and maps of these roads and old growth habitats.

Table 3-50. Proposed Road Construction in Old Growth and in Mature Forests Moving Toward Old Growth Conditions (Exhibits Q-5 and Q-7).

	Alt. A	**Alt. B**	**Alt. C**
Permanent road construction through old growth habitat	-	0.2 miles	-
Permanent road construction along edge of old growth habitat	-	0.1 miles	0.1 miles
Temporary road construction through mature forest approaching old growth conditions	-	0.2 miles	-
Temporary road construction along edge of mature forest approaching old growth conditions	-	0.1 miles	0.1 miles

In Alternative C, construction of 0.2 miles of road construction would affect old growth and mature habitats approaching old growth conditions (Table 3-50, above). This would require the harvest of approximately 0.1 acre of old growth and the felling of hazard trees along the road corridors (Exhibit Q-7).

All road locations in the action alternatives would be located to minimize impacts to old growth to the extent feasible (Exhibits Q-7 and Q-10). No public wheeled motorized access is planned on any of these roads, although they could facilitate non-motorized access for trapping and hunting. These roads would be gated after use by this project and the road prisms would be kept clear of most deadfall. Snags would have an increased chance of loss to illegal firewood cutting than if they had been bermed. On new permanent roads (3.1 miles in Alternative B and 0.3 miles in Alternative C), over-snow motorized travel may disturb or displace some species that use old growth habitat.

Yearlong road closures are planned with implementation of both action alternatives. Motorized access changes would help protect snag and downed wood habitat in old growth habitat and other mature forests that appear to be moving towards old growth along about 1.3 miles of open roads in Alternative B and along about 2.0 miles in Alternative C.

Effects on Northern Goshawks

No harvest is proposed in any alternative in any known current or historic goshawk nest stand or within a 40-acre buffer of these areas. Design Criteria (Chapter 2) would protect any nests discovered in the future.

USFS Region One objectives for goshawks (USDA Forest Service 2007b) would be met under all action alternatives, although timber harvest in Alternative B would likely make one potential home range temporarily unsuitable by removing a relatively large amount of nesting habitat in a home range that is already fragmented (Table 3-51 and Exhibit Q-11). Based upon the amount and distribution of past harvest, combined with proposed harvest, it is likely that all potential goshawk territories would remain functional in Alternative C, as would all other potential territories in Alternative B. The *Forest Vegetation* section of Chapter 3 discusses changes in forest components needed by goshawks in detail, as do other portions of the Wildlife sections of this chapter.

Table 3-51. Summary of Effects on Potential Home Ranges for Northern Goshawks (Exhibit Q-11).

	Alt. A	**Alt. B**	**Alt. C**
Maintains historic and existing nest areas	Yes	Yes	Yes
Percent of potential home ranges functioning as nesting habitat (and average)	35 to 70% (56%)	33 to 70% (55%)	35 to 70% (56%)
Regeneration harvest in potential nest habitat in potential home ranges	0 acres	310 acres	24 acres
Regeneration harvest units in potential nesting habitat	(None)	1, 6, 7, 10, 11, 16, 17, 21, 22	11
Number of functioning potential home ranges	5	4	5

Proposed treatments in many stands would create habitat conditions suitable for foraging by northern goshawks (see “Flammulated Owl” portion of the *Sensitive Wildlife Species* section of Chapter 3). Tree harvest in shelterwood and commercial thin harvest units would create more open stand conditions while retaining the largest trees. Habitat elements important for maintaining both goshawk and prey populations would be maintained under all alternatives. These include abundant snags, large live trees, large downed logs/woody debris, interspersion

of different tree sizes across the landscape, and the presence of older-aged forests in each potential goshawk territory (Exhibit Q-11).

Proposed road construction would occur in four of the five potential territories in both alternatives. This would remove suitable nesting habitat, although in some cases it may create forest edges and smaller openings that goshawks could use for foraging (Exhibit Q-11).

Cumulative Effects

Human-caused and natural changes in the past century have had an extensive effect on old growth habitat in and near the Martin/Radnor Wildlife Analysis Area. Past regeneration harvest across varying ownerships converted former old growth into stands of younger trees; highway, railroad, or power line corridors; livestock pasture; agricultural fields; gravel or rock pits; and a variety of smaller developed sites (Exhibit Q-8). Other intermediate timber harvests removed all or most of the larger trees that might have later become components of old growth habitat. Past wildland fires are reflected in a lack of old growth in some areas, particularly in the LeBeau Natural Research Area. Insects and diseases continue to impact a variety of conifer species across the analysis area, making some stands no longer able to meet old growth definitions (Exhibit Q-1). While timber harvest that is likely to be proposed in the Radnor Resource Management Project on NFS lands would not include harvest of old growth habitat, it could include management of forests that are moving toward old growth habitat. All of these factors have cumulatively led to the amount and patchiness of old growth habitat. Because the Martin Creek Project would not harvest old growth habitat, the amounts provided in Table 3-45 above would not vary by alternative.

In many places across the Martin/Radnor Wildlife Analysis Area, past timber harvest and wildland fires created a substantial amount of “edge effect,” where sun, wind, predators, and competitors, can penetrate further into what was previously interior forest. Table 3-52 displays the cumulative impact of the alternatives.

Table 3-52. Cumulative Abrupt Edge on Old Growth Habitat and Acres Old Growth Affected (Exhibit Q-12).

Alternative	Feet of Abrupt Edge	Miles of Abrupt Edge
A	360,577	68.3
B	372,117	70.5
C	363,887	68.9

On Forest Service lands, about 90 percent of this harvesting was done before Forest Plan Amendment 21 (USDA Forest Service 1999a) came into effect in January 1999. Some past timber harvest specifically targeted old growth stands and large, old trees. Large downed wood has often been reduced during harvest operations and the removal of large live trees reduces the accumulation of large downed wood for the foreseeable future. In many Forest Service stands, some of the larger trees were left, largely to provide seed sources or shelter for regenerating tree seedlings. After harvest, however, the tree densities and amounts of standing and downed dead wood were typically much less than would be left by natural processes and the large live trees were often later removed. Past precommercial thinning, understory

fuel reduction, prescribed fire, tree planting, shrub planting, and noxious weed control had little or no long-term effects on old-growth wildlife while increasing tree growth and diversity of plant species.

Roads in the area dissect and fragment old growth habitat. Roads form physical and habitat barriers, increase risk of predation, create vehicle-caused mortality, and increase access for trapping, and hunting. Across the Martin/Radnor Wildlife Analysis Area, open roads facilitate access for firewood cutters, which can lead to a decrease in the snags and downed woody material important for many wildlife and plants using old growth habitat, as described in the Snags and Downed Wood Habitat section of this chapter and in Exhibit Rd-1. The Proposed Action for the Radnor Resource Management Project would construct additional roads in about 0.3 miles of recruitment old growth. Table 3-53 displays the cumulative length of permanent roads through known or suspected old growth or recruitment old growth habitats, by alternative. The Martin Falls Trail passes through old growth habitat and trails to Finger and Lagoni Lakes pass through recruitment old growth. Construction and maintenance of these trails requires clearing of downfall.

Table 3-53. Miles of USFS Permanent Roads Passing Through Known or Suspected Old Growth or Recruitment Old Growth, by Alternative (Exhibits Q-5 and Q-7).

Alternative	Open Yearlong	Open Seasonally	Closed Yearlong	Total Miles
A	9.0	3.6	8.7	21.4
B	9.2	3.6	8.9	21.6
C	9.0	3.6	8.9	21.4

Wildland fires have been actively suppressed in the analysis area since about 1940. This has contributed to a change in the structure of some old growth habitat by increased understory growth and denser mid-canopy trees (Lesica 1996). While enhancing habitat value for species like pileated woodpeckers and American marten, this reduced foraging habitat for species preferring a more open understory such as flammulated owls and northern goshawks. These structural changes have resulted in an increased risk of a stand-replacement wildland fire in old growth areas, as described in the *Forest Vegetation* and *Fire and Fuels* sections of this Chapter.

Other cumulative effects on wildlife using old growth habitats are varied, but they do not differ by alternative. Probably due to trapping, lynx were extremely scarce in the first half of the last century in Montana, with specimen records restricted to two western counties. The lynx trapping season is currently closed in Montana. The Martin/Radnor Wildlife Analysis Area is part of MDFWP's Region 1, which now has an annual trapping quota of two fishers. Recreation activities include hunting, hiking, fishing, boating, river floating, camping, snowmobiling, dog sledding, cross-country skiing, horseback riding, motorized trail and road use, and bicycling. All of these can disturb or displace wildlife. Driving on roads can cause some collision-related injuries or mortalities to wildlife. Work on roads, decommissioning, and the removal and transport of gravel could similarly disturb wildlife. Human settlement occurs in and around the town of Olney and on many of the private land holdings, and subdivision continues to increase, which can cause a direct loss of old growth habitat or indirect effects on wildlife from dogs left at large. Fish stocking and removal of nonnative fish in several lakes

in the areas may have indirectly affected available prey for some old-growth associated wildlife, such as bald eagles. A variety of research and monitoring efforts, such as that on snowshoe hares, on western larch stand development, or on reed canary grass control methods, are likely to continue to occur with little or no effect on species that use old growth habitats.

For more information about many of the past, present, and reasonably foreseeable actions described above, see the *Introduction* to Chapter 3 of this document, the Cumulative Effects section for *Snags and Downed Wood Habitat*, below, and Exhibits Q-8 and Rd-12. Other past, present, and reasonably foreseeable actions and activities would have minor or negligible effects on old growth habitat and old growth associated species (Exhibits Q-8 and Rd-12). For more information, see the *Sensitive Wildlife Species*, *Threatened Wildlife Species*, *Forest Vegetation*, *Aquatic Resources*, *Fire and Fuels*, and *Soils* sections in this chapter.

Regulatory Framework and Consistency

The Forest Service is required by the National Forest Management Act (NFMA) 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 USC 1604(g)(3)(B). To implement NFMA, the Forest Service's regulations, implemented on April 21, 2008, state that "the overall goal of the ecological element of sustainability is to provide a framework to contribute to sustaining native ecological systems by providing ecological conditions to support diversity of native plant and animal species in the plan area." All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability. A ***goal*** under the Forest Plan, as directed in Amendment 21 (USDA Forest Service 1999a), is to "ensure that Forest Service actions do not contribute to the loss of viability of native species."

Forest Plan Amendment 21 named all sensitive wildlife species as Management Indicator Species, several of which represent the spectrum of old growth habitats on the Flathead National Forest (Exhibit Rg-2). These are the bald eagle, flammulated owl, boreal owl, black-backed woodpecker, fisher, and Canada lynx. Conditions favorable to these species would generally also benefit other old-growth associated species found within the Martin/Radnor Wildlife Analysis Area, such as brown creepers, Townsend's warblers, winter wrens, and northern flying squirrels, all of which are considered under the umbrella of MIS evaluation. The Flathead National Forest formerly used the pileated woodpecker, barred owl, and marten as Management Indicator Species (MIS) to represent species dependent on old growth stand characteristics. Amendment 21 replaced these by designating all sensitive wildlife species as MIS and by developing a list of old growth associated species (Exhibits Q-4 and Rg-2). The northern goshawk is no longer on the Region One sensitive species list, but is included in the effects analysis for this project.

Standards given in Amendment 21 include managing for wildlife dependent on old growth by protecting old growth forest consistent with the Vegetation Standard Section H6. Vegetation management within old growth shall be limited to actions necessary to: 1) "maintain or restore old growth composition and structure consistent with native succession and disturbance regimes" or to 2) "reduce risks to sustaining old growth composition and structure." Vegetation Standard Section H6 also states that "Road construction associated with vegetation

management actions shall avoid or minimize impacts to old growth to the extent feasible." Implementation of all alternatives would be consistent with the standards in the Forest Plan related to old growth management (Exhibit Q-10).

Amendment 21 has ***objectives*** to "manage landscapes to attain the 75 percent range around the median amount of old growth that occurred historically," "maintain ecological processes and provide for natural patch size distribution," and to "manage landscape patterns to develop larger old growth patch sizes where needed to satisfy wildlife habitat requirements (Exhibit Q-10)." Sufficient mid-seral/structural stage stands are to be maintained to allow for recruitment of old growth within the historical range of variability, emphasizing old growth development "in stands that are most likely to persist under native disturbance regimes, and that provide a patch size and pattern most advantageous to old growth associated wildlife species." Across the landscape, "sufficient retention of forest structure (large diameter live trees, snags, and coarse woody debris)" should be left to provide for future wildlife movement through the matrix surrounding old growth forests. Alternative B would not respond as well as Alternative C to some of these Forest Plan objectives (Exhibit Q-10). Alternative A would not reduce risk of loss of old growth stands from future wildland fire or insect outbreak. Alternative B would have regeneration harvest in mature late-seral forests that appear to be progressing towards old growth habitat, as well as creating new abrupt edge along old growth habitat that would be likely to cause blowdown (Exhibit Q-12). The Martin Creek drainage and the larger Martin/Radnor Wildlife Analysis Area are within the 75 percent range around the historic range of variability for old growth habitat and would remain so under any action alternative (Exhibit Q-9).

An analysis of vegetation composition, structure, and landscape pattern on the FNF (Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2012, monitoring item #68) reported on changes in vegetation since the Amendment 21 analysis in 1999 (Exhibit Rg-8). During this time, approximately 0.9 percent of the Flathead National Forest was changed from a mid- or late-seral condition to an early-seral condition due to regeneration harvest and 0.8 percent of the Forest had undergone fuels treatment. Late-seral habitat would continue to provide for future old growth recruitment.

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Snags and Downed Wood Habitat

Introduction

Snags, broken-topped live trees, downed logs, and other woody material are required by a wide variety of species (Exhibit Rd-4; Bull, et al. 1997). About one third of the bird and mammal species living in the forests of the Rocky Mountains use snags for nesting or denning, foraging, roosting, cover, communication, or perching. On the Flathead National Forest, at least 42 species of birds and 10 species of mammals are dependent on dead wood habitat for nesting, feeding, or shelter (Exhibit Rd-2). In addition, large snags and downed wood play central roles in diverse ecosystem processes and functions such as nutrient recycling, shelter for growing trees, and habitat for wildlife and fish (Rose, et al. 2001, Rochelle 2008). It is prohibitively difficult and costly to artificially restore snags or downed logs, and natural restoration of snag or downed wood habitat can take decades (Spring, et al. 2008).

The number, condition, size, species, and distribution of snags strongly affect snag-dependent wildlife (Drever, et al. 2008). Too few suitable snags may limit or eliminate populations of cavity-using species (Raphael and White 1984; Thomas, et al. 1979; Saab and Dudley 1998; ICBEMP 2000). Snags with old nesting cavities, broken tops, and decay are most likely to be used (Bull, et al. 1986). Large-diameter, taller snags are an especially important component of forested ecosystems. The larger the diameter of the snag, the less crowding of nestlings or young and the better they are protected from weather and predators. Although smaller creatures can use many sizes of dead trees, larger birds and mammals require larger snags (Saab, et al. 2004). The pileated woodpecker builds cavities that are then used for years by many other species (Bonar 2000), but it has very low or no nestling survival in any snag or tree smaller than 20 inch DBH (McClelland and McClelland 1999). Large larch snags remain standing longer and are much more likely to develop suitable decay conditions for cavity-using species (McClelland 1979; Bull, et al. 1997; Daenzer 2007). Smaller-diameter snags also get some use as nesting and feeding habitat by some species.

Downed trees are critical for many species (Bull, et. al 1997). In the Pacific Northwest, 47 vertebrate species respond positively to downed wood (Bunnell, et al. 2002). Downed logs and stumps are required for denning and resting, are vital for hunting below snow (Buskirk and Ruggiero 1994), and are used as travel cover, particularly when living plant cover is absent. Marten often den and forage in under-snow cavities that occur under downed logs. Canada lynx, fisher, and wolverine dens are associated with abundant woody debris, usually large-diameter logs (Bull, et al. 2001, Olson et al. 2014, and Sauder and Rachlow, 2014). Winter wrens do most of their feeding underneath suspended logs (Stewart, et al. 2004). Several amphibians and reptiles make use of large woody debris for shelter and breeding sites (Bull, et al. 1997). Longer and larger-diameter downed trees are generally more important because they can be used by a far greater range of species. In addition, they provide stable and persistent structures as well as better protection from weather extremes.

Reliance on dead wood habitat occurs at a variety of scales, from large landscapes, to small patches, to individual snags or downed logs. More mobile species that depend on dead wood habitat include black bears, Canada lynx, wolverines, marten, fisher, bats, woodpeckers, and

small owls. Less mobile species that depend on dead wood include snowshoe hares (the primary prey of Canada lynx), red-backed voles (the primary prey of marten, fisher, boreal owl, northern goshawk, and several other species), shrews, bryophytes, lichen, fungi, and protozoa (Bull and Blumton 1999; Raphael and Jones 1997; Brown, et al. 2003).

Cavity-using birds have been proven to substantially reduce tree mortality and damage caused by forest pest insects (Beebe 1974; Otvos 1979; Torgersen, et al. 1990; Torgersen 1996; Bull, et al. 1997). In addition, many ant species that need large-diameter downed logs are major predators of defoliating insects such as western spruce budworm (Torgersen and Bull 1995).

Successful management and conservation of snag-using wildlife depend upon maintaining a sufficient number and distribution of large-diameter snags and downed logs on a continuing basis. The scientific literature contains a variety of recommendations for densities and distributions of large snags and downed logs (Agee 1998; Saab and Dudley 1998; Bull and Holthausen 1993; Bull 1994; Marcot, et al. 1999; Bunnell, et al. 2002; Brown, et al. 2003). A variety of sizes and decay classes are needed in downed wood "in order to conserve functional processes that foster sustainable forest ecosystems" (Torgersen and Bull 1995). Homogenously managed stands are likely to not provide habitat for many species (Tobalske, et al. 1991; Hutto 1995b; Saab and Dudley 1998; Lyon, et al. 2000; Aubry and Raley 2002; Kotliar, et al. 2002; Saab, et al. 2002; Brown, et al. 2003). Likewise, any one stand would not provide habitat for all cavity-using species. Maintaining ecological diversity at all scales is the "key to retaining resilience" to future stresses or changes (Franklin, et al. 1989) and the key to maintaining viable populations of all wildlife species, as well as for a great variety of invertebrates, plants, fungi, and microbes.

Timber harvest, fuel reduction, insects, disease, fires, and firewood cutting can directly affect the availability and use of snag and downed wood habitat. Harvest activities often create large accumulations of downed woody material. However, this is generally of smaller diameter, and much of it is cleared from the forest floor for fuel hazard reduction and future tree regeneration. Removal of intact, wind-firm snags such as western larch and Douglas-fir has greater impacts on wildlife species than removal of non-windfirm snags such as lodgepole pine, subalpine fir, or spruce.

Information Sources

Data used in this analysis included wildlife monitoring and observations (Exhibit Rd-11); aerial photography; stand exams (FSVeg database); in-depth old growth field surveys; field surveys of snags and downed logs in and near the area; aerial photographs; the FACTS activity tracking database; the R1 Vegetation Map; and GIS data sets for features such as old growth habitat, riparian areas, ownership, general forest attributes, slope, aspect, habitat types, insects and disease, past timber harvest, and road locations. For more information, see the entire Exhibit Rd and Exhibit Rg-9. Vulnerability to loss by firewood cutting was assessed via a GIS analysis tool that modeled areas within 200 feet of roads. Population diversity concerns at the Flathead National Forest and larger scales are assessed in Exhibit Rg-1. This analysis covered the standing and downed dead wood resource in terrestrial areas. See the *Aquatic Resources* section of this chapter for consideration of large wood recruitment in aquatic systems. Also, see sections in this chapter on *Forest Vegetation* and

Old Growth Habitat and on Black-backed Woodpeckers (in the *Sensitive Wildlife Species* section); and Exhibits Rd-1, Rd-3, Rd-5, Rd-8, and Rd-11, and Project Record section Q.

Analysis Area

The Martin/Radnor Wildlife Analysis Area (Figure 3-7, above) was considered for the evaluation of direct and indirect effects on snags and downed woody material habitat. At approximately 42.4 square miles (about 27,000 acres), it is large enough to include the home range of numerous wildlife species using snag and downed woody material habitats and is representative of the effects of wildland fire, natural tree mortality, timber harvest, fuel reduction, and firewood cutting across the landscape. It is sufficiently large to evaluate the ability of the habitat to support populations of wildlife and plant species using dead wood habitats, but small enough to not obscure effects of the alternatives. All of the actions proposed in the alternatives that could directly or indirectly affect this resource are contained within the analysis area. No known or suspected population sinks for these species occur in or near the area. Larger-scale assessments were also conducted to address population viability concerns (Exhibits Rd-9 and Rg-1). For this project, the analysis of effects on snag and downed wood habitat spans as far as 100 years, enough time for some of the trees to grow and die or to acquire decay and other characteristics that make them useful to numerous wildlife species.

Affected Environment

Population Status

Numerous wildlife species are known to make use of snag and downed wood habitat in the Martin/Radnor Wildlife Analysis Area (Exhibits Rd-2 and Rd-11). Exhibit Q-4 also displays occupation by old growth associated species. For more information about wildlife using dead wood habitat across the Flathead National Forest, see the Final Environmental Impact Statement for the Forest Plan's Amendment 21 (USDA 1999a) and Exhibit Rg-1.

Habitat

Hillis, et al. (2003; Exhibit Rd-9) assessed the status of snag habitat and snag dependent species across Forest Service Region 1. They concluded that the distribution of mature and old forest (that provides snag nesting habitat for pileated woodpeckers and other cavity-dependent species) has not changed substantially since pre-fire suppression and pre-logging periods. Habitat estimates for the pileated woodpecker based on the Regional nest tree habitat model showed that nest habitat is abundant and well-distributed across the Forest and Region. Since 2003, numerous wildland fires across the Flathead Forest have created abundant, high quality snag habitat (Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2010, monitoring item #70; Exhibit Rg-8).

Recent research on the Flathead National Forest in 2008 (Wisdom and Bate 2008) used a stratified random sample of 49 stands and found that statistically significant factors affecting snag density included seral stage, timber harvest, proximity to open roads, distance to the nearest town, and whether the stand was uphill or downhill from the nearest road. Mean snag

density for all species was found to be 19 times higher in unharvested stands than in clearcut areas and three times higher than in stands that had undergone partial harvest.

Snag and downed wood habitat and its use by wildlife vary dramatically across the Martin/Radnor Wildlife Analysis Area, largely depending on disturbance history (Exhibits Q-9, Rd-3, and Rd-12). Wildland fire was the dominant disturbance in the watershed prior to timber management, and extensive areas of snag habitat often occurred in areas dominated by a stand-replacing fire regime. In mixed-severity fire regime areas, underburns occasionally killed large trees and stand-replacement fires were infrequent. Although their overall numbers appear to have decreased, large larch snags are well distributed across the area from fires early in this century. In recent decades, the mountain pine beetle was at epidemic levels in lodgepole pine, causing substantial mortality in some mature stands. Currently, insects and diseases are impacting a variety of conifer species on many acres. "Recruitment snags" (live trees) are abundant across the landscape, although in many stands desirable tree species for snags are sparse or do not occur. This would include dense pole-sized stands. Although stands dominated by Douglas-fir and western larch are most common across the analysis area, much of the analysis area is dominated by lodgepole pine, subalpine fir, and spruce, which get far less use as nesting snags. See the *Forest Vegetation* section of this chapter for more information.

Past logging and firewood cutting reduced the availability of snags and large downed logs for wildlife. About 51 percent of NFS lands have had timber harvest since the 1950s. Most timber harvesting activities left few snags and large pieces of downed wood, particularly when lodgepole pine stands were cut. Where past logging created abrupt edges, blowdown is common. The Martin/Radnor Wildlife Analysis Area is likely to have a snag situation very similar to the nearby Logan Creek analysis area, where 11,243 acres of regenerated stands (18 percent of the analysis area) have no snags visible on recent aerial photographs. Nevertheless, overall snag and downed wood habitat may be more available than in the past, as snags are visible in 73 percent of the unharvested areas in the Logan Creek drainage (Exhibit Rd-8). Firewood cutters can remove dead trees from about seven percent of NFS land, where close to 1400 acres of forest are within 200 feet of roads that are open either yearlong or in July and August of each year (Exhibit Rd-1).

For quantifying downed wood habitat in the Martin/Radnor Wildlife Analysis Area, we used data collected in the Good Creek drainage, adjacent to the south and ecologically similar, as well as counts of pre-fire downed wood pieces on plots in the Brush Creek Fire area, five to 10 miles to the south (Table 3-54 and Exhibit Rd-3). Both data sources show that the amounts of downed wood are highly variable across the landscape, ranging from less than one ton per acre to over 130 tons per acre. The distribution of sizes, species, and condition of downed wood also vary dramatically within and between stands, forest types, seral/structural stages, and fire regimes. "Late" seral-structural stage corresponds to the areas of high-quality downed log habitat and "mid" seral-structural stage corresponds to the areas of moderate-quality downed log habitat (Exhibit Rd-3). These levels are not indicative of historical conditions because they reflect many years of fire suppression, tree harvest, and firewood cutting across the landscape.

Table 3-54. Downed Wood Habitat Conditions Extrapolated to the Martin/Radnor Wildlife Analysis Area (Exhibit Rd-3).

Seral/Structural Stage	Average via Brown's Transects* in Good Creek Drainage	Average Via pre-fire Plots in Brush Creek Fire Area	Acres across all Ownerships, Martin/Radnor Wildlife Analysis Area (and %)
Mid (Pole-sized)	>8 tons/acre 11-30" diameter (19.7 tons/acre all sizes)	10.4 tons per acre 9"+ diameter	4,434 ac (13.5%)
Late (Mature)	>17 tons/acre 11-30" diameter (30.9 tons/acre all sizes)	14.9 tons per acre 9"+ diameter	16,518 ac (65.7%)

*Brown, et al. 2003.

For more information about dead wood habitat conditions across the Flathead National Forest, see the Final Environmental Impact Statement for the Forest Plan's Amendment 21 (USDA 1999a) and Exhibits Rd-9, Rg-1, and Rg-3.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No additional actions, such as timber harvest, fuel reduction, or road construction, are proposed with this alternative. Selection of this alternative would leave snag and downed wood habitat across the area to continue with relatively natural processes, along with fire suppression, occasional felling of hazard trees, and firewood gathering. Trees would continue to succumb to a variety of causes. However, enough western larch and Douglas-fir would likely continue to provide both the green tree component and future high-quality snags for cavities and feeding. Dense canopy, downed logs, or lack of seed sources would continue to delay the development of new trees in some stands, with little or no potential for regeneration of western larch, which is preferred by numerous wildlife species for cavity nesting. The probability of stand-replacing wildland fire would increase in such areas as dead trees fall and new understory growth contributes more fine fuels, as discussed in the *Forest Vegetation* and *Fire and Fuels* sections of this chapter. Such fire would increase the availability of snag habitat over the short term, along with the reduction of living tree canopy over large areas. Large stand-replacement fires would favor species associated with recent burns and the resulting large numbers of snags and woody debris.

No road openings or additional yearlong road closures are planned with implementation of this or any alternative. This would leave valuable snag and downed wood habitat vulnerable to firewood cutting along open roads as shown in Table 3-56, below.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

These alternatives propose timber harvest, fuel reduction, or other vegetation management in 367 to 472 acres of mid-seral/structural forest and 93 to 395 acres of late seral/structural forest, as shown in Table 3-55. The "late" seral-structural stage corresponds to the areas of high-quality downed log habitat and "mid" seral-structural stage corresponds to the areas of moderate-quality downed log habitat (please note that not all of the "late" seral-structural stage appears to be moving toward old growth conditions, as detailed in Exhibit Q-5). Regen-

eration harvest would remove forested cover needed by many species using snags and downed wood, although the larger material would persist into the next forests grown on these sites. Intermediate harvest would remain functional habitat for most of these species. In some units, piling and burning of sub-merchantable material would also remove deadwood structure.

Table 3-55. Acres of Timber Harvest, Fuel Reduction, and other Vegetation Management Relevant to Snags and Downed Wood Habitat across the Martin/Radnor Wildlife Analysis Area, in acre (Exhibit Rd-3).

Alt.	Mid-seral/structural Stage		Late-seral/structural Stage *	
	Regeneration	Intermediate	Regeneration	Intermediate
B	222	250	381	14
C	63	304	40	53

* "Late-seral/structural Stage" is not synonymous with "Mature Late-Seral Forests that Appear to be Moving toward Old Growth Conditions", as detailed in Exhibit Q-5.

The site-specific snag/live tree prescriptions for the Martin Creek Project (in Chapter 2 of this document and Exhibits Rd-5 and Rd-6) were based on the habitat needs of wildlife species that use snags and downed wood; field data on the expected availability of live and dead trees; silvicultural objectives; scientific literature; and experts in ecological processes, timber salvage systems, and safety. They are based on current conditions, the extent of past actions in the analysis area, and aspects of the proposed harvest and fuel reduction.

In both action alternatives, design criteria for retention of live, dead, and downed trees (*Chapter 2*) would help ensure that an adequate amount of green canopy, cavity habitat, and large woody material are available over time. The patchy nature of many treatment areas should also help maintain the diversity of dead-wood habitat for wildlife species (Machmer 2002). In some situations, large larch infested with mistletoe would be girdled instead of felled, which would contribute high-quality snag and downed wood habitat. In some stands, planted western larch and Douglas-fir would provide future higher-quality snags than the lodgepole pine, subalpine fir, and spruce that are expected to regenerate naturally. Efforts would be made to protect high-quality snags for wildlife, but skyline corridors and other safety concerns could necessitate some felling. A range of amounts of the largest available downed material is expected in most units, depending on the existing and potential vegetation of the sites and the proximity to private lands. Generally, the lesser amounts would be the result on dry sites, in stands where the bulk of the trees are smaller-diameter, or in the urban interface. Leaving some piles unburned, as specified in Exhibit Rd-6, would provide cover and nesting or denning sites for a variety of species. Additional snags and downed logs are expected as the retained trees die over time.

Insect and disease populations may decrease, and fewer new snags created by bark beetle infestations would be expected over the larger landscape in the next few years, as described in the *Forest Vegetation* section of this chapter. For more information, see Exhibit Rd-5.

Road construction would also have an effect on snag and downed wood habitat, requiring the felling and removal of snags and live trees from the road template and additional felling of hazard trees. On new permanent roads (3.1 miles in Alternative B and 0.3 miles in Alternative C), over-snow motorized travel may disturb or displace some species that use snag and downed wood habitat.

Yearlong closure of 2.1 to 2.5 miles of roads to public wheeled motorized use is being considered in these alternatives. The effects on snag and downed wood habitat vulnerable to firewood cutting along open roads is shown in Table 3-56, which also reflects changes in amounts of mid- and late-seral stage habitat due to timber harvest in the alternatives.

Table 3-56. Vulnerability to Loss of Snag and Downed Wood Habitat on USFS Land due to Firewood Cutting.

Alt.	Acres within 200' of open roads (all seral stages)	Mid-seral/structural Stage and Late-seral/structural Stage Stands		
		Acres within 200' of open road	% of USFS area within 200' of open road	% of this habitat across USFS lands
A	1,945	1,403	72.1%	8.9%
B	1,781	1,283	72.1%	8.5%
C	1,698	1,208	71.1%	7.7%

This project is expected to reduce the potential for stand-replacing fires across the landscape (see the *Forest Vegetation* and *Fire and Fuels* sections of this chapter). In some areas, the green canopy cover would be more likely to remain intact; in other areas, fire-resistant trees such as western larch and Douglas-fir would be more likely to survive fires.

Precommercial thinning, shrub slashing, tree and shrub planting, and seeding, would be beneficial to species that use snag and downed wood habitats by providing a diversity of future sites for nesting, feeding, and cover.

Activities between May and August may have direct effects on individual cavity-nesting birds. If a cavity-nesting bird were using the snag at the time of operations, the nest and/or birds could be destroyed. Noise from the various proposed activities may impact juvenile dispersal, or may cause premature displacement of young or cause young to be prematurely abandoned. This would be expected to be limited.

The short segment of proposed trail construction would pass through an area of mature forests that appears to be moving toward old growth habitat, which may require the felling of a small number of smaller trees.

Other aspects of the project, such as road rehabilitation, roadwork along Martin Creek, culvert replacements, and dust abatement would not have measurable effects on wildlife species that use snags and downed wood habitat.

Cumulative Effects

On all ownerships, most timber harvesting activities left few snags or large pieces of downed wood, particularly when lodgepole pine stands were harvested. After harvest, the tree densities and amounts of standing and downed dead wood were typically much less than would be left by natural processes, and the large live trees were often later removed. Regeneration harvests also dramatically reduced the potential of those sites to provide large snag or downed wood habitat in the event of fire or other disturbance. On NFS lands, most of this harvesting was done before Forest Plan's Amendment 21 (USDA 1999a) came into effect in January 1999, although the shelterwood and salvage units may have met the later Amendment 21 standards for snags and downed wood (See Exhibit Rd-10 for implementation monitoring elsewhere on the Flathead National Forest to meet these standards). Timber harvest that is

likely to be proposed in the Radnor Resource Management Project on NFS lands would follow these standards as well. Overall, mid- and late-seral forests in the Martin/Radnor Wildlife Analysis Area is likely to have a snag situation similar to the nearby Logan Creek analysis area, where 11,243 acres of regenerated stands (18 percent of the analysis area) have no snags visible on recent aerial photographs (Exhibit Rd-8).

Table 3-57 displays the cumulative result of past stand-replacement events. At least 75 percent of non-Forest Service lands have had regeneration harvest over the past 50 years. Where this converted forest into highway, railroad, or power line corridors; livestock pasture; agricultural fields; gravel or rock pits; and a variety of smaller developed sites, very few or no snags are expected to exist (Exhibit Rd-12). Also on private land, removal of live and dead vegetation for the purpose of reducing wildland fire intensity is expected to continue.

Table 3-57. Early, Mid, and Late Seral/structural Stages, by Alternative, for All Ownerships across the Martin/Radnor Wildlife Analysis Area (Exhibit Rd-3).

Seral/structural Stage	Alternative A	Alternative B	Alternative C
Early (Seedling and sapling areas generated by timber harvest or wildland fire, plus small natural openings)	19%	21%	20%
Mid (Pole-sized)	16%	15%	16%
Late* (Mature)	61%	59%	61%

* "Late-seral/structural Stage" is not synonymous with "Mature Late-Seral Forests that Appear to be Moving toward Old Growth Conditions", as detailed in Exhibit Q-5.

Wildland fires have been actively suppressed in the Martin/Radnor Wildlife Analysis Area since the 1940s. This has affected snag and downed wood habitats through denser tree stocking, slower tree growths, and more intense fires, as described in the *Forest Vegetation* and *Fire and Fuels* sections of this chapter.

Across the analysis area, firewood cutters have removed many of the large snags from within 200 feet of open roads, as well as some of the downed logs (Bate and Wisdom 2004). Research suggests that about half of the snags within 200 feet of roads are felled for firewood, especially when screening cover has been removed (Wisdom and Bate 2008). Large snags of western larch, ponderosa pine, and Douglas-fir snags are very rare along open roads in northwest Montana. Firewood cutters using cable and winch systems can legally and easily access standing or downed dead trees in about five percent of the analysis area, where forests are within 200 feet of roads that are either open yearlong or seasonally. Firewood cutting is prohibited within 300 feet of any stream, river, or lake across the Flathead National Forest (Exhibit Rd-7). This would leave valuable snag and downed wood habitat vulnerable to firewood cutting along open roads as shown in Table 3-58. All non-NFS lands are assumed to be vulnerable to this habitat loss.

Table 3-58. Vulnerability to Loss of Snag and Downed Wood Habitat on all Ownerships in Forested Stands due to Firewood Cutting (Exhibit Rd-1).

Alt.	Mid-seral/structural Stage and Late-seral/structural Stage Stands			
	Acres within 200' of open roads (USFS)	Acres of Non-USFS lands	Total Vulnerable Acres	% of this habitat across analysis area
A	1,403 ac	5,205 ac	6,608 ac	31.5%
B	1,283 ac		6,488 ac	31.9%
C	1,208 ac		6,413 ac	30.8%

Construction of roads, trails, campgrounds, and gravel pits required felling of many trees and snags. Regular maintenance of these routes and other areas requires hazard trees to be felled and fallen trees to be cleared. Nearly 90 miles of system road have been built on NFS land in the Martin/Radnor Wildlife Analysis Area, including about three miles that have been reclaimed during past efforts. The Martin Falls Trail passes through old growth habitat and trails to Finger and Lagoni Lakes pass through recruitment old growth. Construction and maintenance of these trails requires clearing of downfall.

Other cumulative effects on wildlife using snag and downed wood habitats are varied, but they do not differ by alternative. Past precommercial thinning, understory fuel reduction, prescribed fire, tree planting, shrub planting, and noxious weed control had little or no long-term effects on dead-wood associated wildlife while increasing tree growth and diversity of plant species. Recreation activities include hunting, hiking, fishing, boating, river floating, camping, snowmobiling, dog sledding, cross-country skiing, horseback riding, motorized trail and road use, and bicycling. All of these can disturb or displace wildlife that use dead-wood habitats. Driving on roads can cause some collision-related injuries or mortalities to wildlife. Work on roads, decommissioning, and the removal and transport of gravel could similarly disturb wildlife. Fish stocking and removal of nonnative fish in several lakes in the areas may have indirectly affected available prey for some dead-wood associated wildlife. A variety of research and monitoring efforts, such as that on snowshoe hares, on western larch stand development, or on reed canary grass control methods, are likely to continue to occur with little or no effect on species that use these habitats.

For more information about past, present, and reasonably foreseeable actions that could impact snag and downed wood habitat species, see the *Introduction* section at the beginning of Chapter 3, the Cumulative Effects section for *Old Growth Habitat*, and Exhibits Q-8 and Rd-12. Other past, present, and reasonably foreseeable actions and activities would have minor or negligible effects on snags and downed wood habitat (Exhibit Rd-12).

Regulatory Framework and Consistency

All alternatives are consistent with NFMA diversity requirements for wildlife, as described in the *Old Growth Habitat* section of this chapter. See Exhibit Rg-1 for more information.

Direction specific to snag and downed wood habitat is also provided by the Forest Plan's Amendment 21. Sufficient vegetation structure is to be retained, including large diameter trees, in timber harvest areas other than personal-use firewood permits. To comply with Amendment 21, the retention amount must be consistent with native disturbance and succession regimes and provide for long-term snag and coarse woody debris recruitment, essential

soil processes, species habitat (including feeding and dispersal habitat for small mammals and birds), and long-term structural diversity of forest stands. In the absence of a site-specific landscape analysis to derive retention levels for this standard, minimum retention levels apply beyond 200 feet from roads open to the public. These are as shown in Table 3-59, and include a requirement for five live replacement trees over 12 inches DBH for each snag over 20 inches DBH. If existing snag densities are below the following densities, live trees are to be retained as future snags where possible. Although the minimum diameters are not always present in a given stand, these would be retained to meet or exceed the intent of the Forest Plan under all alternatives wherever they exist (Exhibits Q-10 and Rd-5). Implementation monitoring for these standards is provided in Exhibits Rd-10 and Rg-8.

Table 3-59. Forest Plan Amendment 21 Snag and Downed Wood Standards.

Potential Vegetation Group	Snags per acre		Live Replacement trees >12" DBH	Pieces of downed wood >6 feet long/acre	
	12-20" DBH	20+" DBH		9-20" diameter	20+" diameter
Dry	2	1	5	15	10
Moist	6	2	10	32	15
Cold	6	1	5	30	15

All alternatives would comply with standards in the Flathead LRMP for general nongame wildlife and snag and downed wood habitat, as described in Chapter 2 under Features Common to Action Alternatives (Exhibits Rd-3 and Rd-5). In addition, relatively few large live trees would be harvested, as the Martin Creek Resource Management Project emphasizes retention of the largest trees and removal of the understory and/or mid-story trees. Unharvested live trees would be available to provide a fairly uniform distribution of future snags. Site-preparation prescriptions would be designed to maintain as much of the larger downed material as possible and practicable, given other resource objectives such as fire hazard reduction and reforestation. Trees retained after harvest would provide recruitment of future downed wood.

Additional standards given in Amendment 21 include managing for wildlife dependent on old growth. These standards are covered in the *Old Growth Habitat* section of this chapter.

All alternatives comply with the direction in the Forest Plan for MA 12, riparian management emphasis. These include the goals for snag management, water quality, and fish habitat.

Commonly Hunted Big Game

Introduction

The three most common ungulates (white-tailed deer, mule deer, and elk) are used as Management Indicator Species (MIS) for the commonly hunted big game species. At the forest level, meeting these species' habitat needs indicates that the needs of species such as black bear, moose, and mountain lion will also be met. Their basic habitat needs of cover, forage, and security are similar and may be altered by human actions in similar ways (Joslin and Youmans 1999; Witmer, et al. 1998). During the development of the Forest Plan, it was assumed that standards designed for elk would also be adequate for mule deer because they both tend to use similar habitats. White-tailed deer living in the Salish Range are more closely associated with riparian features (Dusek, et al. 2006).

Timber harvest and fire typically alter the amount and distribution of hiding cover, thermal cover, and forage as well as habitat security. In many situations, these disturbances create temporary foraging areas with associated increases in diversity and edge, which typically allow for proliferation of big game species. In northwest Montana, the extent that large animals will make use of a natural or man-made opening depends on an animal's experience, seasonal forage quality, proximity of security cover, presence of roads, pressure by predators, and intensity of human use. Openings can decrease ungulates' ability to travel within their home ranges, as well as making them more vulnerable to predation and hunting. When sufficient downed woody material, understory trees, and wind-firm live trees and snags are retained, timber harvest and fuel reduction actions can maintain adequate hiding cover values. See Exhibit Rb-3 for a discussion of the definition and measurement of cover.

Research findings and management guidelines for these species are generally consistent. Studies of white-tailed deer habitat use and populations for the Tally Lake Ranger District (Morgan 1993 and Dusek, et al. 2006; Exhibit Rb-5) indicated that minimal impact would result from timber harvest on northern aspects, ridge tops, sites greater than 2450 feet from riparian zones, and in elevations below approximately 3500 feet and above 4950 feet. Morgan also stressed the value of immature and pole-sized timbered stands. Research indicates that white-tailed deer in open forage areas prefer to have hiding cover within approximately 165 feet, and elk approximately 500 feet (Thomas and Toweill 1982). Spring, summer, and fall months are important periods when ungulates give birth to and nurse calves and fawns, grow antlers, build body condition, accumulate fat for enduring the winter months, and endure the stress of the big game hunting season. Mature Douglas-fir stands provide critical fawn-rearing habitats (Pac, et al. 1991) and should be associated with high-quality foraging areas and security.

Vehicle traffic on forest roads evokes an "avoidance response" by elk that can be used to estimate Elk Habitat Effectiveness through densities of roads open to public motorized use (Lyon 1983). Christiansen, et al. (1993) suggest that in Forest-level planning "all forms of motorized vehicles and all uses, including administrative use" should also be recognized.

During hunting season, elk appear to require contiguous, nonlinear hiding cover patches over 250 acres in size, and more than one-half mile from open roads (Hillis, et al. 1991) in order

for the elk population to provide continued hunter opportunity and a diverse bull age structure (Youmans 1991). It has been recommended that for a stable or increasing population, and for opportunities to maintain or harvest large bull elk, at least 30 percent of an elk herd unit should be in hunting season security areas (Hillis, et al. 1991).

Information Sources

A GIS analysis was conducted on the effects of vegetation management and the associated activities proposed by each alternative (Exhibits Rb-3 and Rb-7). Data used in this analysis included wildlife monitoring and observations (Exhibit Rb-2); aerial photography; stand exams (FSVeg database); the FACTS activity tracking database; the R1 Vegetation Map; and GIS coverages and data sets for features such as riparian areas, general forest attributes, habitat types, past timber harvest and fires, and road locations. For more information, see the entire Exhibit Rb section, Exhibit Rg-9, and the *Forest Vegetation* section of this chapter. Aerial photographs and other assumptions for cover status were verified via field visits. See Exhibit Rb-3 for a discussion of the definition and measurement of cover. The lack of winter habitat use in the Martin Creek drainage by ungulates other than moose is based on mapping conducted by the Montana Department of Fish, Wildlife and Parks (MDFWP) (Exhibit Rb-8). Hunting season security/vulnerability values were derived through GIS procedures that detected areas of continuous cover further than one-half mile from open roads and motorized trails (Exhibit Rb-1). Effects on connectivity cover are in Exhibit Rg-7. Exhibit Rb-5 includes MDFWP information about local white-tailed deer research.

Analysis Area

The analysis area for commonly hunted big game is the Martin/Radnor Wildlife Analysis Area (Figure 3-7, above). At approximately 42.4 square miles (about 27,000 acres), this area is large enough to include the home range of big game species and to represent the effects of timber harvest, fuel reduction, and motorized access across the landscape. It is sufficiently large to evaluate the ability of the habitat to support populations of big game and the species under their MIS “umbrella,” but small enough to not obscure the effects of the alternatives. Past actions and current conditions beyond this area (i.e. on the adjacent Kootenai National Forest) that could affect wildlife in the analysis area were considered, such as open roads and trails that could have affected elk hunting season security areas (Exhibit Rb-1). For this project, the analysis of effects on big-game habitat for cover and security/vulnerability span 100 years, at which time areas regenerated by this project are likely to regain thermal cover value (Exhibits Rb-1, Rb-3, and Rb-6). An additional assessment was also conducted to address population diversity concerns at the Forest scale (Exhibit Rg-1).

Affected Environment

Population Status

The project area provides spring, summer, and fall habitat for elk, mule deer, and white-tailed deer. Parts of the area are used year-round by moose, mountain lions, and black bears. Throughout the Martin/Radnor Wildlife Analysis Area, white-tailed deer use is extensive due to the intact riparian cover, stands of conifer trees, and the abundance of available forage in

past timber harvest units and in meadows. This is despite the fact that some recently regenerated areas are large in the key use zones for white-tailed deer (Exhibits Rb-3 and Rr-1). Elk and mule deer that use the analysis area are relatively common and their populations appear to be stable. Moose use of the area is also relatively extensive, and many riparian sites in the analysis area support vegetative types preferred by moose (Exhibit Rr-3). Mountain lion and black bear are also frequently reported. No part of the Martin Creek drainage or the larger Martin/Radnor Wildlife Analysis Area was designated as an ungulate winter range Management Area for the Forest Plan (USDA Forest Service 1986, Exhibit Rb-8). Montana Department of Fish, Wildlife and Parks (MDFWP) mapped none of the Martin Creek drainage as winter habitat for elk or deer, although across the larger Martin/Radnor Wildlife Analysis Area about 7000 acres around Upper Stillwater Lake were mapped as elk winter habitat and about 700 acres in the Fire Lakes area were mapped as white-tailed deer winter habitat (Exhibit Rb-8). According to MDFWP, the entire Martin/Radnor Wildlife Analysis Area provides summer habitat for elk and deer and year-round habitat for moose (Exhibit Rb-8). For population information for big game and other species under their MIS umbrella, see Exhibit Rb-2.

At a broader scale, the State of Montana manages big game species to provide a surplus of animals that can sustain harvest by hunters. MDFWP Region 1 (northwest Montana) made population estimates for 2010 totaling an estimated 117,880 elk, 281,160 mule deer and 249,001 white-tail deer in Montana (Exhibit Rg-1). The project area is in Deer and Elk Hunting District 102, Moose Hunting District 102, Mountain Lion Hunting District 102, and (Black) Bear Management Unit 102. MDFWP follows the philosophy that potential impacts of weather and of large predators such as mountain lions, black bears, grizzly bears, and wolves need to be taken into account in ungulate population management.

Habitat

Available hiding and thermal cover are well distributed across the Martin/Radnor Wildlife Analysis Area despite the larger blocks of recent timber harvest in the upper third of the Martin drainage and south and southeast of Martin Falls (Exhibit Rb-3). About 75 percent of the analysis area currently functions as hiding cover and/or thermal cover (Exhibit Rb-3). About 14,000 acres (eight percent) of this is considered hiding cover for deer without also providing thermal cover. The wildland fire history of the analysis area indicates that large patches of cover and forage were usually available (see the *Fire and Fuels* section in this chapter). Based on extrapolations from the fire history analysis of the adjacent Good Creek area, hiding and thermal cover together may have typically varied from 58 to nearly 100 percent.

In the Salish Range, the primary foods for white-tailed deer from spring through fall are forbs, grasses, and shrubs. In the Martin/Radnor Wildlife Analysis Area, most of the foraging habitat has hiding cover nearby, particularly in the north of the Martin Creek drainage (Exhibit Rb-3). Only 215 acres appear to support elk foods but are over 500 feet from hiding cover and are thus less likely to be used by elk. Over 1275 acres of forage are over 165 feet from cover and thus less likely to be used by white-tailed deer. This unavailable forage is about 37 percent of the forage potentially available for deer, and six percent of forage potentially available for elk (Exhibit Rb-3).

Large patches of early-seral/structural stage habitat that have not yet regained hiding cover value for big game occur in the upper third of the Martin drainage and in an area south and southeast of Martin Falls (Exhibits Rb-3 and Rg-7). Connectivity cover is most persistent along riparian zones. Past timber harvests have narrowed or severed forested connections, as discussed above in the *Old Growth Habitat* section of this chapter.

The road mileages and densities on lands administered by the Forest Service are shown in Table 3-60. According to Lyon 1983, this indicates a Habitat Effectiveness level for elk of 70 percent or higher, a level deemed appropriate for "areas where elk are one of the primary resource considerations habitat effectiveness" (Exhibit Rb-9 and Christiansen, et al. 1993). Road restrictions across the Martin/Radnor Wildlife Analysis Area are generally effective (Exhibit Rg-6). See the *Snags and Downed Wood Habitat* section of this chapter and Exhibit Rg-5 for road miles and densities on other ownerships.

Table 3-60. Open Road Densities Across Forest Service Lands (Exhibits Rb-9 and Rg-5).

	Open Roads in Summer (USFS Only)	**Open Roads Fall through Spring (USFS Only; Includes big game hunting season)**
Martin Creek drainage	2.1 miles/square mile (64 miles)	1.5 miles/square mile (25 miles)
Martin/Radnor Wildlife Analysis Area	1.3 miles/square mile (80 miles)	1.0 miles/square mile (33 miles)

The maintenance of security during the hunting season is of particular concern for elk management. Big game harvest data indicate a declining representation of branch-antlered bulls; an indication of excess vulnerability. The Martin/Radnor Wildlife Analysis Area contains all or parts of five elk hunting season security areas (Exhibit Rb-1) which are defined as at least 250 acres of contiguous nonlinear cover, all farther than one-half mile from a road or trail that is open to motorized use. The security areas are well distributed across the analysis area. One of the security areas is less effective because it contains roads open to motorized use in the summer, closing just before hunting season. Hillis, et al. (1991) recommended that at least 30 percent of an elk herd's area should provide hunting season security area for elk. The existing security areas currently make up nearly 34 percent of the analysis area.

Moist sites are also an important characteristic of elk habitat. About 150 acres of seeps and springs appear to meet the definition of "elk moist sites" as defined by the Forest Plan and Lyon, et al. (1985) (Exhibits Rr-3 and Rb-7). These areas are well distributed across the Martin/Radnor Wildlife Analysis Area except for the lower-elevation front-country areas near Upper and Lower Stillwater Lakes. Some of them are more remote, upper-drainage perched sites, which provide the best habitat. Over 90 percent of the Martin/Radnor Wildlife Analysis Area is within one-quarter mile of water (Exhibit Rr-1).

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No additional actions, such as timber harvest, fuel reduction, or road construction, are proposed with this alternative. Selection of this alternative would allow ungulate habitat across the Martin/Radnor Wildlife Analysis Area to continue with relatively natural processes. If no further timber harvest or wildland fire occurs over the next five years, over 75 percent of the area would continue to function as hiding cover and the availability of high-quality grazing and browse forage would decrease slightly. Motorized access would remain as is and the elk security areas would retain their current levels of effectiveness. The probability of intense wildland fire would continue to increase in some areas as dead trees fall and new understory growth contributes fine fuels. Such a fire could result in the loss of extensive areas of cover. See the Cumulative Effects section below for more information, including public access and elk security areas.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Table 3-61 displays the amounts of hiding and thermal cover that would be removed or altered by commercial harvest, fuel treatment, and precommercial thinning. Slash levels would not impede ungulate movement. An uncut buffer would be left around all riparian areas. Both action alternatives propose to retain most of the large wind-firm trees and snags in all units and some of the smaller trees, which would help provide cover over time. As big game animals are common in the area, some disturbance and displacement is likely to occur. Overall, there could be an effect on ungulate species' movements or habitat use patterns, but no appreciable change would be expected in ungulate population numbers or their availability to hunters, predators, or carrion eaters due to management actions.

Table 3-61. Vegetation Treatment that Would Temporarily Negate Cover Values for Large Mammals or Reduce the Effectiveness of Cover Values for Large Mammals (Exhibit Rb-3).

Alt.	Acres of Cover Removed		Acres of Hiding/Thermal Cover Altered
	Hiding Cover	Hiding/Thermal Cover	
A	0 ac	0 ac	0 ac
B	0 ac	591 ac	264 ac
C	0 ac	90 ac	356 ac

Most of the regeneration treatments would be expected to stimulate grasses and shrubs. Very few of the regeneration units would remove cover adjacent to recently harvested areas that have not yet regrown hiding cover in a way that would create new areas of forage less preferred or unavailable to deer and elk (Exhibit Rb-3). Regeneration harvest in both action alternatives would sever or substantially narrow forested connections, although longer alternate routes would persist. See the *Old Growth Habitat* section of this chapter above for more information and see maps and details in Exhibit Rg-7.

One timber harvest unit (9) would occur in and near a remote area that appears to be an "elk moist site" that is suspected to function as a wallow. Alternative B would also construct 1.0 miles of new permanent road (Roads H and I) within a quarter mile of this remote site, coming within 215

feet of the site. Alternative C does not include construction of Road I, although a shorter version of Road H would be 0.3 miles of new permanent road construction coming within 240 feet of this site. See Exhibit Rg-7 for more information.

All five elk security areas would continue to function, although regeneration harvest of 288 acres in Alternative B (Units 10, 11, 13, 14, 16, 17, 18, 22, 23, 24, and 25) would reduce the size of one security area by 415 acres (Exhibit Rb-2). In Alternative C, proposed motorized access changes would add approximately 500 acres to this area and timber harvest would remove about one acre.

Both action alternatives would cause short-term displacement of deer and elk during project activities as animals avoid areas of high human activity, including administrative use (Christiansen, et al. 1993; Lyon, et al. 1985). All public road closures would remain in effect during management operations and the transport of hunters or game would be prohibited by timber, road building, or other contract workers while working on or off all roads closed to motorized vehicle use by the general public. See the cumulative effects section below for more information about road use effects, including motorized administrative access, motorized public access and changes by alternative, and elk security areas.

Winter logging may displace moose using the area in the winter. Deer and elk winter range would not be directly affected since none occurs in the Martin Creek drainage. Timber hauling and other traffic associated with this project would not pass through the elk and deer winter range to the north in the larger Martin/Radnor Wildlife Analysis Area (Exhibit Rb-8). On new permanent roads (3.1 miles in Alternative B and 0.3 miles in Alternative C), over-snow motorized travel may disturb or displace wintering moose.

Both action alternatives are expected to cause temporary displacement to ungulates within activity areas. Shrub slashing, tree and shrub planting, and seeding of bare areas would enhance big game forage hiding cover values. Other aspects of the project, such as road rehabilitation, culvert replacement, and trail construction, would not have measurable effects on ungulates in the Martin/Radnor Wildlife Analysis Area.

Cumulative Effects

Past wildland fires and timber harvest on national forest, state, and private lands across the Martin/Radnor Wildlife Analysis Area have resulted in a complex matrix of forested interior habitat, edge, and openings in various stages of succession. Past timber harvest and fires converted a considerable amount of the hiding and thermal cover into seedling and sapling stands, particularly in the upper third of the Martin Creek drainage. Most of the stands regenerated by timber harvest have progressed to hiding cover, although many of these were precommercially thinned, reducing the quality of cover for approximately five or 10 years. Other timber clearing for highway, railroad, or power line corridors; livestock pasture; agricultural fields; gravel or rock pits; and a variety of smaller developed sites have also reduced hiding cover. The cumulative effects of these factors on the alternatives are shown in Table 3-62.

Table 3-62. Cover Remaining Across the Martin/Radnor Wildlife Analysis Area after Regeneration Harvest and Cover with Reduced Effectiveness (Exhibit Rb-3).

Alt.	% Cover Remaining Across Analysis Area			% Altered Across Analysis Area
	Hiding Cover	Hiding/Thermal Cover	Total Cover	
A	8.3%	75.4%	83.7%	0.0%
B	9.3%	72.2%	81.5%	1.3%
C	9.6%	73.7%	83.3%	1.7%

The two action alternatives would have positive and negative effects on the availability of forage. White-tailed deer are more adaptable to large landscape fragmentation and road construction and use than are elk, and it appears that they have not been impacted as directly from past human activities (Dusek, et al. 2006). Overall, past timber harvest has improved available food sources for white-tailed deer. Wildland fire suppression has also been largely beneficial to ungulates in this area, as it maintains dense cover in a network of foraging habitat existing in natural openings or created by timber harvest. Past precommercial thinning, understory fuel reduction, prescribed fire, tree planting, shrub planting, and noxious weed control had little or no long-term effects on big game while increasing tree growth and diversity of plant species available for cover and forage.

Numerous recreational opportunities across the Martin/Radnor Wildlife Analysis Area, including hiking, can cause displacement of big game species. Big game hunting takes a portion of the ungulate population every year (Exhibit Rb-2), as do road collisions and predation. Some snowmobiling and cross-country skiing occurs in areas used by moose in winter. Tree harvest has removed hiding and screening cover along open and closed roads. Human population and access are dramatically increased over historical conditions. Subdivision of private land has permanently altered habitats and displaced deer and elk from prime areas. Dogs that run free may kill many deer directly or cause deer to waste their energy reserves (Sime 1999). On NFS land, ease of human access has stabilized over the last decade or so, as new roads built for logging are generally reclaimed or closed soon after use.

Across all ownerships, 59.6 to 61.4 miles across the Martin/Radnor Wildlife Analysis Area would continue to be open in summer to public motorized use for an Open Road Density (ORD) of 1.4 miles per square mile (Table 3-63). According to Lyon (1983), this would mean an Elk Habitat Effectiveness value of 55 percent for all alternatives. An Elk Habitat Effectiveness level for elk of 50 percent or higher has been deemed appropriate for “areas where elk are one of the primary resource considerations habitat effectiveness” (Christiansen, et al. 1993). When administrative use for the Martin Creek Project is included, Habitat Effectiveness based loosely on Lyon’s open road model (1983) drops to 48 percent in both action alternatives. Close to 60 miles of road would remain open to public motorized use during hunting season, winter, and spring, with an ORD of 1.4 (Exhibit Rg-5).

Table 3-63. Road Densities by Alternative across All Lands in the Martin/Radnor Wildlife Analysis Area Based on GIS Lengths (Exhibit Rg-5).

Alternative	Open Road Density in Summer	Open Road Density Fall through Spring (includes big game hunting season)
B	1.45 miles/square mile (61.4 miles)	1.29 miles/square mile (54.6 miles)
C	1.40 miles/square mile (59.6 miles)	1.25 miles/square mile (53.1 miles)

Neither Alternative B nor C would cause much net change in the amount of elk hunting season security areas (Table 3-64 and Exhibit Rb-1). Both action alternatives would remove security area by regenerating forest in areas that are over one-half mile from motorized traffic. Proposed motorized access changes in Alternative C would add approximately 500 acres of security area, although the reasonably foreseeable Radnor Resource Management Project proposes to remove some cover within this potentially added area. Although it would be limited by the locations of open roads and natural permanent openings, the available elk hunting season security area is expected to increase over the next 15 to 30 years, as most of the harvested stands would have regrown hiding cover (Exhibit Rb-3).

Table 3-64. Elk Hunting Season Security Area Across the Martin/Radnor Wildlife Analysis Area by Alternative (Exhibit Rb-1).

Alt.	# of units that reduce security area	Acres timber harvest that reduces security area	Acres added by access management changes	% of analysis area in security area
A	0	0	0	33.6%
B	11	288	0	32.0%
C	1	1	508	35.4%

Other cumulative effects on commonly hunted big game are varied, but they do not differ by alternative. A reasonably foreseeable action would be measures to control tansy ragwort and other weed species, which would have positive effects on ungulates by improving forage availability. On private land, grazing and fencing has reduced forage and altered movement patterns. Predator control in the early part of the last century reduced or negated the selective pressures provided by predators. Beaver control reduced the amount of wetland habitat that white-tailed deer and elk often prefer. A variety of research and monitoring efforts, such as that on snowshoe hares, on western larch stand development, or on reed canary grass control methods, are likely to continue to occur with little or no effect on species that use these habitats.

These species' affected environment described above has been shaped by past and present cumulative effects. Past, ongoing, and planned timber harvest and further cumulative effects relevant to big game species are discussed in sections on *Neotropical Migratory Birds and Riparian Habitat*, *Old Growth Habitat*, and *Snags and Downed Wood Habitat* in this chapter, and in Exhibit Rb-6. These effects would be cumulative to those discussed above for each alternative.

Regulatory Framework and Consistency

All alternatives are consistent with NFMA biodiversity requirements for wildlife, as described in the *Old Growth Habitat* section of this chapter. The analysis for Forest Plan Amendment 21 assessed the forest-level viability of elk, white-tailed deer, and mule deer (USDA Forest Service 1999a). Regardless of scale, species viability is not a concern for elk or deer. These species are habitat generalists, and all indications are that healthy populations are well distributed across the western states, Montana, and the Flathead National Forest. In Montana and on the Flathead National Forest, this is evidenced by the hunting seasons administered by the MDFWP. In northwest Montana, the rapid recovery of the gray wolf is also evidence of substantial ungulate populations, which comprise their primary food source.

See Exhibit Rg-1, a multi-scale evaluation of NFMA requirements to provide a diversity of plant and animal communities on the Flathead National Forest, for more information.

Flathead National Forest Plan, Amendment 21, establishes a Forest-wide goal to "provide appropriate habitat and access to maintain desired hunting, fishing, and viewing opportunities, in coordination with the Montana Department of Fish, Wildlife, and Parks." The Forest Plan has identified white-tailed deer, elk, and mule deer as Commonly Hunted Big Game Management Indicator Species (MIS) that use general forest habitat. Conditions favorable to these species would generally also benefit other big game species, such as moose, black bear, and mountain lion, which are considered under the umbrella of Forest-level MIS evaluation.

The MDFWP includes habitat goal recommendations in their big game management plans, specifically the Montana Statewide Elk Management Plan (MDFWP 2004). The state elk plan calls for an increase in elk populations in the Salish Elk Management Unit, which includes the Martin/Radnor Wildlife Analysis Area, with an emphasis on maintaining a diverse bull age structure. As stated in the 2010 Statewide Elk Status Report (Exhibit Rb-2), elk populations in Hunting District 102 of the Salish Elk EMU are "at objective" levels. The Habitat Management Strategies for this area emphasize the need for consideration of elk security and hunter access in planning activities (MDFWP 2004; Exhibit Rb-4). All alternatives fully meet these objectives. The Forest Plan Amendment 21 objective to provide sufficient habitat to contribute toward meeting the objectives of MDFWP's management plans is met by both action alternatives.

Moist sites are also identified as an important characteristic of elk habitat and management considerations have been outlined in the Forest Plan (pages II-22 and 23). These apply to all management areas, in accordance with recommendations from the Coordinating Elk and Timber Management, Final Report of the Cooperative Elk-Logging Study, 1970-1985, January 1985 (Forest Plan Appendix DD). This direction is met by all alternatives (See Exhibit Rb-1 for more information):

- Management in moist sites would continue to be consistent with habitat type/moist site recommendations (Exhibit Rr-3).
- Motorized access would not be increased near any elk moist site.
- Open road densities near moist sites would be consistent with the Forest Plan.
- The alternatives would not change the relationship between these moist sites and elk security areas (Exhibit Rb-1.
- Slash would not impede elk movement in or near moist sites.

As shown in Table 3-85 in the *Threatened Wildlife* section below in this chapter, all alternatives would meet all Forest Plan direction for motorized road access, which does not apply to administrative road use in the Salish Range. In addition, design criteria for this project (Chapter 2) that keep new roads closed to public motorized use and prohibit transport of hunters, firearms, or game are consistent with other recommendations adopted by the Flathead Forest Plan.

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Neotropical Migratory Birds and Riparian Habitat

Introduction

Neotropical migratory birds regularly summer in North America and winter south of the Tropic of Cancer. Population declines in some of these species may be due to loss, modification, and fragmentation of breeding habitat; loss of wintering and migratory habitat; and brood parasitism (Montana Partners in Flight 2000). In 1988, an amendment to the Fish and Wildlife Conservation Act mandated the USFWS to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." Exhibit Rn-2 lists the 73 species of Neotropical migratory birds on the Flathead National Forest. Two of these are Management Indicator Species, the flammulated owl and the peregrine falcon. Six are old-growth associates, at least 13 are associated with snags or downed wood, and 43 are associated with riparian habitats.

In western Montana forests, two especially important habitats to nesting birds are: 1) "riparian habitat, because of the availability of water and the variety of plant communities, and 2) old growth habitat, which has the highest density and diversity of birds nesting in tree cavities. Snags, broken-topped live trees, downed logs, and other woody material required by a wide variety of these bird species for nesting, roosting, perching, feeding, and cover are often abundant in old growth habitat" (McClelland and Schmidt 1995).

Riparian habitats occur along lakes, rivers, streams, springs, and seeps where the vegetation and microclimate are influenced by year-round or seasonal water and associated high water tables. Most plant and animal species in riparian habitat are more productive and diverse than on nearby uplands, making these areas very important to many wildlife species. On the Flathead National Forest, 36 bird, four mammal, three reptile, and two amphibian species are recognized as dependent upon riparian marsh habitat; 23 bird, seven mammal, and four amphibian species are recognized as dependent upon forested riparian areas (Forest Plan, Planning record 219.12[g], 1980). These include threatened and sensitive species (bald eagle, harlequin duck, common loon, western toad, northern leopard frog), and some Neotropical migrants. Some, such as the harlequin duck and common loon, must have clear, clean water for their aquatic food sources.

Timber harvest, fuel reduction, insect epidemics, and wildland fire can impact wildlife using riparian habitats, including changes in plant species, hiding cover, downed wood recruitment, water temperature, shading, humidity, erosion, water quality, and predator-prey interactions. Bird populations that breed in the western United States appear to be affected by forest fragmentation in breeding habitat (Rotenberry, et al. 1995; Hejl, et al. 1995; Turcotte and Desrochers 2003). Problems associated with forest fragmentation include overall habitat loss, increase in high-contrast edge habitat and edge effects, isolation effects, and increased vulnerability to predators (Finch 1991; Turcotte and Desrochers 2003). Moreover, brown-headed cowbirds benefit from forest fragmentation, particularly where livestock graze within about five miles (Rotenberry, et al. 1995), and cowbirds may have a negative impact on many Neotropical migratory birds, at least in the eastern United States (Tewksbury, et al. 1998).

However, when sufficient downed woody material, residual understory trees, and wind-firm live trees and snags are available, adequate habitat values can be maintained after timber harvest (Vanderwel, et al. 2007).

Information Sources

The effects on Neotropical migrants are discussed by using analyses presented in the sections on *Old Growth*, *Snags and Downed Wood*, *Aquatic Resources*. Riparian habitats were assessed by way of the Riparian Landtype Polygon coverage in the Flathead GIS library (Exhibit Rr-3). The flammulated owl has a separate section under *Sensitive Wildlife Species*. The USFS Northern Region Songbird Monitoring Program (Hutto 1995a, Hutto and Young 1999, Hutto and Young 2002, Young and Hutto 2002; Exhibit Rn-4) has provided data on population trends, habitat relationships, and effects from past management activities for Neotropical migratory birds breeding in western Montana. These have been combined to determine population trends on a continental, regional, statewide, or physiographic region scale. Other observations and monitoring for riparian habitat wildlife species are in Exhibit Rr-4. Wildlife population viability concerns on the Flathead National Forest, and larger scales, are assessed in Exhibit Rg-1.

Analysis Area

The evaluation of direct, indirect, and cumulative effects on Neotropical migratory birds and on riparian habitats was done for the same spatial and temporal extent as that for old growth associated species and their habitats, the Martin/Radnor Wildlife Analysis Area (Figure 3-7, above). All habitat attributes are distributed across this area, with some natural clumping of features like drier forests and large wetlands. It is also representative of effects of fires, natural tree mortality, timber harvest, fuel reduction, firewood cutting, and other factors across the landscape. At approximately 42.4 square miles (about 27,000 acres), it is large enough to include the spring, summer, and fall range of numerous individuals of these migratory bird species as well as the home range of numerous wildlife species using riparian habitats. It is sufficiently large to evaluate the ability of the habitat to support populations of wildlife and plant species using riparian habitats, but small enough to not obscure effects of the alternatives. No known or suspected population sinks for these species occur in or near the area. For this project, the analysis of effects on Neotropical migrants and other species that use riparian habitat spans as far as 25 years, sufficient time for any effects to stabilize. An assessment at multiple scales was also conducted to address population diversity concerns (Exhibit Rg-1).

Affected Environment

Population Status

The Flathead National Forest participated in the Region 1 Landbird Monitoring Program that includes: 1) standard point-count survey routes; 2) Monitoring of Avian Productivity and Survivorship (MAPS); and 3) single species habitat use and distribution surveys. The Avian Science Center at the University of Montana conducted habitat and distribution surveys for several individual species. The USFS Northern Region Songbird Monitoring Program (Hutto and Young 2002) provided data on population trends, habitat relationships, and effects from past management activities for birds breeding in western Montana. According to the Avian

Science Center's "Regional Population Trends" webpage, "[t]here 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 between 1994-2006." See Exhibit Rn-1 for their results in and near the Martin/Radnor Wildlife Analysis Area.

The Institute for Bird Populations conducted MAPS surveys from 1992 to 2008. One hundred forty bird species were observed on the FNF during these surveys, representing a diversity of habitats. MAPS data showed that 10-year trends in productivity were generally stable, with 20 of 25 species showing no declines in productivity, two species showing increased productivity, and three species showing declines (Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2012, Exhibit Rg-8).

Table 3-65. Migratory Birds of Concern Known or Suspected to Occur in the Martin/Radnor Wildlife Analysis Area (Exhibits Rg-4, Rn-1, and Rn-2).

Species *	Status and Habitat Association **	Reported in Analysis Area	Relative Abundance in Flathead Basin and Neighboring Areas
Cassin's Vireo	B	No (1/2 mile SE)	Common; numerous observations just outside the analysis area
Cordilleran Flycatcher	b; Rip	No	Occasional (potential habitat present but species unlikely in Martin drainage)
Flammulated Owl (SOC, Sens, MIS)	B; Sens; OG, DW, Grass	No (10 miles W)	Occasional
Hammond's Flycatcher	B; OG	No (2 miles NW)	Common
Lazuli Bunting	B	No (2 miles NW)	Common (potential habitat present but species unlikely in Martin drainage)
Olive-sided Flycatcher	B; Rip, Grass	Yes	Uncommon
Red-eyed Vireo	b	No (4 miles SE)	Common
Red-naped Sapsucker	B; DW, Rip	Yes	Common
Rufous Hummingbird (PSOC)	B; Grass	No (2 miles NW)	Common
Tennessee Warbler (PSOC)	b; Rip, Grass	No (4 miles E)	Rare (potential habitat present but unlikely in Martin drainage)
Turkey Vulture	b; Grass	Yes	Uncommon
Vaux's Swift	B; OG, DW, Grass	No (4 miles SE)	Common
Veery (SOC)	b; Rip	No (4 miles SE)	Uncommon (potential habitat present but species unlikely in Martin drainage)
Williamson's Sapsucker	B; DW	No (2 miles NW)	Uncommon
Willow Flycatcher	B; Rip	No (2 miles NW)	Uncommon

* Species not in this table because there is no suitable habitat in the project area or because the species or its habitat would not be impacted by the project: Black Swift, Black-chinned Hummingbird, Bobolink, Brewer's Sparrow, Clay-colored Sparrow, Grasshopper Sparrow, Merlin, Peregrine Falcon, and Swainson's Hawk.
** Status and Habitat Association: B = Direct evidence of breeding; b = Indirect evidence of breeding; t = No evidence of breeding; Sens = Flathead National Forest Sensitive Species; OG = Old growth Associated Species; DW = Snag/Downed Wood Associated Species; Rip = Riparian Associated Species; Grass = Grassland Associated Species.

Ten of the 24 migratory bird species of concern that are known or suspected to breed on the Flathead National Forest have been reported in or close to the Martin/Radnor Wildlife Analysis Area (Exhibits Rn-1 and Rn-2; Table 3-65). The flammulated owl was recorded 10 miles west of the analysis area in habitats that also occur in the Martin Creek drainage; parts of the nearby

Logan Creek analysis area were surveyed for this species, but none were detected (Exhibit Rs-5). Potential habitat for four of the species occurs in the analysis area, but their presence is unlikely. The other nine species use habitats that either does not occur in the analysis area or that would not be affected by the project (Exhibits Rn-1 and Rn-2).

Of the 73 species of the migratory birds known or suspected to breed on the FNF, 49 have a Montana ranking of S5 ("Common, widespread, and abundant--although it may be rare in parts of its range…") or they did not warrant a ranking at all (MNHP 2014). Approximately 95 percent of the 73 species have a comparable global ranking of G5. Based on FNF management direction that applies to the habitats used by the 24 species that have some level of conservation concern, there appears to be little risk of population loss due to FNF actions. For more information, see Exhibits Rg-1, Rn-1, and Rn-2.

Habitat

Overall, the area provides a considerable diversity of forested habitats, including old growth, snag and downed wood habitats, and a variety of riparian areas. The existing conditions of habitats important for migratory birds are described in the sections of this chapter on *Old Growth Habitat* and *Snags and Downed Wood*. Additional information is provided for the flammulated owl in a separate part of the section on *Sensitive Wildlife Species*. Physical conditions of the streams, wet meadows, ponds, seeps, and springs are further described in the *Aquatic Resources* portion of this chapter. For more information about wildlife habitat conditions across the Flathead National Forest relevant to Neotropical migrants, see the Final Environmental Impact Statement for the Forest Plan's Amendment 21 (USDA 1999a) and Exhibit Rg-1.

Riparian wildlife habitats in the analysis area appear to be functioning well, with numerous and well-distributed ponds, seeps, and streams providing a diversity of habitats (Table 3-66), Exhibit Rr-3, Flathead National Forest 1995). Most of the birds listed as "riparian associated species" in Table 3-66 above use the dense shrubs and deciduous trees found in these habitats. The largest marshy area is along Martin Creek above Martin Falls, followed by areas along Upper Stillwater Lake and LeBeau Creek and its tributatires. About 1360 acres of the riparian areas are willow and sedge communities with fine silty soils. Another 730 acres are also relatively flat, but dominated by Engelmann spruce, subalpine fir, or black cottonwood. Most of the remaining areas are associated with creeks, seeps, springs, or wet depressions.

Over 90 percent of the Martin/Radnor Wildlife Analysis Area is within one-quarter mile of a stream, pond, or other riparian feature, which is a zone generally regarded as "key use" habitat for white-tailed deer (Exhibit Rr-1). As is typical across the Salish Range, connectivity cover is most persistent along riparian zones (Exhibits Rg-7 and Rr-3).

Wildlife species reported to be using riparian habitats in the analysis area include river otter, moose, white-tailed deer, elk, black bear, coyote, bobcat, mountain Lion, beaver, water shrew, dusky or montane shrew, red-tailed chipmunk, bushy-tailed woodrat, meadow vole, deer mouse, western jumping mouse, yellow-pine chipmunk, hoary bat, little brown myotis, long-eared myotis, silver-haired bat, bald eagle, common loon, boreal owl, caspian tern, common gartersnake, western terrestrial gartersnake, painted turtle, northern alligator lizard, long-toed salamander, western (boreal) toad, Pacific treefrog, and Columbia spotted frog (Exhibit Rr-4).

Table 3-66. Riparian Habitats across the Martin/Radnor Wildlife Analysis Area (Exhibit Rr-3).

Riparian Landtypes	Acres	% of Area
FL1C (Valley bottom, clay and silt substrate, in subalpine-fir/spruce forest community)	453	1.7%
FL1E (Rivers and lakes, clay and silt substrate, in willow/sedge community)	798	2.9%
NL1A (Nearly level, poorly drained fine substrate, wetland in subalpine-fir/spruce forest community)	91	0.3%
NL1E (Nearly level, poorly drained fine substrate, wetland in sedge/willow community)	562	2.1%
NL2A (Nearly level; gravel substrate; in subalpine-fir/spruce forest community along perennial stream)	187	0.7%
SL2A, SL3A, SL3B (Slightly sloping; gravel or boulder substrate; in subalpine-fir/spruce or grand fir/western redcedar forest communities typically along perennial streams)	66	0.3%
MS3A, MS4A, VS4A (Moderately or very steep; boulder or bedrock substrate; in subalpine-fir/spruce community along streams) *	34	0.1%
WL5A, WS5A (springs, seeps, wet depressions, and seasonal near-surface groundwater in subalpine-fir forest communities) *	156	0.6%
Total Across Analysis Area	**2348**	**8.7%**

* These types are often not included in the Forest-wide GIS coverage but are typically discovered during field surveys and harvest unit layout. These acreages represent minimum amounts.

Environmental Consequences

The direct and indirect effects of the proposed activities on riparian habitats and on habitats important for migratory birds are described in the sections of this chapter on *Old Growth*, *Snags and Downed Wood*, *Aquatic Resources*, and *Riparian and Wetland Wildlife Habitat*. Additional information is provided for the flammulated owl in a separate part of the section on *Sensitive Wildlife Species*.

Direct and Indirect Effects of Alternative A (No Action)

No additional actions, such as timber harvest, fuel reduction, road construction, road access changes, or road reclamation, are proposed with this alternative. Overall, this alternative would leave riparian habitats and other areas important for Neotropical migratory birds across the analysis area to continue with relatively natural processes. Trees and snags would provide potential habitat for many species, and subsequently for secondary cavity nesters, including some Neotropical migrants. The probability of wildland fire would increase. However, the proposed BMP improvements on roads and culvert replacements would not occur, and fine sediments would continue to enter the creeks and wetlands at present levels.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

In several instances in Alternatives B and C, mapped vegetation management units would lie adjacent to mapped riparian landtypes (Table 3-67, Exhibit Rr-3); although all wetlands and buffers around them would be excluded from regeneration harvest units during layout and equipment would be excluded from these buffers in other units. In Alternative B, forested riparian connectivity would be narrowed to 300 feet or less by some units (Table 3-67); Exhibit Rg-7) and other units would sever connectivity between riparian and upland habitats. Exhibits Rg-3 and Rr-3 includes unit-specific information.

Table 3-67. Timber Harvest and Precommercial Thinning in and near Mapped Riparian Habitats (Exhibits Rg-7 and Rr-3).

Alt.	Acres within 0.1 Mile of Riparian Habitat	Units with Potential Effects on Riparian Wildlife Habitats	Units that would Narrow Forested Riparian Connectivity to 300 feet or less
B	527 acres	1, 9, 11, 60, 101, 104	9, 11, 21, 22, 24, 25, 30, and 33
C	268 acres	9, 11, 60	11 and 33

Temporary and permanent road construction in Alternatives B and C would not be likely to directly or indirectly affect riparian wildlife habitats (Table 3-68). In and near riparian habitats, additional drainage structures would be required, as well as other measures to prevent damage to moist areas. For more information about temporary road construction effects, see the *Aquatic Resources* section of this chapter. On new permanent roads (3.1 miles in Alternative B and 0.3 miles in Alternative C), over-snow motorized travel may disturb or displace some species that use riparian habitats.

Table 3-68. Alternative B Road Construction and Mapped Riparian Habitats (Exhibit Rr-3).

Road	Type of Road Construction (and miles within 0.1 mile of riparian habitats)		Comment
	Alt B	Alt C	
A	Temporary road (0.06 miles)	Temporary road (0.06 miles)	Across an existing permanent road and about 450 feet from an NL1E area along a tributary to LeBeau Creek.
F	Temporary road (0.17 miles)	Temporary road (0.17 miles)	Gets as close as 250 feet from and about 120 feet elevation above a perennial tributary to Martin Creek.
H	Permanent road (0.20 miles)	Permanent road (0.10 miles)	Although a shorter road in Alternative C, in both alternatives it would be 240 feet from and about 40 feet above a 1-acre WL5A area.
I	Permanent road (1.11 miles)	--	Would be 210 feet from and about 60 feet above the same 1-acre WL5A as Road H. Also crosses one intermittent stream and gets within 350 feet of two others.

NL1E = Nearly level, poorly drained fine substrate, wetland in sedge/willow community.
WL5A = Seeps and springs with an undifferentiated streambed, in subalpine-fir/spruce forest community.

The trail proposal, common to both action alternatives, has potential for short-term negative and long-term positive effects on riparian habitat. Rehabilitating this steep, user-created trail would stop erosion and vegetation loss just above a large area of NL1E that surrounds Upper and Lower Martin Lakes. Construction of approximately 150 feet of system trail to replace the user-created trail may have minor short-term impacts and possible disturbance of wildlife using the NL1E and Upper Martin Lake.

Yearlong road closures are planned with implementation of both action alternatives. Motorized access changes would help protect snag and downed wood habitat in riparian habitats along about 0.7 miles of currently open roads in Alternative B and along about 0.1 miles in Alternative C.

BMP road improvements, dust abatement, culvert replacements, tree and shrub planting, and seeding would occur to similar extents in both action alternatives. Feeding and nesting sites for songbirds and other riparian-associated wildlife would be enhanced. All of these actions have the potential for short-term localized effects on riparian systems, but the current upward trend in stream stability would likely continue (Exhibit Rr-3).

In Alternatives B and C, activities between May and August may have direct effects on nesting Neotropical migrants, as well as on other wildlife species that use riparian habitats. Noise from the various activities proposed during the breeding season may impact juvenile dispersal, cause premature displacement of young, or cause young to be prematurely abandoned. Some temporary displacement of Neotropical migrants and other wildlife species is likely to occur. Nest parasitism by cowbirds may increase in fuel reduction areas (Bull, et al. 1995) and adjacent to regenerated stands. There is a slight chance that some nests could be destroyed by springtime burning of hand piles in five precommercial thinning units (101, 102, 103, 104, and 105). No broadcast burning is proposed and machine piles in commercial harvest units would be burned in fall or winter when birds are not nesting.

Other aspects of the project would not have measurable effects on Neotropical migratory birds and other wildlife species using riparian habitats.

Cumulative Effects

Most of the cumulative effects relevant to migratory birds and riparian habitats (Exhibits Rn-3 and Rr-2) are described in the sections of this chapter on *Old Growth Habitat, Snags and Downed Wood Habitat,* and *Aquatic Resources*. These include loss and alteration of habitat due to timber harvest; past fires; clearing vegetation for roads, railroads, power lines, and agriculture; and access for firewood cutting and furbearer trapping. Table 3-69 displays the cumulative acreages of timber harvest in mapped riparian landtype areas. No timber harvest is proposed within these areas in Alternatives B and C. Timber harvest likely to be proposed in the Radnor Resource Management Project on NFS lands would not be expected to occur in any of these riparian habitats. Saab and Rich (1997) list threats, species, and relevant habitats of concern for Neotropical migrants on the scale of the Columbia River Basin.

Table 3-69. Cumulative Acreages of Past and Proposed Timber Harvest in Mapped Riparian Habitats across the Martin/Radnor Wildlife Analysis Area for All Alternatives (Exhibit Rr-3)(See Table 3-66, above, for descriptions of the Riparian Landtypes).

Riparian Landtype	No Timber Harvest	Seed-tree Seed Cut	Shelterwood Cut	Stand Clearcut	Total
FL1C	450			3	453
FL1E	798				798
NL1A	91				91
NL1E	556		2	5	563
NL2A	163			23	186
SL2A. SL3A, SL2B	60	6	1		67
MS3A, MS4A, VS4A	34				34
WL5A, WS5A	129	5	3	20	156
Total Acres	**2,281**	**13**	**5**	**51**	**2,350**

Road and trail construction and maintenance on all ownerships have converted or altered riparian habitats to varying levels and are expected to do so in the future. For example, some road construction has filled in, moved, or created riparian habitat. Most of the roads constructed and maintained on state and industrial timber lands meet BMPs and roadwork continues to improve surface drainage, stabilize slopes, and reduce erosion and stream sedimentation. Trail maintenance is accomplished annually on the Tally Lake Ranger District primarily involving the repair of drainage features and clearing live and down vegetation. This road and trail maintenance often has short-term negative impacts on riparian wildlife, with long-term positive effects of improved water quality. The Radnor Resource Management Project's Proposed Action includes about one half mile of permanent road construction within a tenth mile of riparian habitats. Including that amount with the road construction in the Martin project, Alternative A would total 35.1 miles of roads within one tenth mile of riparian habitat, Alternative B would have 36.4 miles, and Alternative C would have 35.2 miles.

Several recreation activities such as fishing, boating, camping, hunting, hiking, horseback riding, motorized trail use, and bicycling may impact riparian habitats or disturb or displace wildlife in riparian habitats. Recreational use in and near the Upper Stillwater Lake campground and several other lake access sites has altered shoreline habitats and continue to disturb wildlife. Driving on roads can cause some collision-related injuries or mortalities to wildlife, particularly in the denser-cover areas associated with riparian habitats.

Other cumulative effects on wildlife using riparian habitats are varied. Stream and lake habitats have been indirectly affected by a variety of efforts. Splash-dam log transport on the Stillwater River in the early 1900s dramatically varied water levels on Upper Stillwater Lake and battered shorelines downriver. Fish stocking and non-native fish removal in some of the lakes has altered species composition and may have increased the intensity of recreational fishing. Fire suppression activities since the early 1940s may have affected wetlands or streams through chemical retardant or fire lines. On all ownerships, trapping of beavers and destruction of beaver dams has reduced the size of wetlands and other flooded areas. Past precommercial thinning, understory fuel reduction, prescribed fire, tree planting, shrub planting, and noxious weed control had little or no long-term effects on riparian-associated wildlife and Neotropical migratory birds, while increasing tree growth and diversity of plant species used for cover, forage, and nest sites. Human settlement occurs on most of the private lands, and subdivision development continues to increase, which can cause considerable impacts on riparian habitat or indirect effects on wildlife from dogs left at large. Livestock and ungulate grazing on non-USFS lands has likely altered plant composition in some riparian areas and may have contributed some level of bank trampling or erosion. See the *Aquatic Resources* sections of this chapter for cumulative effects of road and trail construction and maintenance. A variety of research and monitoring efforts, such as that on snowshoe hares, on western larch stand development, or on reed canary grass control methods, are likely to continue to occur with little or no effect on species that use these habitats. See Exhibits Q-8, Rd-12, Rr-2, and Rs-9 for more information about cumulative effects relevant to Neotropical migratory birds and riparian habitats.

Regulatory Framework and Consistency

All alternatives are consistent with NFMA biodiversity requirements for wildlife (Exhibit Rg-1), as described in the *Old Growth Habitat* section of this chapter. For information about and

consistency with INFISH requirements, the Forest Plan, and other regulatory requirements specific to aquatic systems, see the *Aquatic Resources* section of this chapter and Exhibit G-1.

The Forest Service's Landbird Conservation Strategic Plan (2000), Executive Order 13186 (2001), the Partners in Flight Habitat Conservation Plans for birds, and the Partners in Flight North American Landbird Conservation Plan (Rich, et al. 2004) all reference goals and objectives for integrating bird conservation into forest management and planning. In 2008, a Memorandum of Understanding (MOU) was signed between the USDA Forest Service and the USDI Fish and Wildlife Service to promote the conservation of migratory birds. The intent was to strengthen migratory bird conservation through enhanced collaboration and cooperation between the Forest Service and the Fish and Wildlife Service as well as other federal, state, tribal, and local governments. On the National Forests, conservation of migratory birds focuses on providing a diversity of habitat conditions at multiple spatial scales and ensuring that bird conservation is addressed when planning for land management activities. See Exhibit Rn-2 for more information.

Under the Migratory Bird Treaty Act, it is unlawful to take, kill, or possess migratory birds, including their nests and eggs. A list of Neotropical migrants protected by the Migratory Bird Treaty Act is provided in 50 CFR 10.13. Some migratory birds are covered by state hunting regulations; others are protected by non-game status by the Montana Department of Fish, Wildlife, and Parks. The flammulated owl and the peregrine falcon are Forest Service Region One sensitive species, and are discussed in this document and in other sections of the Project Record (Exhibits Rs-2, Rs-3, Rs-7, and Rs-20). No impacts on the flammulated owl would be expected (Exhibit Rs-2).

Upon review of the information regarding Neotropical migratory birds here and in the project record (Exhibits Rn-2 and Rn-3), no substantial loss of migratory bird habitat is expected from the implementation of any of the action alternatives and a diversity of habitat conditions would be provided at multiple scales. The project would not adversely impact migratory landbird species or their associated habitats. Potential impacts to migratory species would be minimized through the adherence of Forest Plan Standards and Guidelines for snags/down woody debris, riparian reserve buffers, and limited ground disturbance. The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. The intent of the Migratory Bird Treaty Act, the 2001 Executive Order, and the 2008 MOU to conserve and protect Neotropical migrants would be met under all alternatives. All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability.

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Threatened Wildlife

Threatened status affords a species and its habitat special protection from adverse effects resulting from federally authorized or funded projects. It is the responsibility of the Forest to design activities that contribute to the recovery of listed species in accordance with recovery plans that were developed as directed by the Endangered Species Act (ESA) (50 CFR part 402). The Flathead National Forest's Amendment 21 to the Forest Plan has a goal to "provide sufficient habitat to promote the recovery of threatened and endangered species and conserve the ecosystems upon which they depend." Section 9 of the Endangered Species Act of 1973, as amended, requires threatened and endangered species be protected from "harm" and "harassment" wherever they occur, regardless of recovery boundaries. A biological assessment for these species (Exhibit Rt-4) will be prepared and consultation with the USFWS will be completed prior to a Decision Notice being completed for this project. See Exhibits Rt-2 and Rt-3 for documentation of USFWS consultation. All alternatives are consistent with NFMA diversity requirements for wildlife, as described in the Old Growth Habitat section of this chapter. See Exhibit Rg-1 for more information.

Tables 3-49 and 3-50 in the Wildlife Introduction section summarized the current conditions for the threatened wildlife species in the project area (Canada lynx and grizzly bear). Since the gray wolf was delisted in May 2011, there are no endangered wildlife species in or near the project area. The United States Fish and Wildlife Service (USFWS) concurs with this list of species that "may occur" in the Martin/Radnor Wildlife Analysis Area and the Martin Stillwater Lynx Analysis Unit (Exhibit Rt-1). The gray wolf and wolverine are included in the *Sensitive Wildlife Species* section of this chapter.

Canada Lynx and Canada Lynx Habitat

Introduction

In Western Montana, Canada lynx (*Felis lynx*) typically forage in sapling forests or multi-storied older stands that have a dense layer of saplings and lower branches that support their primary prey, the snowshoe hare (Squires and Ruggiero 2007). During winter, lynx prefer dense mature, multi-layer forests with spruce and subalpine fir; during summer, lynx also select younger forests with high horizontal cover (Squires, et al. 2010). Lynx most often den under downed logs in mesic older forests (Squires, et al. 2008). They use forested cover for traveling between patches of boreal forest (USDI FWS 2008a), frequently moving along forested saddles, ridges, and riparian areas. Another important aspect of lynx habitat is winter snow that is deep and fluffy for extended periods. In the Northern Rockies, the Canada lynx is adapted to fire regimes that created new foraging opportunities in young stands and along edges, while leaving behind a mosaic of travel connections and dense older stands.

The alteration of cover for this species and its primary prey through timber harvest, precommercial thinning, and wildland fire can have negative short-term effects (Koehler and Aubrey 1994). This is especially true in feeding habitat and where large openings are created without travel connections between areas of dense young forest and older forests used for denning.

Stands up to about 20 years old, while unsuitable to lynx in the short term, are needed to provide sapling foraging habitat for the future. Timber harvest and fuel reduction generally reduce existing or future downed woody material, while sometimes accelerating regeneration of the green canopy cover used by lynx and its prey. An insect epidemic or wildland fire can provide a great influx of downed logs, providing denning sites and cover for lynx kittens. Non-target trapping mortality correlates with ease of human access into an area during prime trapping seasons. Human activity in spring and summer, especially motorized use, may force lynx to move kittens, although this does not appear to affect kitten survival (Olson et al. 2011). Maternal dens are "little more than temporary sheltered locations" and the relocation of kittens to a succession of maternal dens appears to be the norm in all lynx and bobcat species (Olson et al. 2011).

Following the information found in the Northern Rockies Lynx Management Direction (Exhibit Rt-10), the Canada Lynx Conservation Assessment and Strategy (USDA Forest Service, Interagency Lynx Biology Team 2013), and numerous additional published research efforts, primary lynx habitat in the Rocky Mountains and on the FNF includes lodgepole pine, subalpine fir, and Engelmann spruce. Moist Douglas-fir types are considered secondary habitat that can support squirrels, an alternate prey species for lynx during periods when snowshoe hare densities are low. In Montana west of the Continental Divide, lynx habitat is primarily subalpine fir habitat types, generally between 4000 and 7000 feet (Exhibit Rt-8).

Information Sources

Data used for analysis included over 2700 acres of lynx and snowshoe hare habitat surveyed in the Martin Stillwater Lynx Analysis Unit (augmented by 7500 acres of lynx and snowshoe hare habitat field surveys in the nearby Griffin Creek drainage); stand exams; field surveys of snags and downed logs; old growth surveys; other project area field visits and walk-through surveys; aerial photography; the FACTS activity tracking database; the R1 Vegetation Map; research literature; and GIS data for features such as general forest attributes, slope, aspect, habitat types, and elevation. Observation, monitoring, habitat, and habitat use information are in Exhibits Rt-7, Rt-8, and Rt-12. See the *Forest Vegetation* section of this chapter and Exhibit Rg-9 for more information. Effects of vegetation manipulation and temporary road construction were determined by overlaying coverages of potential lynx habitat with proposed unit and road locations (Exhibit Rt-15). All vegetation management activities were modeled as occurring simultaneously. Open road information is in Exhibit Rg-5. See also the sections on *Snags and Downed Wood Habitat* and *Old Growth Habitat* in this chapter.

Analysis Area

The analysis area for effects on Canada lynx is the Martin Stillwater Lynx Analysis Unit (LAU), consistent with a forest-wide protocol developed in November 1999 (Exhibit Rt-8). The Martin Creek Resource Management Project Area (Figure 1-1, above) is the Martin Creek drainage, which lies entirely within this LAU, which is about twice as large as the project area. All of the actions proposed in the alternatives that could directly or indirectly affect Canada lynx are contained within this area. This approximately 37 square mile area (about 24,000 acres) is large enough to include the home ranges of one female lynx and numerous snowshoe hares, and to represent the effects of timber harvest, fuel reduction, road

construction, and firewood cutting across the landscape. Exhibit Rt-6 includes information about LAUs across the landscape, including those on the Kootenai National Forest adjacent to the west. An assessment at multiple scales was also conducted to address population viability concerns (Exhibit Rg-1). See also Exhibit Rt-11 for a Region-wide assessment done in 2001. The temporal scale of the effects analysis extends 20 years into the future, enough time for new feeding habitats to develop.

Affected Environment

Population Status

Lynx range over much of Canada, Alaska, and the northern edges of the lower 48 states, although the only population strongholds in the western United States are in Washington State, western Montana, and possibly northern Idaho (USFS Forest Service, Interagency Lynx Biology Team 2013). Several national forests in USFS Region One support lynx. Snowshoe hare populations cycle widely in the more northern parts of Canada lynx range, leading to fluctuations in lynx populations. However, hare populations in the southern areas such as Montana generally have much less pronounced fluctuations (Hodges 2000). These southern populations of lynx apparently exist close to a threshold of population equilibrium (McKelvey, et al. 2000).

Despite their wide-ranging nature and difficulty of detection, Canada lynx and their sign have been recorded in and near the Martin Stillwater Lynx Analysis Unit (Exhibit Rt-7). Snowshoe hares, the primary prey of lynx, appear to be very common throughout the Tally Lake Ranger District, particularly along roads, in moderately dense sapling-to-pole sized stands, and in some older multi-storied stands. Numerous snowshoe hares and their sign have been recorded across the LAU, and they continue to be the subject of several long-term research studies (Hodges 2000, Mills et al. 2005, Ausband and Baty 2005, Hodges and Mills 2008). Species that may compete with lynx for prey have also been observed across the area. Numerous historic and current lynx records exist across western Montana and the Flathead National Forest, including those of lynx adults with kittens. Efforts such as lynx telemetry studies, carnivore snow-track surveys, lynx hair-snare sampling, and compilation of incidental reports are ongoing on FNF lands (Exhibit Rt-7).

See Exhibit Rg-1 for more detailed population, monitoring, management, and legislation information for the Canada lynx.

Habitat

Potential lynx habitat is abundant across the Flathead National Forest, with over 1,733,000 acres estimated in 2000 (Exhibit Rg-1). In 2001, a regional, multi-scale lynx habitat assessment (Hillis, et al. 2003, Exhibit Rt-11) found that lynx habitat is widespread across USFS Region One (R1) and the FNF. This assessment derived estimates of the proportions of foraging and unsuitable habitat at the forest-scale and compared them to forage and unsuitable habitat estimates at larger scales. This analysis showed that unsuitable habitat totaled ten percent of lynx habitat on the FNF and 9.2 percent at the R1 scale. Foraging habitat equaled nine percent of lynx habitat on the FNF and five percent of lynx habitat in R1. This is below the historic average, but would likely increase as a result of recent wildland fires. Denning

habitat equaled 15 percent at the R1 level, exceeding the historic and standard levels of ten percent. At the FNF scale, 67 percent of the land base is designated as roadless and wilderness habitat. This reduces the risk of mortality attributed to humans and reduces the potential negative effects of fragmenting small populations (USDI FWS 2009a).

Nearly 90 percent of the Martin Stillwater LAU is delineated as "mapped lynx habitat," as finalized through consultation with the USFWS with minor adjustments for this project using more accurate GIS data and aerial photographs (Exhibit Rt-8). The bulk of the Martin Creek drainage provides this potential lynx habitat; a large area of lake along with numerous broken rocky areas and wetlands in the northern half of the LAU do not. There are no barriers to lynx movement in the LAU other than possibly the nearly 600-acre Upper Stillwater Lake at its eastern edge. The LAU is not in or near one of the "putative" corridors that connect lynx habitat in Canada with that in the United States' Northern Rockies (Squires, et al. 2013) although it was mapped as a "Lynx Linkage Zone" at an interagency meeting in Montana in 2001.

Tables 3-70 and 3-71 display the current situation of potential habitat for lynx (Exhibit Rt-8), using descriptions from the Northern Rockies Lynx Management Direction (Exhibit Rt-10). Currently, 8.8 percent of lynx habitat is in early seral/structural stage condition and too young to be of use for lynx. The Martin Stillwater LAU is in "moderate" functioning condition (Exhibit Rt-8). Over most of the lynx habitat in the area, denning habitat is well distributed and many acres of heavy tree mortality can provide future structures for denning (Exhibit Rt-8). All areas of denning habitat have feeding habitat nearby, although feeding habitat is generally less available north of the Martin Creek drainage. Most of the abundant "Other" forests in Table 3-71 are moist Douglas-fir types that are likely to support alternate prey, such as red squirrels. Figure 3-9 shows the current distribution of lynx habitats. Exhibit Rt-12 has additional photographs of lynx habitat in the Martin Stillwater LAU.

Table 3-70. Calculation of Lynx Habitat across the Martin-Stillwater Lynx Analysis Unit (Exhibit Rt-8).

Acres in Lynx Analysis Unit	Permanent Non-lynx[1]	Mapped Lynx Habitat	% of LAU Supporting Mapped Lynx Habitat
23,775 ac	2,505 ac	21,270 ac	89.5%

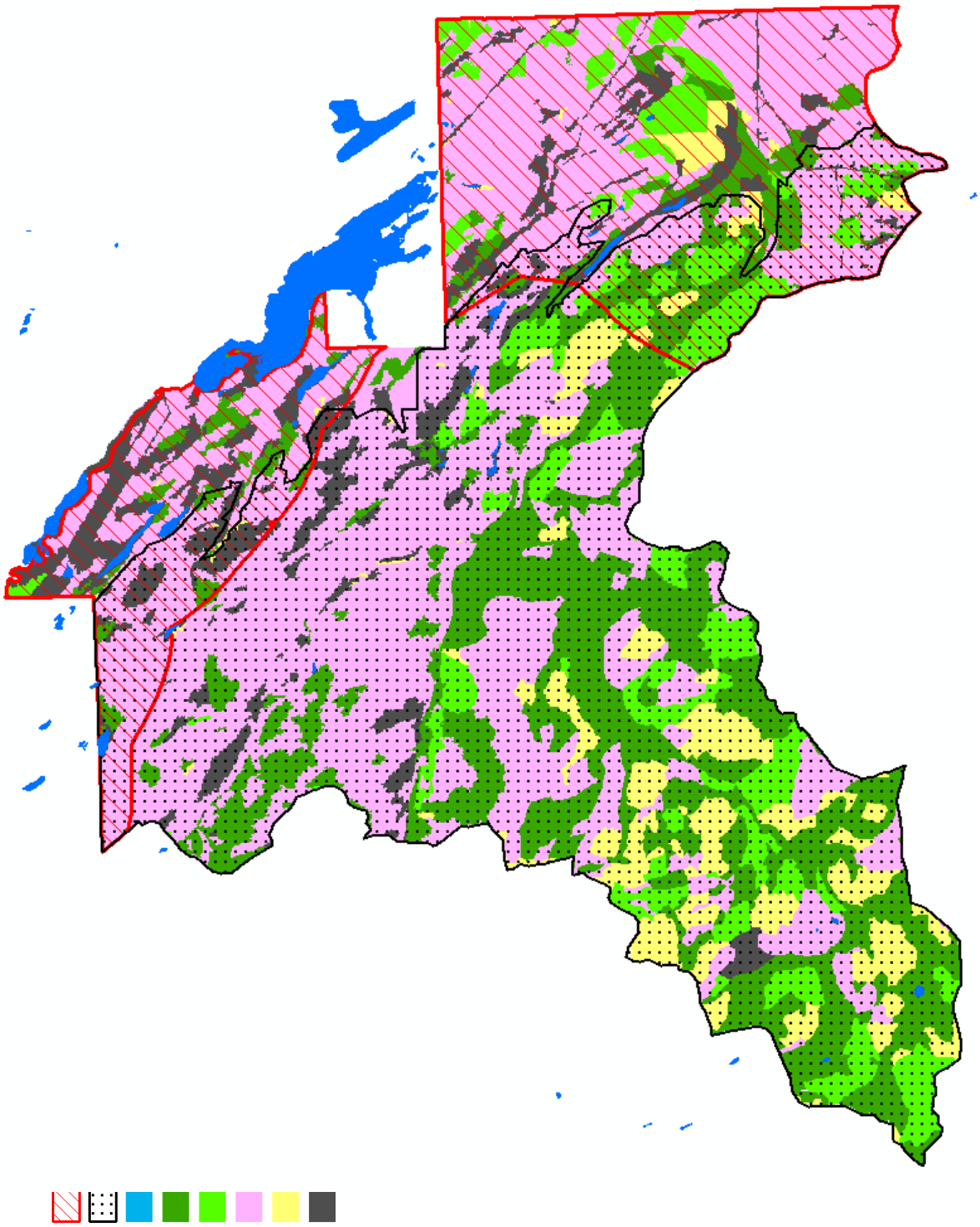
[1] Permanent Non-lynx-habitat includes dry forest habitat types, rock outcrops, sites dominated by dry grass/forbs/shrubs, low elevations, and large water bodies if present within the LAU.

Table 3-71. Acres of Lynx Habitat Components and Percentages of Mapped Lynx Habitat across the Martin-Stillwater Lynx Analysis Unit (Exhibit Rt-8).

Early Stand Initiation (not providing winter forage)[2]	Stand Initiation (provides winter forage)[3]	Multistory (forage)[4]	Other[5] (stem exclusion; non-feeding)
1,867 (8.8%)	2,407 (11.3%)	5,893 (27.7%)	11,103 (52.2%)

[2] Stand initiation structural stage *that currently does not provide* winter snowshoe hare habitat because trees have not yet grown tall enough to protrude above the snow in winter.
[3] Stand initiation structural stage *that currently provides* snowshoe hare habitat.
[4] Forested multi-storied structural stage with many age classes and vegetation layers *that appears to currently provide* winter snowshoe hare habitat (VEGS6).
[5] Forested conditions that do not fit Categories 1 through 4. Stem Exclusion Structural Stage – Closed canopy with understory limited; does not provide snowshoe hare habitat.

Figure 3-9. Current Lynx Habitat Conditions, Martin Stillwater Lynx Analysis Unit, including



Refer to Exhibit Rg-7 and the section on *Old Growth Habitat* in this chapter for more information about the existing condition in terms of connectivity.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No additional actions, such as timber harvest, fuel reduction, precommercial thinning, road construction, or road access changes, are proposed with this alternative. The availability of denning and hiding sites would gradually increase, as would habitat used by numerous species preyed on by the lynx (Table 3-76, below in the Cumulative Effects section). In lieu of wildland fire or other stand-replacing disturbance, feeding habitat would gradually increase and then diminish in quality and quantity. The fuel loading in many stands would increase the chance of large hot wildland fires in adjacent areas, which could have mixed results for lynx habitat. Stand-replacement disturbances are more likely to occur under this alternative, which would have the greatest and longest negative effect on potential denning habitat. Ecological disturbances are often favorable to lynx, but the net effects could be negative in a managed landscape.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

The assumptions involved in the analysis of vegetation management effects on lynx are detailed in Exhibit Rt-15. These include a) alteration of lynx habitats would occur as shown in Table 3-72; b) trees would continue to grow, particularly affecting young sapling stands; and c) there would be a lack of other stand-level changes, such as wildland fire and insect epidemics. All timber harvest and precommercial thinning units were modeled as occurring simultaneously.

Table 3-72. Vegetation Management Changes in Lynx Habitat Used for Effects Analysis (Exhibit Rt-15). See Table 3-71, above for definitions of these habitats.

Pre-treatment Lynx Habitat	Regeneration Harvest (CC, ST, SW)	Intermediate Harvest (CT)	Precommercial Thinning (PCT)
Multistory (Forage)	Early Stand Initiation	*(n.a.)*	*(n.a.)*
Stand Initiation (Sapling Forage)	*(n.a.)*	Early Stand Initiation	Early Stand Initiation
Other (Not Forage)	Early Stand Initiation	(No change)	Early Stand Initiation
Early Stand Initiation	(No change)	*(n.a.)*	(No change)

Where "n.a." is entered, that combination does not occur in any alternative.

Table 3-73. Changes in Potential Lynx Habitats through Vegetation Management, Martin Stillwater LAU, in acres (Exhibit Rt-15).

Alt.	Early Stand Initiation [1]	Sapling Feeding [2]	Multistory Feeding [3]	Other [4]
B	+ 1156 acres	- 564 acres	- 9 acres	- 583 acres
C	+ 405 acres	- 314 acres		- 91 acres

[1] Stand initiation structural stage *that currently does not provide* winter snowshoe hare habitat because trees have not yet grown tall enough to protrude above the snow in winter.
[2] Stand initiation structural stage *that currently provides* snowshoe hare habitat.
[3] Forested multi-storied structural stage with many age classes and vegetation layers *that appears to currently provide* winter snowshoe hare habitat (VEGS6).
[4] Stem Exclusion Structural Stage – Closed canopy with understory limited; does not provide snowshoe hare habitat.

The bulk of the commercial timber harvest and precommercial thinning in Alternatives B and C would occur in stands identified as lynx habitat (Exhibit Rt-15). Table 3-73 shows changes

in lynx habitats due to vegetation management. See Table 3-76 below, for the resulting percentages of lynx habitats across the Lynx Analysis Unit.

Effects on lynx feeding habitats vary by alternative and whether they are inside or outside the Wildland Urban Interface (WUI). No reductions to multistory lynx feeding habitats would occur outside the WUI. Alternative B would have nine acres (Unit 1) of timber harvest in multistory feeding habitat that is inside the mapped Wildland Urban Interface (WUI). Alternative C would not have any vegetation management in multistory feeding habitat. Both action alternatives would precommercially thin areas that function as sapling feeding habitat for lynx (Table 3-74). Effects of precommercial thinning on lynx habitats are incorporated into Table 3-73, above.

Table 3-74. Acres of Precommercial Thinning (PCT) by Alternative, Inside and Outside the Wildland Urban Interface (WUI) (Exhibit Rt-15).

Alt.	Standard PCT inside WUI	Western White Pine Restoration PCT outside WUI	Research PCT outside WUI	Total
B	267	72	226	564
C	0	72	226	297

In all action alternatives, the loss of denning habitat (which is plentiful in the area) would be partially balanced in that the removal of fuels would reduce the probability of fire spreading to remaining denning habitat of higher quality. In addition, tree planting and the removal of smaller-diameter downed wood in harvest units would accelerate regeneration into sapling stands preferred by snowshoe hares and hunting lynx.

Road construction and use would also have effects on lynx and lynx habitat. In all action alternatives, most of the road construction would cut through areas of potential lynx habitat (Table 3-75, Exhibit Rt-15). Permanent road construction would have a greater impact because permanent road corridors are wider (approximately 30 feet) and those cleared for temporary roads are narrow (approximately 20 feet) and allowed to revegetate. Two permanent roads in Alternative B (H and I) would cross a ridgeline, one in a saddle. All of these roads would be closed to motorized public access during and after implementation of the project, although the permanent roads could facilitate non-motorized access for trapping for other furbearer species.

Table 3-75. Temporary and Permanent Road Construction in Lynx Habitats, in acres (Exhibit Rt-15). (See Table 3-71, above, for definitions of these habitats.)

	Alternative B		Alternative C	
	Temporary	Permanent	Temporary	Permanent
Early Stand Initiation	0.2	0.1	0.0	0.1
Sapling Feeding	0.1	0.3	0.1	0.2
Multistory Feeding	0.2	0.1	0.3	0.0
Other	1.7	12.2	1.2	0.8
Total Acres	**2.2**	**12.7**	**1.6**	**1.1**

Some proposed timber harvest units may be logged in winter, requiring snow plowing on roads. Indirectly, snow plowing may facilitate movement of competitors that prey on snowshoe hares (such as bobcat, wolf, and coyote), but the science on this is inconclusive at this time. On new permanent roads (3.1 miles in Alternative B and 0.3 miles in Alternative C), over-snow motorized travel may disturb or displace Canada lynx, snowshoe hares, or other prey species, although such travel is already authorized across this relatively accessible landscape. Temporary roads and skid trails are not expected to receive use by over-snow recreationists.

The ability of lynx to travel across the Martin Stillwater LAU would be slightly affected by timber harvest, road construction, and human access, but there would be no effect on the area's potential to provide connectivity or linkage between larger areas of lynx habitat (Squires, et al. 2013). Road traffic on existing and proposed new roads would fall far below traffic volumes expected to impede movements by lynx (USDA Forest Service, Interagency Lynx Biology Team 2013). The effects of cover loss on travel routes are summarized in the section above on *Old Growth Habitat*.

Timber harvest, precommercial thinning, road construction, and other actions could cause temporary disturbance to lynx, with possible temporary displacement from the immediate area. Seeding, tree and shrub planting, and shrub slashing would enhance habitat values for a variety of species preyed upon by lynx. These and other actions, motorized access changes, including road maintenance, culvert replacements, and trail construction, would not have measurable effects on this species beyond their potential to displace lynx to a minor degree. For more information on effects relevant to the lynx, see the sections of this chapter on *Old Growth Habitat* and *Snag and Downed Wood Habitat*.

If active lynx denning is discovered in any proposed harvest or fuel reduction unit, activities would be modified if needed to protect denning stand conditions and maintain reproduction efforts.

Cumulative Effects

Most of the cumulative effects relevant to Canada lynx (Exhibit Rt-6) are described in the sections of this chapter on *Old Growth Habitat*, *Snags and Downed Wood Habitat*, *Neotropical Migratory Birds and Riparian Habitat*, and *Commonly Hunted Big Game*. These include loss and alteration of habitat due to timber harvest, past wildland fires, and access for recreation, firewood cutting, hunting, and trapping. See also Exhibits Q-8, Rb-6, Rd-12, Rn-3, Rr-2, and Rt-6. For an assessment of this species' viability at the Forest level, see the Final Environmental Impact Statement for the Flathead's Forest Plan Amendment 21 (USDA Forest Service 1999a) and Exhibit Rg-1.

Table 3-76 takes into account all proposed and reasonably foreseeable changes across the Marin Stillwater LAU, including the Radnor Resource Management Project. Timber harvest, precommercial thinning, and fuel reduction across national forest, state, and private lands has removed or altered lynx habitat, typically leaving few smaller trees, low limbs, snags, or large downed wood (Exhibits Rg-1 and Rt-6). Such areas can still function as lynx habitat but at reduced quality for a period of time. Other areas were cleared to create gravel or rock pits; corridors for the highway, railroad, or power lines; and a variety of smaller developed sites. These areas are essentially no longer lynx habitat. In the LeBeau Natural Research Area, past

wildland fires are reflected in a relative scarcity of lynx multistory forage while past fire suppression may have contributed to low levels of sapling feeding habitat and an increased risk of a stand-replacement wildland fire. Past prescribed fire, tree planting, shrub planting, and noxious weed control had little or no long-term effects on lynx while increasing tree growth and diversity of plant species used by lynx prey species. Beaver control has reduced the amount of moist habitat that supports other prey species.

Table 3-76. Resulting Percentages of Potential Lynx Habitats due to Vegetation Management Across Martin Stillwater LAU (Exhibit Rt-15). Percent of LAU does not include "permanent non-lynx habitat" such as dry Douglas-fir habitats, open water, and open rocky areas. Changes in italics are due to the Radnor Resource Management Project's Proposed Action (as of May 2014). See Table 3-71 above, for definitions of these habitats.

Alt.	Early Stand Initiation (not providing winter forage) Acres (% of lynx habitat)	Stand Initiation (provides winter forage) Acres (% of lynx habitat)	Multistory (forage) Acres (% of lynx habitat)	Other (stem exclusion; non-feeding) Acres (% of lynx habitat)
A	1867 (8.8%) *+ 602 ac* = 2469 **(11.6%)**	2407 (11.3%) *- 300 ac* = 2107 **(9.9%)**	5893 (27.7%) *- 14 ac* = 5879 **(27.6%)**	11,103 (52.2%) *- 303 ac* = 10,800 **(50.8%)**
B	3023 (14.2%) *+ 602 ac* = 3625 **(17.0%)**	1843 (8.7%) - 300 ac = 1,543 **(7.3%)**	5884 (27.7%) - 14 ac = 5870 **(27.6%)**	10,520 (49.4%) *- 303 ac* = 10,217 **(48.0%)**
C	2272 (10.7%) *+ 602 ac* = 2874 **(13.5%)**	2093 (9.8%) *- 300 ac* = 1793 **(8.4%)**	5893 (27.7%) - 14 ac = 5879 **(27.6%)**	10,012 (51.8%) *- 303 ac* = 9709 **(45.6%)**

Roads and railroad tracks constructed across the Martin-Stillwater LAU facilitated access for trapping, hunting, firewood cutting, and other exploits, as discussed in the *Snags and Downed Wood Habitat* section of this chapter. Firewood cutting along open roads has decreased downed logs particularly important for lynx and their prey. Brushing of saplings along most USFS roads in lynx habitat has reduced their value to snowshoe hares. Across the area, open and closed roads facilitate human access, contributing to the risk of mortality or displacement of lynx (Table 3-77, Exhibit Rg-5), although the Radnor Resource Management Project proposed action, as of May 2014, would change an additional 0.7 miles of roads that are currently open year-round to no public wheeled motorized access. Roads and railroads can cause some collision-related injuries or mortalities to lynx. The Proposed Action for the Radnor Resource Management Project would construct 1.0 miles of temporary or closed permanent roads, some of which are likely to impact lynx habitats, while proposed decommissioning of Road 2870A and its conversion to solely a National Forest System Trail would not affect lynx habitat. The Martin Falls Trail trails to Finger and Lagoni Lakes pass through areas of multistory feeding habitat. Construction and maintenance of these trails requires clearing of downfall. Snowmobile access, which can provide easy winter access for trappers and possibly competitors, is generally limited on Forest Service lands in the analysis area, due to short seasons and relatively shallow snows, but this would be additive to additional over-snow motorized travel opportunity on new permanent roads (3.1 miles in Alternative B and 0.3 miles in Alternative C) . The analysis area is close to several population centers and is easily accessed.

Table 3-77. Road Densities Across all Ownerships in the Martin-Stillwater Lynx Analysis Unit.

Alternative	All Roads	Roads Open in Summer	Roads Open Year-long
A	2.7 miles/mile^2	1.5 miles/mile^2	1.2 miles/mile^2
B	2.8 miles/mile^2	1.5 miles/mile^2	1.2 miles/mile^2
C	2.7 miles/mile^2	1.5 miles/mile^2	1.2 miles/mile^2

Hunting, trapping, and predator control may have had the greatest cumulative impact. Human access, available cover, and public attitudes largely determine mortality risk to lynx. Lynx harvest is currently closed in Montana.

Other cumulative effects on lynx are varied, but they do not differ by alternative. Probably due to trapping, lynx were extremely scarce in the first half of the last century in Montana. The lynx trapping season is currently closed in Montana. In addition to the human endeavors discussed above, all activities could disturb or displace lynx. These include numerous recreational activities such as hunting, hiking, fishing, camping, boating, snowmobiling, dog sledding, cross-country skiing, horseback riding, bicycling, driving, and motorized trail riding. Work on roads, decommissioning, and the removal and transport of gravel could similarly disturb lynx. Human settlement occurs on many of the private land holdings, and subdivision continues to increase. A variety of other research and monitoring efforts, such as that on snowshoe hares, western larch stand development, or on reed canary grass control methods, are likely to continue to occur with little or no effect on Canada lynx. Fish stocking and removal of nonnative fish in several lakes in the area, as well as historic splash-dam log transport may alter aquatic species composition, which would not affect lynx.

In consideration of habitat conditions, human use, human dwellings, roaded access, and the number of reported observations, the mortality risk to Canada lynx remains low-to-moderate. No geographic or man-made barriers exist within the Martin Stillwater LAU that would preclude lynx movements to adjacent populations or recovery areas.

Regulatory Framework and Consistency

The contiguous United States population segment of the lynx, including Montana, became a threatened species on March 24, 2000. The Final EIS and Record of Decision for the Northern Rockies Lynx Management Direction (NRLMD) were completed in March 2007 (Exhibit Rt-10). This decision amended the Forest Plan by providing lynx habitat management goals, objectives, standards, and guidelines (Table 3-78). Alternatives A and C would be consistent with the Northern Rockies Canada Lynx Direction. Because Alternative B would construct two permanent roads that would cross a ridgeline, one of which would be in a saddle, it would not meet Guideline HU G7 of the NRLMD. This inconsistency would require rationale to be provided in the project decision. Alternative B is otherwise consistent with the NRLMD. See Exhibit Rt-10 and *Chapter 2* of this EA for more information.

Table 3-78. Northern Rockies Lynx Management Direction Applicable to the Martin Creek Resource Management Project (See Exhibit Rt-10 for the full text of this direction and for more detailed information).

Direction	Northern Rockies Lynx Management Direction	Consistency
Objective ALL O1	Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.	All alternatives are consistent. Some forested connections between older forests would be altered in Alternatives B and C, but dense sapling stands would retain connectivity for lynx.
Standard ALL S1	New or expanded permanent development and vegetation management projects must maintain habitat connectivity in an LAU and/or linkage area.	
Objective VEG O1	Manage vegetation to mimic or approximate natural succession and disturbance processes while maintaining habitat components necessary for the conservation of lynx.	Natural succession and disturbance processes would be approximated in all alternatives.
Objective VEG O2	Provide a mosaic of habitat conditions through time that support dense horizontal cover, and high densities of snowshoe hare. Provide winter snowshoe hare habitat in both the stand initiation structural stage and in mature, multi-story conifer vegetation.	The mosaic would be provided over time.
Objective VEG O4	Focus vegetation management in areas that have potential to improve winter snowshoe hare habitat but presently have poorly developed understories that lack dense horizontal cover.	Most of the vegetation management proposed in Alternatives B and C would occur in areas with poorly developed understories.
Standard 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. This standard does not apply to fuel treatment projects within the Wildland Urban Interface (WUI) as defined by HFRA, subject to limitations.* In addition, fuel treatment projects may not result in more than three adjacent LAUs exceeding the standard.	All alternatives are consistent. Less than 30% of the LAU does not yet provide winter snowshoe hare habitat. Currently, 9% of the LAU is in this condition. The Martin Creek project would increase this to 14% under Alternative B and 11% under Alternative C. When adding cumulative effects (the Radnor Project), this would be 17% and 14%, respectively. In all alternatives, far less than the FNF's 6% allowance (103,800 acres) would be used. No more than 3 adjacent LAUs would exceed the standard under any alternative. See Exhibits Rt-8 and Rt-15.
Standard VEG S2	Timber management projects shall not regenerate more than 15 percent of lynx habitat on NFS lands in an LAU in a 10-year period. This standard does not apply to fuel treatment projects within the wildland urban interface (WUI) as defined by HFRA, subject to limitations.*	All alternatives are consistent. Less than 15% of lynx habitat by LAU would be regenerated in a 10-year period. The Martin Creek project would regenerate 5% of lynx habitat in the LAU under Alternative B and 2% under Alternative C. When adding cumulative effects (the Radnor Project), this would be 8% and 5%, respectively.
Standard VEG S5	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 under certain exceptions, such as daylight thinning of planted rust-resistant white pine where 80% of the winter snowshoe hare habitat is	All alternatives are consistent. About 13% of the precommercial thinning in Alternative B and 24% in Alternative C would fall under Exception 5 for white pine; the rest would be on non-lynx habitat or in the Wildland

Direction	Northern Rockies Lynx Management Direction	Consistency
	retained. This standard does not apply to fuel treatment projects that use precommercial thinning as a tool within the wildland urban interface (WUI) as defined by HFRA, subject to limitations.*	Urban Interface, as allowed under the NRLMD. Also see discussion under standards VEG S1 and VEGS2 and guideline VEG G10.
Standard VEG S6	Vegetation management projects that reduce snowshoe hare habitat in multi-story mature or late successional forests may occur only: 1. Within 200 feet of administrative sites, dwellings, outbuildings, recreation sites, and special use permit improvements; 2. For research studies or genetic tree tests evaluating genetically improved reforestation stock; or 3. For incidental removal during salvage harvest (e.g. removal due to location of skid trails). This standard does not apply to fuel treatment projects within the wildland urban interface (WUI) as defined by HFRA, subject to limitations.*	All alternatives are consistent. Vegetation management in multi-story lynx feeding habitat would occur only inside of the Wildland Urban Interface (Alternative B, 9 acres), as allowed under the NRLMD. Also see discussion under standards VEG S1 and VEGS2 and guideline VEG G10.
Guideline VEG G1	Vegetation management projects should be planned to recruit a high density of conifers, hardwoods, and shrubs where such habitat is scarce or not available. Priority should be given to stem-exclusion, closed-canopy structural stage stands for lynx or their prey (e.g. mesic, monotypic lodgepole stands). Winter snowshoe hare habitat should be near denning habitat.	All alternatives are consistent. Site productivity in this area is such that a high density of conifers and other vegetation would be created in younger stands; winter hare habitat remains close to potential lynx denning habitat.
Guideline VEG G4	Prescribed fire activities should not create permanent travel routes that facilitate snow compaction. Constructing permanent firebreaks on ridges or saddles should be avoided.	All alternatives are consistent. No permanent travel routes or firebreaks would be created.
Guideline VEG G5	Habitat for alternate prey species, primarily red squirrel, should be provided in each LAU.	All alternatives are consistent. A considerable amount of habitat for alternate prey would remain.
Guideline VEG G10	Fuel treatment projects in the WUI, as defined by HFRA, should be designed considering standards VEG S1, S2, S5, and S6 to promote lynx conservation.	These standards were considered for Alternatives B and C. Approximately 100% of the 5893 acres multi-story lynx feeding habitat and 77% to 87% of the 2407 acres of stand initiation lynx feeding habitat would remain intact. Further, treatments would reduce risks from fire and insect and disease, consistent with the project's Purpose and Need. Also see discussion above under standards VEG S1, S2, S5 and S6.
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 small 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.	All alternatives are consistent. Denning habitat will continue to be abundant. In harvest units, some of the coarse woody debris, piles, and trees would be retained.
Guideline HU O1	Maintain the lynx's natural competitive advantage over other predators in deep snow by discouraging the expansion of snow-compacting activities in lynx habitat.	Motorized public over-snow travel would be allowed on the new system roads, but such travel is already authorized across this relatively accessible landscape.

Direction	Northern Rockies Lynx Management Direction	Consistency
Guideline HU O2	Manage recreational activities to maintain lynx habitat and connectivity.	All alternatives are consistent. Recreational activities are focused along narrow corridors.
Guideline HU O3	Concentrate activities in existing developed areas, rather than developing new areas in lynx habitat.	All alternatives are consistent. No new recreation sites would be developed in this proposal.
Guideline HU G7	New permanent roads should not be built on ridge-tops and saddles, or in areas identified as important for lynx habitat connectivity. New permanent roads and trails should be situated away from forested stringers.	Two permanent roads in Alternative B would cross a ridgeline, one in a saddle. No permanent roads or trails would be built in areas important for lynx connectivity, or close to forested stringers.
Guideline HU G8	Cutting brush along low-speed, low-traffic-volume roads should be done to the minimum level necessary to provide for public safety.	All alternatives are consistent. Funding constraints limit this to the minimum necessary for safety.
Guideline HU G9	On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is over, these roads should be reclaimed or decommissioned, if not needed for other management objectives.	All alternatives are consistent. Public motorized use would be restricted on new roads. Permanent roads built for this project would be needed for other management objectives.

* 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 six percent (cumulatively) of lynx habitat on each administrative unit (National Forest). For fuel treatment projects within the WUI, see guideline VEG G10.

If any active Canada lynx denning sites are discovered in or near any proposed vegetation management unit, area of road construction, or similar activity, activities would be modified if needed to protect habitat conditions and maintain reproductive efforts. While other factors outside of the Forest Service's control (i.e. non-target trapping mortality and competing predator populations) may impede lynx recovery, in the context of the NRLMD, actions proposed in the project area are compatible with conserving lynx to a non-listed status and they are consistent with maintaining habitat for viable populations of lynx at the regional scale.

Consultation with the USFWS for Canada lynx will be completed on the selected alternative before the decision is finalized for the Martin Creek Resource Management Project (Exhibits Rt-2, Rt-3, and Rt-4).

Canada Lynx Critical Habitat

Introduction

The analysis for Canada lynx Critical Habitat (USDI FWS 2014) is separate from that applied above to the Northern Rockies Lynx Management Direction, although the scientific basis of the analysis is essentially the same (Exhibit Rt-20). See the *Introduction, Information Sources, Analysis Area, Affected Area,* and *Environmental Consequences* subsections above on Canada Lynx and Canada Lynx Habitat for more information.

Affected Environment

The western bulk of the Martin Stillwater Lynx Analysis Unit (LAU) and all but the eastern tip of the Martin drainage is designated as Critical Habitat in Unit 3 (USDI FWS 2014 and Exhibit Rt-20). In such areas, the "Primary Constituent Element" for the Canada lynx is "boreal forest landscapes supporting a mosaic of differing successional forest stages." These landscapes also contain snowshoe hares and their preferred habitats, winter snows that are generally deep and fluffy for extended periods of time, sites for denning that have abundant coarse woody debris, and a matrix of habitats that do not support snowshoe hares but lynx are likely to travel through within a home range (USDI FWS 2014). See Table 3-79 for a summary of lynx critical habitat Primary Constituent Elements (PCEs) across critical habitat in the Martin Stillwater LAU. All of the PCEs, including deep fluffy snows and connectivity, are abundant and well-distributed across this area (Exhibit Rt-20).

Table 3-79. Current Conditions of Potential Lynx Habitats Relevant for Critical Habitat Analysis by Lynx Analysis Unit and Percentages of Mapped Lynx Habitat in the LAU (Exhibit Rt-20).

Lynx Analysis Unit	Sapling Feeding [1] (PCE1a)	Denning with Multi-story Feeding [2] (PCE1a & PCE1c)	Other [3] (PCE1c)	Total of PCE1a	Total of PCE1c
Martin Stillwater	1923 acres 11.6%	5297 acres 32.1%	7580 acres 45.9%	7220 acres 43.7%	12,877 acres 78.0%

[1] Stand initiation structural stage that provides snowshoe hare habitat.
[2] Forested multi-storied structural stage with many age classes and vegetation layers that provides denning habitat and winter snowshoe hare habitat.
[3] Stem Exclusion Structural Stage – Closed canopy with understory limited; does not provide snowshoe hare habitat but does provide potential denning habitat.

The entire Flathead National Forest is within Unit 3 of designated lynx Critical Habitat and contains physical and biological elements essential for the conservation of the species, including its Primary Constituent Elements (PCEs) and its components (USDI FWS 2014). Unit 3 is 9,783 square miles (6,261,095 acres).

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No additional actions, such as timber harvest, fuel reduction, precommercial thinning, road construction, or road access changes, are proposed with this alternative. The availability of denning and hiding sites would gradually increase, as would habitat used by numerous species preyed on by the lynx. See Table 3-82, below in the Cumulative Effects section. In lieu of wildland fire or other stand-replacing disturbance, feeding habitat would gradually increase and then diminish in quality and quantity. The fuel loading in many stands would increase the chance of large hot wildland fires in adjacent areas, which could have mixed results for lynx habitat. Stand-replacement disturbances are more likely to occur under this alternative, which would have the greatest and longest negative effect on potential denning habitat. Ecological disturbances are often favorable to lynx, but the net effects could be negative in a managed landscape.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

The assumptions involved in the analysis of vegetation management effects on Lynx Critical Habitat (USDI FWS 2014) are detailed in Exhibits Rt-15 and Rt-20. These include a) trees would continue to grow, particularly affecting young sapling stands; and c) there would be a lack of other stand-level changes, such as wildland fire and insect epidemics.

The bulk of the commercial timber harvest and precommercial thinning in Alternatives B and C would occur in stands identified as lynx Critical Habitat (Exhibits Rt-15 and Rt-20). Table 3-80 shows changes in lynx habitats due to vegetation management, although it should be noted that many acres qualify as both PCE1a and PCE1c so some areas appear to be double counted. See Table 3-82, below in the Cumulative Effects section for Threatened Species for the resulting percentages of lynx habitats across the Lynx Analysis Unit. See Table 3-82, below, for the resulting percentages of lynx habitats on Critical Habitat across the Lynx Analysis Unit.

Table 3-80. Changes through Vegetation Management and Tree Growth in Potential Lynx Habitats relevant for Critical Habitat Analysis, Martin Stillwater LAU, in acres (Exhibit Rt-20).

Alternative	PCE1a (Presence of Snowshoe Hares and their Preferred Habitat Conditions)	PCE1c (Sites for Denning)
B	- 385 acres	- 583 acres
C	- 307 acres	- 91 acres

In all action alternatives, the loss of denning habitat (PCE1c), which is plentiful in the area, would be partially balanced in that the removal of fuels would reduce the probability of fire spreading to remaining denning habitat of higher quality. In addition, tree planting and the removal of smaller-diameter downed wood in harvest units would accelerate regeneration into sapling stands preferred by snowshoe hares and hunting lynx (PCE1a).

Almost all of the road construction that would affect lynx Critical Habitat PCEs (Table 3-81) would go through “Other” denning habitat. Permanent road construction would have a greater impact because permanent road corridors are wider (approximately 30 feet) and those cleared for temporary roads are narrow (approximately 20 feet) and allowed to revegetate. PCE1b and PCE1d would not be impacted by road construction. See Table 3-83, below, for the resulting road densities on Critical Habitat across the Lynx Analysis Unit.

Table 3-81. Changes through Road Construction in Lynx Habitats relevant for Critical Habitat Analysis, Martin Stillwater LAU, in acres (Exhibit Rt-20).

Potential Lynx Habitat	Alternative B		Alternative C	
	Temporary	Permanent	Temporary	Permanent
PCE1a (Snowshoe Hare Habitat)	0.3	0.4	0.3	0.3
PCE1c (Denning Habitat)	0.9	6.1	1.5	0.8

Cumulative Effects

Most of the cumulative effects relevant to Canada lynx Critical Habitat (Exhibit Rt-6) are described in the sections of this chapter on *Old Growth Habitat*, *Snags and Downed Wood Habitat*, *Neotropical Migratory Birds and Riparian Habitat*, and *Commonly Hunted Big Game*.

These include loss and alteration of habitat due to timber harvest, past wildland fires, and access for recreation, firewood cutting, hunting, and trapping. See also Exhibits Q-8, Rb-6, Rd-12, Rg-1, Rn-3, Rr-2, and Rt-6.

Table 3-82 takes into account all proposed and reasonably foreseeable changes relevant to Canada lynx Critical Habitat across the Martin Stillwater LAU, including the Radnor Resource Management Project. Timber harvest, precommercial thinning, and fuel reduction has removed or altered lynx habitat, typically leaving few smaller trees, low limbs, snags, or large downed wood (Exhibits Rg-1 and Rt-6). Other areas were cleared to create gravel or rock pits and corridors for power lines. Actions that have affected PCE1a (snowshoe hares and their habitats) include timber harvest, precommercial thinning, fire, fire suppression, and road construction. Those same actions have affected PCE1c (sites for denning), as have firewood collection. Actions that may have affected PCE1b (deep fluffy snows) include over-snow recreation and snow plowing. In the LeBeau Natural Research Area, past wildland fires and fire suppression are reflected in a relative scarcity of PCE1a and an increased risk of a stand-replacement wildland fire. Past prescribed fire, tree planting, shrub planting, noxious weed control, and beaver control had little or no long-term effects on lynx Critical Habitat.

Table 3-82. Resulting Percentages relevant for Critical Habitat Analysis across Lynx Habitats (non-matrix) in the Martin Stillwater LAU (Exhibit Rt-20).

Alternative	PCE1a (Presence of Snowshoe Hares and their Preferred Habitat Conditions)	PCE1c (Sites for Denning)
A	40.2%	72.9%
B	39.0%	69.5%
C	39.5%	72.3%

Roads constructed across lynx Critical Habitat in the Martin-Stillwater LAU (Table 3-83) facilitated access for timber harvest, firewood cutting, and other exploits, as discussed in the *Snags and Downed Wood Habitat* section of this chapter. Firewood cutting along open roads has decreased downed logs particularly important for lynx and their prey. Brushing of saplings along most USFS roads in lynx habitat has reduced their value to snowshoe hares. The Proposed Action for the Radnor Resource Management Project would construct 1.0 miles of temporary or closed permanent roads, some of which are likely to impact lynx habitats, while proposed decommissioning of Road 2870A and its conversion to solely a National Forest System Trail would not affect lynx Critical Habitat. The Martin Falls Trail and trails to Finger and Lagoni Lakes pass through areas of multistory feeding habitat (PCE1a). Construction and maintenance of these trails requires clearing of downfall.

Table 3-83. Road Densities Across all Ownerships on Lynx Critical Habitat in the Martin-Stillwater Lynx Analysis Unit (Exhibit Rg-5).

Alternative	All Roads	Roads Open in Summer	Roads Open Year-long
A	2.52 miles/mile^2	1.23 miles/mile^2	0.91 miles/mile^2
B	2.64 miles/mile^2	1.12 miles/mile^2	0.88 miles/mile^2
C	2.53 miles/mile^2	1.06 miles/mile^2	0.82 miles/mile^2

Facilitation of human access, hunting, trapping, predator control, fish stocking and removal of nonnative fish in several lakes in the area, and historic splash-dam log transport would not

impact lynx Critical Habitat PCEs. A variety of other research and monitoring efforts, such as that on snowshoe hares, western larch stand development, or on reed canary grass control methods, are likely to continue to occur with little or no effect on Canada lynx Critical Habitat.

Regulatory Framework and Consistency

Critical Habitat designation for Canada lynx (USDI FWS 2014) was revised on September 12, 2014, and covers the western bulk of the Martin-Stillwater LAU (Exhibit Rt-20). The analysis done for lynx critical habitat is separate from that applied to the Northern Rockies Lynx Management Direction, although the scientific basis of the analysis is essentially the same. Consultation on lynx critical habitat is not tiered to Northern Rockies Lynx Management Direction. The Martin Creek project analysis considered the Primary Constituent Elements (PCEs) of lynx critical habitat and encompassed the appropriate landscape scale, consistent with the lynx critical habitat rule. Table 3-84 and Exhibit Rt-20 describe the effects of this project in the perspective of the LAU and across Critical Habitat Unit 3.

Table 3-84. Primary Constituent Elements of Canada Lynx Critical Habitat (USDI FWS 2014) and the Martin Creek Resource Management Project (Exhibit Rt-20).

Primary Constituent Element		Effect Across LAU and Critical Habitat Unit 3
PCE1a	Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface.	The 308 to 386 acres of hare habitat that would be affected by vegetation management and/or road construction make up less than 4% of the available hare habitat in the LAU and a miniscule part of Critical Habitat Unit 3.
PCE1b	Winter snow conditions that are generally deep and fluffy for extended periods of time.	Other than snow plowing for up to three units, the presence of deep fluffy snows would not be affected by this proposal.
PCE1c	Sites for denning that have abundant coarse woody debris, such as downed trees and root wads.	Denning habitat would still be abundant (>70%) and well distributed across Lynx Critical Habitat.
PCE1d	Matrix habitat (e.g., hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe 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 through such habitat while accessing patches of boreal forest within a home range.	The proposal would not alter the ability of lynx to access habitat within or between home ranges. There would be no negative impacts on any lynx linkage area (Squires et al. 2013).

The Martin Creek Resource Management Project would not result in destruction of critical lynx habitat, nor would it impede movement through matrix habitat. All PCEs would remain abundant and well distributed across the Martin Stillwater LAU before, during, and after implementation of all alternatives.

Consultation with the USFWS for Critical Habitat designated for the Canada lynx will be completed on the selected alternative before the decision is finalized for the Martin Creek Resource Management Project (Exhibits Rt-2, Rt-3, and Rt-4).

Grizzly Bear

Introduction

The grizzly bear (*Ursus arctos horribilis*) is the largest carnivore in northwest Montana, a species that could occur in any part of the Martin/Radnor Wildlife Analysis Area. At the Forest level, meeting the needs of the grizzly bear is an indicator that the needs of other forest carnivores are met. When grizzlies are away from denning habitat or other areas that provide sufficient food and security, the effects of actions such as timber harvest, road construction and use, wildland fires, and insect epidemics are mostly limited to temporary displacement and changes in the availability of cover. Bears are most vulnerable in areas with high open road densities and limited cover and escape habitat (Claar, et al. 1999, Schwartz et al. 2010). Timber harvest and wildland fire can eliminate cover for security and thermal regulation and short-term changes in food availability (Witmer, et al. 1998). See Exhibit Rt-13 for more background information.

Information Sources

The effects on grizzly bears are discussed in relationship to acres and the spatial arrangement of hiding cover lost, as well as ease of human access. The analysis was done through use of GIS of the effects of the different types of vegetation management proposed (Exhibits Rb-3 and Rb-7), as discussed above for big game. Hunting season security values were derived through GIS procedures that detected areas of continuous cover further than one-half mile from open roads and motorized trails (Exhibit Rb-1). Road information can be found in Exhibit Rg-5. Effects on connectivity cover are in Exhibit Rg-7. Exhibit Rg-9 provides additional information about the vegetation data used.

Analysis Area

For this project, the analysis of effects on grizzly bears is the Martin/Radnor Wildlife Analysis Area (Figure 3-7, above). At approximately 42.4 square miles (about 27,000 acres), it is large enough to include the year-round range of a grizzly bear and to represent the effects of wildland fires, natural tree mortality, timber harvest, fuel reduction, and firewood cutting across the landscape. It is sufficiently large to evaluate the ability of the habitat to support populations of wildlife and plant species used by grizzly bears, but small enough to not obscure the effects of the alternatives. All of the actions proposed in the alternatives that could directly or indirectly affect grizzly bears are contained within this area. No known or suspected population sinks for this species occur in or near the area. An assessment at multiple scales was also conducted to address population diversity concerns (Exhibit Rg-1). The temporal scale of the effects analysis extends up to 20 years, at which time areas affected by this project are likely to provide hiding cover. In addition, human activities associated with this project that could disturb or displace bears would have ceased.

Affected Environment

Population Status

The Martin/Radnor Wildlife Analysis Area is outside the Grizzly Bear Recovery Zone, which is identified in the Grizzly Bear Recovery Plan (USDI FWS 1993, p. 59) and referred to as the Northern Continental Divide Ecosystem (NCDE). Federal lands in the proposed project area are designated in the Forest Plan as unoccupied grizzly bear habitat (II-24). However, grizzly bears are reasonably expected to occur throughout the area and recent science indicates that grizzly bears continue to expand their range outside the recovery area (USDI FWS 2013; Exhibits Rt-5 and Rt-13). Grizzly bears are reported in and near the analysis area (Exhibit Rt-7), although this is only a fraction of the sightings on the Whitefish Range to the east in the NCDE.

Ongoing research indicates the NCDE contains the largest population of grizzly bears in the lower 48 states. A U.S. Geological Survey (USGS) population estimate, based on DNA sampling completed in 2004, estimated that the minimum number of grizzly bears in the NCDE was 765 with a 95 percent confidence interval of 715 to 831 bears (Kendall, et al. 2009). This method of estimating the population is more accurate than methods used in the 1993 Grizzly Bear Recovery Plan (Harris, et al. 2011). Mace and Roberts (2011) estimated that the NCDE grizzly bear population has been growing at a rate of about three percent annually for the last five years. The best available information suggests the grizzly bear population on the Flathead National Forest and in the NCDE is expanding outside the recovery zone and has a population beyond recovery plan levels. See Exhibit Rg-1, which includes more information about this species and its habitat at various scales, including that of the FNF.

Habitat

The Martin/Radnor Wildlife Analysis Area is not “traditional prime habitat” for grizzly bears (Tim Manley, pers. comm. 2005), although bears are recognized to occupy this area outside the NCDE Recovery Area. Overall, the forage values for grizzly bears are moderate to low, the availability of travel corridors between forage areas is good, and cover patches are abundant and well dispersed. In 2012, about five miles southwest of the Martin Creek drainage, MTFWP located what is believed to be the first verified grizzly bear den in the Salish Mountains since recovery efforts were initiated. No geographic or man-made barriers exist within the area that would preclude grizzly bear movements to adjacent populations or recovery areas.

Potential grizzly bear food is plentiful and well distributed across the analysis area. These are primarily clovers, grasses, sedges, umbel-type forbs, and the various huckleberry species. Ungulate populations, especially white-tailed deer, appear to be at healthy numbers (Exhibit Rb-2). No specific ungulate calving or fawning sites have been identified in the analysis area, as these appear to be dispersed. Moose and several smaller prey species are also yearlong residents. Cover conditions are described in the section of this chapter titled *Commonly Hunted Big Game*.

The relatively dense network of roads in parts of the Martin/Radnor Wildlife Analysis Area provides many opportunities for bears to forage on road kill, but causes temporary displace-

ment of bears themselves. Across all ownerships, 64 miles across the analysis area are open in summer to public or private motorized use for an Open Road Density (ORD) of 1.5 miles per square mile. Approximately 55 miles are open during hunting season, winter, and spring, with an ORD of 1.3 (Exhibit Rg-5). Road restrictions in the analysis area are generally effective (Exhibit Rg-6). See the Cumulative Effects and Regulatory Framework and Consistency sections below, which also include information about road densities by Geographic Unit.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No additional actions, such as timber harvest, fuel reduction, precommercial thinning, access changes, or road construction, are proposed with this alternative. In lieu of wildland fire or other stand-replacing disturbance, the availability of cover would gradually increase, as would habitat used by species preyed on or scavenged upon by grizzly bears (See Table 3-61, above in the Cumulative Effects section for *Commonly Hunted Big Game*). The fuel loading in many stands would increase the chance of large hot wildland fires in adjacent areas, which could have mixed results for grizzly bear habitat. Stand-replacement disturbances are more likely to occur under this alternative. See the *Commonly Hunted Big Game* section of this chapter for more information.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Timber harvest and road construction in these alternatives would affect cover used by large mammals such as grizzlies and their prey. The short-term loss of hiding cover would occur on 90 (Alternative C) to 591 acres (Alternative B) (Table 3-61 in the *Commonly Hunted Big Game* section of this chapter, above, and Exhibit Rb-3). Timber harvest would reduce the available secure habitat, as defined for elk during hunting season, particularly in Alternative B. See the *Commonly Hunted Big Game* section of this chapter for more information.

Temporary displacement of individual grizzly bears might occur during preparation or implementation of activities. There would be no direct or indirect effects on grizzlies from disturbance to key habitat areas such as den sites in or beyond the area where this project is proposed.

The action alternatives are not expected to have any direct, indirect, or cumulative effects to grizzly bear denning habitat or high quality food sources. As a result of the action alternatives, there should be an increase in the quality of forage for ungulates. Due to disturbance and displacement, there could be a minor effect on prey species' habitat use patterns, but not their population levels or availability as prey.

No alternative would reduce the potential of the Martin/Radnor Wildlife Analysis Area to provide connectivity for grizzly bears between adjacent populations or recovery areas. Based on the nature and duration of the proposed project, the mortality risk for grizzly bears would remain low-to-moderate.

For a discussion of the effects of motorized road access changes, road construction, trail construction, burning of landing piles, precommercial thinning, shrub slashing, tree and shrub

planting, and seeding, see the sections above on *Snags and Downed Wood Habitat* and *Commonly Hunted Big Game* in this chapter. Besides an increased chance of short-term displacement of individual grizzly bears, other aspects of the project such as BMPS, culvert replacements, other roadwork, and trail construction would not have measurable effects on grizzly bears.

Cumulative Effects

Most of the cumulative effects relevant to grizzly bears (Exhibit Rt-6) are described in the sections of this chapter on *Old Growth Habitat, Snags and Downed Wood Habitat, Neotropical Migratory Birds and Riparian Habitat*, and *Commonly Hunted Big Game*. These include loss and alteration of cover due to timber harvest, past wildland fires, post-fire hazard tree removal, and access for recreation, firewood cutting, and hunting. See also Exhibits Q-8, Rb-6, Rd-12, Rn-3, and Rr-2. For an assessment of this species' viability at the Forest level, see the Final Environmental Impact Statement for the Flathead's Forest Plan Amendment 21 (USDA Forest Service 1999a) and Exhibit Rg-1.

Vegetation management and timber clearing across national forest, state, and private lands has removed or altered suitable cover (Exhibits Rg-1 and Rt-6). For quantification of cover effects relevant for grizzly bears, see Table 3-69 in the Cumulative Effects section for *Commonly Hunted Big Game.* Past precommercial thinning, understory fuel reduction, prescribed fire, tree planting, shrub planting, and noxious weed control had little or no long-term effects on grizzly bears while increasing tree growth and diversity of plant species available for cover and forage for bears. Beaver control and fish habitat restoration may have changed and may continue to have minor changes on the prey that are available to grizzlies. Beaver control has reduced the amount of moist habitat that supports other prey species.

Roads constructed across the Martin/Radnor Wildlife Analysis Area facilitate access for trapping, hunting, firewood cutting, and other exploits, as discussed in the *Snags and Downed Wood Habitat* section of this chapter. Firewood cutting along open roads has decreased downed logs important for some prey species. Across the analysis area, open and closed roads facilitate human access, contributing to the risk of mortality or displacement of grizzlies (Exhibits Rg-5 and Rt-5). The cumulative amount of open roads by alternative on Forest Service and other lands are shown in Table 3-85, although the Radnor Resource Management Project proposed action, as of May 2014, would change an additional 0.7 miles of roads that are currently open year-round to no public wheeled motorized access. Administrative uses of closed roads for reforestation or road-related work may also affect grizzly bear use of the area. These and other activities such as routine road maintenance, watershed improvements, trail reconstruction, and measures to control weeds are foreseeable and scheduled to occur. An increased emphasis on road closures over the last 20 years appears to have had a positive effect on ungulate survivability during hunting seasons. Monitoring has shown that road restrictions in the analysis area are generally effective (Exhibit Rg-6). As stated in the April 2013 draft of the NCDE Grizzly Bear Conservation Strategy (Exhibit Rt-13), current levels of open roads and secure habitat in the Salish Demographic Connectivity Area are appropriate for grizzly bear conservation there, and are even "adequate to support females with off-spring".

Table 3-85. Open Road Densities across the 47.5 square mile Geographic Unit to Compare with Forest Plan Direction of 1.80 miles/square mile Maximum Forest Plan Unrestricted Road Density on USFS for this Geographic Unit (Exhibits Rg-5 and Rt-5).

	Alt. A	Alt. B	Alt. C
Unrestricted Road Miles, All ownerships	97.25 miles	95.9 miles	94.4 miles
Unrestricted Road Miles, USFS only	66.0 miles	65.3 miles	63.8 miles
Unrestricted Road Density, USFS only	**1.39 miles/square mile**	**1.37 miles/square mile**	**1.34 miles/square mile**

Cumulative effects of recreation and other activities in the area that could alter habitats and/or disturb or displace grizzlies are the same as those described above in the Cumulative Effects section for *Commonly Hunted Big Game.* A difference is that human presence, especially in residences, is associated with an increase availability of food rewards for bears. A mandatory food storage order for the area of the Flathead National Forest outside the Northern Continental Grizzly Bear Ecosystem (NCDE), including the Analysis Area, was signed in June 2011 (Exhibit Rt-13). However, food conditioning of grizzly bears occurs on private lands adjacent to the forest and the potential for adverse impacts to grizzly bears on the forest does exist (USDI FWS 2013b). It is expected that agriculture and other vegetation alteration would continue on adjacent private holdings. This may result in management elimination of some grizzlies and a reduction of natural food sources.

No geographic or man-made barriers exist within the Martin/Radnor Wildlife Analysis Area that would preclude grizzly bear movements to adjacent populations or recovery areas.

Hunting, trapping, and predator control may have had the greatest cumulative impact on grizzlies. Human access, available cover, and public attitudes largely determine mortality risk to grizzly bears. Grizzly bear harvest is currently closed in Montana. There have been some grizzly mortalities due to management removal, mistaken identity, and highway mortality in and near this area. In consideration of habitat conditions, human use, human dwellings, roaded access, and the number of reported observations, the mortality risk to grizzly bears is considered low-to-moderate. The spring black bear hunting season, administered by Montana FWP, is expected to continue in the analysis area. A variety of other research and monitoring efforts, such as that on snowshoe hares, western larch stand development, or on reed canary grass control methods, are likely to continue to occur with little or no effect on grizzly bears, other than possible short-term and short-distance displacement of this wide-ranging species.

Regulatory Framework and Consistency

The grizzly bear is classified as Threatened in Montana and is protected under the Endangered Species Act. The Martin/Radnor Wildlife Analysis Area is outside the recovery zone known as the Northern Continental Divide Grizzly Bear Ecosystem (USDI FWS 1993). It is listed in the Forest Plan as “unoccupied grizzly bear habitat,” based on habitat suitability combined with lack of consistent grizzly observations. However, grizzly bears are reasonably expected to occur anywhere in the analysis area (Exhibit Rt-13). Forest Plan direction includes pages II-24 through II-33 and Amendments 8, 9, and 11. Interagency Grizzly Bear Guidelines (Interagency Grizzly Bear Committee 1986) were adopted as Forest Plan Appendix OO.

Numerous aspects of Forest Plan direction that apply to the analysis area are positive for grizzly bears (Exhibit Rt-5). All alternatives would meet all applicable direction for grizzly bears, including that for motorized road access (See Table 3-85 above). No alternative would appreciably diminish the reproduction, numbers, or distribution of grizzly bears within the NCDE, nor would they reduce the likelihood of the survival or recovery of the grizzly bear population. See Exhibits Rt-2 and Rt-3 for documentation of USFWS consultation. If any active grizzly bear denning sites are discovered in or near any proposed vegetation management unit, area of road construction, or similar activity, activities would be modified if needed to protect habitat conditions and maintain reproductive efforts. While other factors outside of the Forest Service's control may impede grizzly bear recovery actions proposed in the project area are compatible with conserving grizzlies to a non-listed status and they are consistent with maintaining habitat for viable populations of this species at the regional scale. All alternatives are consistent with NFMA diversity requirements for wildlife, as described in the *Old Growth Habitat* section of this chapter. See Exhibit Rg-1 for more information.

Consultation with the USFWS for the grizzly bear will be completed on the selected alternative before the decision is finalized for the Martin Creek Resource Management Project (Exhibits Rt-2, Rt-3, and Rt-4).

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Sensitive Wildlife Species

Sensitive wildlife species (Tables 3-42 and 3-43 in the *Wildlife Introduction* section and in Exhibit Rs-1) are designated by the Regional Forester (FSM 2670.5) and managed under the authority of the National Forest Management Act. The Regional Forester removed the northern goshawk from the sensitive species list in July 2007 (Exhibit Rs-1). This species is still analyzed as an old growth associate. The bald eagle was delisted in the lower 48 States in July 2007, the gray wolf was delisted in May 2011, and the wolverine was removed from proposed listing in August 2014; these species have since been addressed as sensitive species on the Flathead National Forest.

This section, on Sensitive Wildlife Species, is divided into separate subsections, with direct and indirect effects following the affected area for each. Information about cumulative effects and regulatory framework and consistency is at the end of this section. The Biological Evaluation for Sensitive Wildlife Species has been incorporated into the text of this document with a separate signature/summary page in the project file (Exhibit Rs-3). Due to similarities in most aspects of their habitat needs and many potential effects, the bald eagle and peregrine falcon were combined below, as were the four species that typically use wetland riparian habitats (northern leopard frog, western (boreal) toad, northern bog lemming, and Townsend's big-eared bat). The bighorn sheep and common loon are sensitive wildlife species that would not be affected by this project and thus will not be discussed further (Table 3-44, above); Exhibits Rs-21 and Rs-23).

Several of these species are listed by the Montana Department of Fish, Wildlife, and Parks (FWP) as "Montana Animal Species of Concern" (Exhibit Rg-4). The ***northern leopard frog*** is the only sensitive species on the Flathead National Forest with an S1 listing, meaning that it is "at high risk because of extremely limited and/or rapidly declining numbers, range, and/or habitat, making it highly vulnerable to global extinction or extirpation in the state." The ***harlequin duck***, ***northern bog lemming***, and ***western (boreal) toad*** are listed as S2 species, meaning that they are "at risk because of very limited and/or declining numbers, range, and/or habitat, making it vulnerable to global extinction or extirpation in the state." The ***black-backed woodpecker***, ***common loon***, ***fisher***, ***flammulated owl***, ***peregrine falcon, Townsend's big-eared bat*** and ***wolverine*** are S3 species, "potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas." The fisher was petitioned for listing with the U.S. Fish and Wildlife Service (USFWS) (Exhibit Rs-8).

Analysis Area

The analysis area for direct, indirect, and cumulative effects on all sensitive wildlife species is the Martin/Radnor Wildlife Analysis Area (Figure 3-7, In *Wildlife Intro* section). At approximately 42.4 square miles (about 27,000 acres), it is large enough to include the home ranges of these species and is representative of effects of timber harvest, fuel reduction, road construction, firewood cutting, wildland fires, natural tree mortality, and other factors across the landscape. All habitat attributes used by these species are distributed across this area, within the bounds of natural physiographic variation. It is large enough to evaluate the ability of the

habitat to support populations of these species, but small enough to not obscure effects of the alternatives. All of the actions proposed in the alternatives are contained within this area. Past actions and current conditions beyond this area (i.e. on the adjacent Kootenai National Forest) that could affect wildlife in the analysis area were considered, such as open roads and trails that could have affected elk hunting season security areas (Exhibit Rb-1). No known or suspected population sinks for these species occur in or near the area. Larger-scale assessments for each of these species were also conducted to address population diversity concerns (Exhibits Rg-1, Rs-6, Rs-10, Rs-18, and Rs-20). The temporal span of the effects analysis for sensitive wildlife varies by species, as described below.

Bald Eagle and Peregrine Falcon

Introduction

The ***bald eagle*** (*Haliaeetus leucocephalus*) was delisted in the lower 48 States on July 9, 2007, and then became a USFS Region One Sensitive Species. In Montana, bald eagles nest in stands containing very large trees with uneven canopy structure and in direct line of sight of a large river or lake generally less than one mile away (Montana Bald Eagle Working Group 1994). Bald eagles prey on fish, waterfowl, and small mammals, steal food from other predators, and scavenge carrion. During the breeding season, important foraging habitat is usually less than ten miles from their nest. Some eagles stay in the general vicinity of the nesting area during winter while others may migrate hundreds of miles.

The ***peregrine falcon*** (*Falco peregrinus*) is also a USFS Region One Sensitive Species. For nest sites, the peregrine selects steep vertical cliffs that are generally large enough to dominate the surrounding area. These cliffs typically overlook a body of water and are located near open habitats that support a large number of small to medium birds for prey, such as wetlands, large bodies of water, or rivers. They also prey on birds over croplands and meadows and generally do not forage in dense forested habitat. Peregrines can travel substantial distances from their nests to foraging habitat. Some pairs are tolerant of human disturbance, while too much disturbance during the nesting season can cause nest abandonment for some pairs (USDI Fish and Wildlife Service 1984). The quality and quantity of water flowing into lakes can affect their ability to support prey species.

Away from their nests, bald eagles and peregrine falcons are most likely to feel the effects of timber harvest, fire, and insect epidemics through indirect effects on their food sources, such as changes in habitat quality for an aquatic prey species. Timber harvest, fuel reduction, wildland fire, and road construction can all impact current and potential bald eagle habitat by removing nest trees and screening cover. Also, disturbance of eagles and peregrines may increase and security near foraging sites may decline. Stand-replacing wildland fire can destroy or modify perches.

Information Sources

This analysis evaluates whether some harvest operations, fuel reduction, and road construction could alter potential nesting habitat, disturb foraging bald eagles or peregrines, and/or

affect their aquatic prey base downstream. Effects were determined by overlaying a GIS layer of potential habitat with proposed unit and road locations (Exhibits Rs-21 and Rs-22). Observations, monitoring, and habitat use information in and near the project area are found in Exhibit Rs-5. Wildlife population diversity concerns at the Flathead National Forest and larger scales are assessed in Exhibit Rg-1. See also Exhibits Rg-9 and Rr-3 and the sections on *Neotropical Migratory Birds and Riparian Habitat* and *Aquatic Resources* in this chapter.

Analysis Area

The spatial extent of analysis of effects on bald eagles and peregrine falcons is the same as that used for all sensitive wildlife species, as described above. For both species, the temporal extent of the analysis is 15 years, at which time actions with the potential for disturbing peregrines or eagles would be complete.

Affected Environment

Population Status

Bald eagle populations have increased dramatically nationwide, prompting the US Fish and Wildlife Service to remove the bald eagle from the Endangered Species List in 2007. In Montana, the bald eagle is a Special Status Species and has a state ranking of S4: "apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining" (Exhibit Rs-22). The Martin Creek area is located in bald eagle Management Zone 7 (Upper Columbia Basin), which includes all of Montana west of the Continental Divide (USDI FWS 1986). This zone is in the middle of the core population and produces almost 40 percent of the eaglets produced in Montana (Exhibit Rg-1), which is considered to support "one of the most productive populations in the western United States" (Hammond 2010). In the 2010 nesting season, there were 174 active bald eagle nests in northwestern Montana, fledging 190 young (Exhibit Rs-5). Bald eagle populations and productivity are increasing in Zone 7, as well as across the state (Exhibit Rg-1). Population growth has been attributed largely to the substantial reduction of environmental contaminants. Bald eagle nesting is distributed across the Flathead National Forest, with 11 active territories, four successful nests, and six young produced in 2009 (Exhibit Rs-5). Since 1980, the Forest has averaged 7.5 active territories, 5.2 successful nests, and 7.2 young produced each year.

One active bald eagle nest is known in the Analysis Area, associated with Upper Stillwater Lake. At least five other active bald eagle nests are within ten miles of the Martin/Radnor Analysis Area and thus may be expected to forage in the area. These nests have been monitored annually starting as early as 1980. None of these nests (Exhibit Rs-5) are located within the analysis area. Other nests may be located along the Stillwater River within ten miles of the Analysis Area. No nests occur within the Martin Creek drainage. At least four pairs nest within ten miles of the Martin Creek drainage and thus may be disturbed by proposed project activities (Tally, Whitefish, Lower Stillwater, and Upper Stillwater Lakes). There are no known areas in the Martin Creek drainage where bald eagles congregate to roost and feed. The Salish Mountains are not along a documented migratory route.

For peregrine falcons, dramatic population declines occurred from the 1950s through the 1970s due to pesticide accumulation and eggshell thinning. The species has increased in

recent decades and it was removed from the threatened and endangered species list in 1999. By 2003 there were an estimated 1000 pairs in the western United States, excluding Alaska. Peregrines are one of the most widely distributed birds in the world. In Montana they are generally found along the major river drainages, particularly in the western mountains (MPIF 2004). There is no recent documentation of peregrine falcons nesting in the proposed project areas, or the greater analysis area. There are three known nesting sites within the Flathead National Forest, the closest of which is about 10 miles to the southeast of the Martin Creek drainage. The Flathead National Forest cooperates in the monitoring of known and potential territories (Exhibit Rs-5). Biologists, researchers, interns, and volunteers have surveyed Montana's peregrine population for over 25 years. There is one recorded observation of a peregrine feeding within the analysis area, on Duck Lake.
For more information about these two species and their habitat at various scales, including that of the Flathead National Forest, see Exhibit Rg-1.

Habitat

About 933 acres across the Martin/Radnor analysis area appear to meet nesting requirements for bald eagles (Exhibit Rs-22). These areas are associated with Upper Stillwater Lake, Dog Lake, and the Stillwater River. There is a limited amount of potential nesting habitat within the Martin Creek drainage. This is associated with the Stillwater River and occurs near Martin Lakes (Exhibits Rs-5 and Rs-22). One bald eagle pair is known to nest within the larger Martin/Radnor Wildlife Analysis Area near Upper Stillwater Lake, possibly foraging along that lake, the Stillwater River, Martin Creek and its larger tributaries, and scattered among the early seral/structural stage open areas. The relatively dense network of roads in the Martin Creek drainage provides opportunities for foraging on roadkill, while also posing a hazard to the eagles themselves (Exhibit Rg-5).

The situation is similar for the peregrine falcon. Although the Martin Creek drainage does not support any potential nesting habitat for falcons, the area may provide feeding opportunities for falcons nesting in or near the larger Martin/Radnor Wildlife Analysis Area (Exhibit Rs-7). Potential habitat in the larger area is scattered in the LeBeau Natural Research Area, on state lands near Upper Stillwater Lake, and in three small areas on Flathead National Forest near the Stillwater River. The analysis area likely contains adequate avian prey species abundance, particularly on or near the larger water bodies.

In general, conditions for fish and other aquatic life are good throughout the Martin/Radnor Wildlife Analysis Area. See the *Aquatic Resources* section of this chapter for more information.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No actions such as timber harvest, precommercial thinning, road construction, or access management changes, are proposed with this alternative. The proposed BMP improvements on roads would not occur, nor would the culvert replacements. However, the net impact would not affect the fish population in Martin Creek or the Stillwater River to any extent that peregrine or eagle fishing opportunities would change. The fuel loading in some stands

would increase the chance of large intense wildland fires, increasing the potential for effects on bald eagle and peregrine falcon feeding opportunities. See section on *Aquatic Resources* in this chapter.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Proposed activities, particularly timber harvest, precommercial thinning, and road construction, have the potential to disturb peregrines using foraging areas such as Martin Lakes and upland foraging areas used by bald eagles (Exhibits Rs-5 and Rs-22). These areas are a small fraction of the available potential foraging habitat in the analysis area and potential disturbance would be short-term and minor. BMP road improvements and culvert replacements could have positive benefits for downstream food sources for bald eagles and peregrines. Seeding, tree and shrub planting, and shrub slashing would enhance habitat values for a variety of species preyed upon by bald eagles and peregrines. As discussed above in the section on *Neotropical Migratory Birds* in this chapter, the trail proposal, common to both action alternatives, has potential for short-term negative and long-term positive effects on riparian habitat. The implementation of the action alternatives would have no negative direct, indirect, or cumulative effects to bald eagle or peregrine falcon nesting habitat or wintering habitat, nor would it have any anticipated effects on mortality risk. A net loss of avian prey base is not expected with any of the proposed alternatives. Other aspects of the project, such as road access changes and dust abatement, would not have measurable effects on bald eagles or peregrine falcons in the Martin/Radnor Wildlife Analysis Area.

Black-Backed Woodpecker

Introduction

The black-backed woodpecker (*Picoides arcticus*) lives in boreal and montane conifer forests in Alaska, Canada, and the northern lower 48 states (Dixon and Saab 2000). In western Montana, black-backed woodpeckers may depend on one- to six-year-old forest burns with a resultant abundance of beetles and wood-boring insects (Hejl and McFadzen 2000; Hitchcox 1996; Hutto 1995a; Hutto 1995b; Saab, et al. 2004), although they have been known to make use of unburned areas that have high numbers of bark beetles (Dudley 2005). Population spurts associated with large fires and insect epidemics may be necessary for maintaining black-backed woodpecker populations across the landscape (Hutto 1995a and 1995b, Dixon and Saab 2000). Black-backed woodpeckers appear to be drawn away from the unburned forests within about 30 miles of a burn (Hoyt and Hannon 2002).

Hutto (2008), in a study of bird use of habitats burned in the 2003 fires in northwest Montana, found fire severity outstrips the influence of any other variable on the distribution of birds. Some species, including the black-backed woodpecker, were relatively abundant only in the high-severity burned areas. Hutto's results also suggested burned forests that were harvested fairly intensively (seed tree cuts, shelterwood cuts) within a decade or two prior to the fires of 2003 were much less suitable as post-fire forests to the black-backed woodpecker and other fire dependent bird species. Even forests that were harvested more selectively within a decade or two prior to fire were less likely to be occupied by black-backed woodpeckers.

Based on findings by Hejl and McFadzen (2000), black-backed woodpeckers prefer areas where 50 percent or more of the trees were killed by fire that had at least 40 percent canopy closure before the fire and were at least 200 acres in size (Russell, et al. 2007).

Information Sources

Data used in this analysis included aerial photography, stand exams (FSVeg database), old growth field surveys, the R1 Vegetation Map, and research literature. Observations, monitoring, and habitat use information in and near the project area are found in Exhibit Rs-5. For more information, see the *Forest Vegetation* section of this chapter, Exhibits Rg-9 and Rs-10, and Project Record section "Rd." Population diversity concerns at the Flathead National Forest and larger scales are assessed in Exhibit Rg-1.

Analysis Area

The spatial extent of analysis of effects on black-backed woodpeckers is the same as that used for all sensitive wildlife species, as described above. The temporal scale of the effects analysis extends 100 years into the future, enough time for areas of dense trees to develop, with the potential for becoming black-backed woodpecker habitat if they burn.

Affected Environment

Population Status

Evidence suggests the black-backed woodpecker is increasing in numbers in the United States (as cited in Dixon and Saab 2000). Samson (2006) concluded that habitat in the USFS Northern Region exceeds amounts needed for a minimum viable population (Exhibit Rs-20) and numerous large fires have burned in the area since then. Hutto, with the Avian Science Center, collected bird survey data from within each of 17 separate fires in western Montana in each of the four years following the fires of 2003, including six fires on the Flathead National Forest. They found that many bird species are relatively common in burned forests, with the black-backed woodpecker more restricted to burned forest conditions than any of more than 100 other bird species for which they had sufficient data. Black-backed woodpeckers were observed in the 2007 Brush Creek Fire Area to the south of the Martin/Radnor Wildlife Analysis Area (Exhibit Rs-5).

A multi-scale evaluation of compliance with NFMA requirements to provide a diversity of animal communities on the Flathead National Forest (Exhibit Rg-1) concluded that there is a substantial amount of black-backed woodpecker habitat on the forest due to the increasing number of large, high-intensity fires in the last decade. An analysis of vegetation composition, structure, and landscape pattern on the Forest (Forest Plan Monitoring and Evaluation Report: Fiscal Years 2008-2010; Exhibit Rg-8, monitoring item #68) found that 15 percent of the Forest has had wildfire since 1999. An analysis of ten large fires indicated that an average of 47 percent of the area within the fire perimeter burned with high intensity, creating high quality habitat for black-backed woodpeckers. These large, stand replacing wildfires have been part of the natural processes which have shaped historic conditions on the Forest and are moving areas towards larger patch sizes which have been the norm historically. For more

information about this species and its habitat at various scales, including that of the Flathead National Forest, see Exhibits Rg-1, Rg-3, Rs-18, and Rs-20.

Habitat

No stands in the Martin/Radnor Wildlife Analysis Area drainage currently support recent post-fire black-backed nesting or feeding habitat (Rs-10). Areas that would provide ideal black-backed woodpecker habitat in the case of a future large wildland fire are well distributed across the Martin/Radnor Wildlife Analysis Area, where a single block of unburned connected mid- and late-seral forest covers 20,544 acres. The area appears to have the potential to support 93 black-backed woodpecker home ranges, assuming 200 acres for a home range and that a future fire could burn with the fire severities most used by this species. Sections on *Snags and Downed Wood Habitat* and *Old Growth Habitat* further discuss the potential of the area to provide components of black-backed woodpecker habitat.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No additional actions, such as timber harvest, fuel reduction, or road construction, are proposed with this alternative. Indirectly, taking no action to reduce fuels would increase the potential for stand-replacing fires to occur. This could result in large areas of highly suitable habitat for this species, depending on the size and intensity of such a wildland fire. The vulnerability of potential nest tree loss to firewood cutting is discussed in the section on *Snags and Downed Wood Habitat* in this chapter.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

These alternatives would reduce the likelihood of the creation of new post-fire habitat for black-backed woodpeckers. Due to the lack of recent post-fire habitat in any of the proposed units, implementation of any of the action alternatives would not remove any current potential post-fire feeding or nesting habitat for black-backed woodpeckers. Timber harvest would remove some trees infested with mountain pine beetle, Douglas-fir beetle, and other insects sought after by woodpeckers. Other areas that support such prey species would be left intact, as described in the *Forest Vegetation* section of this document. Timber harvest would remove some potential future nesting and feeding trees on approximately 865 acres in Alternative B (Exhibit Rs-10). Due to dropping or modifying harvest units for other concerns, loss of potential future nest and feeding trees would occur on 459 acres in Alternative C. The action alternatives, especially Alternative B, would reduce the chance of large stand-replacing fire, as shown in the *Fire and Fuels* section of this chapter. Other actions, including precommercial thinning, planting and seeding, road construction, motorized road access changes, and other road work, would not have measurable effects on this species.

Fisher

Introduction

The fisher (*Pekania* [*Martes*] *pennanti*) is also a USFS Region One Sensitive Species. This larger, weasel-like predator seems to do best in lower- to mid-elevation areas with shallower snow, partly due to relatively small feet for its body size (Garroway, et al. 2011; Raley, et al. 2012). In the Northern Rockies, fishers evolved under a disturbance regime that created numerous openings in a matrix of moister, mature forested habitats, although large open areas, including large wetlands, are avoided (Weir and Corbould 2010; Schwartz, et al. 2013; Sauder and Rachlow 2014). Fishers seem to require the complex structure that often occurs in late-seral forests – dense canopies; large trees, snags, and logs; tree cavities and branch platforms (Aubry, et al. 2013; Raley, et al. 2012; Olson, et al. 2013). Areas of otherwise suitable habitat can be isolated when cover between home ranges is removed (Fisher and Wilkinson 2005; Garroway, et al. 2011). The average home range for a female fisher in this area is expected to be about 15 square miles (Jones 1991, Heinemeyer and Jones 1994).

Fishers appear to be vulnerable to loss of overhead cover and habitat fragmentation due to factors such as wildland fire, timber harvest, and timber salvage (Powell and Zielinski 1994, Weir and Corbould 2010, Sauder and Rachlow 2014, Zielinski, in press). Fisher seem able to tolerate some level of timber harvest and fuel reduction, although it is recommended to protect large trees with disease or defects, promote diverse multi-stage stands, and maintain habitat connectivity (Garroway,et al. 2011;, Schwartz, et al. 2013; Zielinski, in press,). Fishers are apparently tolerant of human activity, but the ease of human access into an area correlates with fisher mortality through direct or incidental trapping (Claar, et al. 1999). Habitat for the species is expected to expand under future climate scenarios as long as fishers can disperse through unsuitable habitat (Olson, et al. 2013).

Information Sources

The effects to the fisher were analyzed using GIS-generated predicted habitat (Exhibit Rs-8). Forested riparian connectivity was defined as pole-sized or larger forests (mid to late seral) in a zone that extends 300 feet away from riparian features such as lakes, ponds, wetlands, and streams. Forested upland connectivity was defined as these same forests without regard to proximity to wet areas. These areas were overlaid digitized layers depicting proposed units and road construction. Data used in this analysis included aerial photography; stand exams (FSVeg database); old growth field surveys; field surveys of snags and downed logs in and near the area; the FACTS activity tracking database; the R1 Vegetation Map; and GIS coverages and data sets for features such as old growth habitat, riparian areas, general forest attributes, slope, aspect, habitat types, and road locations. Observations, monitoring, and habitat use information in and near the project area are found in Exhibit Rs-5. Open road density calculations are given in Exhibit Rg-5. Exhibit Rg-9 provides additional information about the vegetation data used. See also the sections in this chapter on *Forest Vegetation*, *Snags and Downed Wood Habitat*, and *Old Growth Habitat*.

Analysis Area

The spatial extent of analysis of effects on fishers is the same as that used for all sensitive wildlife species, as described above. For this project, the analysis of effects on fisher spans as far as 100 years, enough time for affected stands to develop into fisher habitat and for snag and downed wood habitat to develop as well.

Affected Environment

Population Status

The U.S. Fish and Wildlife Service analyzed potential factors that may affect the habitat and range of the fisher in the U.S. Northern Rocky Mountains, including timber harvest and management, climate change, wildland fire, forest disease, furbearer trapping, disease and predator relationships, inadequacy of existing regulatory mechanisms, and the effects of small population size. The USFWS concluded in 2011 that these potential factors do not significantly impact the species and that the fisher does not warrant protection under the Endangered Species Act in Idaho, Montana, or Wyoming. Nevertheless, the USFWS recognizes that the fisher in the Northern Rockies may benefit from increased management emphasis due to its need for forest cover and its susceptibility to capture and mortality from furbearer harvest. The project area lies within the larger Trapping District One, encompassing most of northwest Montana, which has a quota of two fishers, and one fisher was harvested in 2009. No fishers were trapped in Flathead County from 1996 to 2013 (Exhibit Rg-1).

The fisher is a Montana Species of Concern (Exhibit Rs-22). Fishers are distributed in northwest and west central Montana and northern and north-central Idaho, but are believed to occur at low densities. Fishers were translocated from the Midwest and British Columbia to the northern Rocky Mountains between 1959 and 1991 in five separate efforts. One effort about 30 years ago occurred approximately ten miles north and east of the Martin Creek project area. Presently, the fisher representation in Montana and Idaho includes a recently discovered remnant native population and descendants of relocated fishers. Fisher tracks were reported in the Griffin Creek drainage in spring 2009 by a lynx researcher (Exhibit Rs-5) about 15 miles south of the Martin Drainage. In 2007, two unconfirmed fishers were reported just south of the Martin Creek drainage in the Good Creek drainage. For these sightings, plus historical and trend information, see Exhibit Rs-5.

Fishers are more difficult to monitor than most species due mostly to its low population density. Efforts to collect fisher hair for DNA confirmation have been put out in winter on numerous portions of the Flathead National Forest since 2007, but fisher presence has not been confirmed through that effort. Montana FWP conducts winter track surveys for forest carnivores throughout the Flathead National Forest, which resulted in 0 to 2.5 fisher detections annually from 1990 to 2000, with no apparent trend in the data (Exhibit Rg-8).

For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see Exhibits Rg-1, Rg-3, and Rs-6.

Habitat

Fisher habitat estimates for the Flathead National Forest and Region One were updated in 2008 using on-the-ground Forest Inventory and Analysis (FIA) plot data. On the Flathead National Forest, forest that is modeled as being suitable for fisher totals 43.5 percent (8.6 percent for summer habitat and 34.9 percent for winter habitat) with 90 percent confidence intervals of two to three percent (Exhibit Rg-1).

Defining potential fisher denning/resting habitat for this analysis applied the approach of the 2013 USFS Full Model for fisher habitat (Olson 2013). This looked at areas of older forest with high canopy cover in patches of at least 160 acres and connected to other patches by mid-to-late seral riparian and upland forest. Forested upland connectivity was defined as pole-sized or larger forests with at least 40 percent canopy cover. Reviewed patches along the edges to find that most are contiguous with other potential denning/resting habitat outside the analysis area on the Kootenai National Forest or in the Good Creek drainage. The resulting potential fisher habitat is made up of over 9800 acres of denning/resting habitat, providing three potential female home ranges (Exhibits Rs-8). Mapped fisher denning/resting habitats in this analysis area are highly likely to have abundant large trees and large downed wood. This is evidenced by the fact that 83 percent is in moist potential vegetation types and 34 percent is in known or suspected old growth or replacement old growth. It appears the current distribution of habitat for fishers would allow dispersal to continue between the home ranges in the Martin/Radnor Wildlife Analysis Area and neighboring areas. Suitable denning and feeding habitats occur in adjacent drainages. Sections on *Snags and Downed Wood Habitat* and *Old Growth Habitat* further discuss the potential of the area to provide habitat components.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No actions such as timber harvest, fuel reduction, road construction, or road access changes are proposed with this alternative. In lieu of wildland fire or other stand-replacing disturbance, the availability of forested connectivity and of denning and hiding sites would generally increase, as would habitat used by numerous species preyed on by the fisher. The fuel loading in some stands would increase the chance of large hot fires in adjacent areas, increasing the potential for destruction or isolation of fisher habitat. Such wildland fires would be less acceptable than if the area had experienced little or no timber harvesting in the past.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

The action alternatives would have regeneration harvest in potential fisher denning and resting habitat as shown in Table 3-86. Regeneration harvest and about half of the intermediate harvest would decrease the tree canopy to a level less than 40 percent. In most units, wind-firm live trees and snags would be left standing, thus helping to maintain the potential for future fisher habitat. Early seral/structural stage stands created by logging would provide habitat for some fisher prey species, increasing sources of food. Fuel reduction and site preparation would remove some potential den structures. However, this along with precommercial thinning and tree and shrub planting, would also accelerate regeneration of canopy

cover and reduce the probability of fire spreading to fisher habitat of higher quality. The more important effects of timber harvest on forested connectivity habitat for fishers are shown in Table 3-87 and Exhibit Rs-8.

Table 3-86. Potential Fisher Habitat and Vegetation Management Effects by Alternative (Exhibit Rs-8).

	Alt. A	Alt. B	Alt. C
Change from Denning/Resting to Forested Connectivity	0 ac	0 ac	26 ac
Change from Denning/Resting to not fisher habitat	0 ac	119 ac	0 ac
Change from Forested Connectivity to not fisher habitat	0 ac	421 ac	79 ac
Total Denning/Feeding Habitat (and % habitat change)	9833 ac (0%)	9714 ac (1.2%)	9807 (0.3%)
Total Forested Connectivity (and % habitat change)	9964 ac (0%)	9543 ac (- 4.2%)	9885 ac (- 0.8%)

Table 3-87. Effects on Forested Connectivity Relevant to Fishers (Exhibit Rs-8).

Unit(s)	Forested Connectivity Concern for Fisher
13, 16, 17, 18	In Alternative B, these units together would sever connections between areas of fisher denning/resting habitat. These four units were dropped from Alternative C.
22	Narrows riparian connectivity on denning/resting habitat. Units 22, 23, and 24 together, if all regeneration harvest as they are in Alternative B, lengthen the distance needed to travel to adjacent area of denning/resting habitat from approximately 1500 to 7800 feet. This unit was dropped from Alternative C.
24	Severs ridgeline connection to denning/resting habitat outside analysis area in Alternative B. Narrows riparian connectivity on denning/resting habitat. Units 22, 23, and 24 together, if all regeneration harvest, lengthen distance needed to travel to adjacent area of denning/resting habitat. This unit was changed to CT in Alternative C.
33	Severs forested connectivity in Alternative B because canopy cover is below 40% on both sides of unit. This unit was reshaped in Alternative C.
39	In Alternative B, west end of unit severs ridgeline connectivity to denning/feeding habitat outside the analysis area. This unit was reshaped in Alternative C.

Approximately 1.0 to 5.4 miles of permanent and temporary road construction would occur through potential fisher habitat in Alternatives B and C (Exhibit Rs-8). On new permanent roads (3.1 miles in Alternative B and 0.3 miles in Alternative C), over-snow motorized travel may disturb or displace fishers or their prey species. Motorized access changes would help protect snag and downed wood habitat in fisher dening/resting habitat and forested connectivity along nearly all of their lengths (about 2.9 miles in Alternative B and along about 2.8 miles in Alternative C).

Timber harvest, precommercial thinning, road construction, and other actions could cause temporary disturbance to fisher, with possible temporary displacement from the immediate area. Seeding, tree and shrub planting, and shrub slashing would enhance habitat values for a variety of species preyed upon by fishers. Other actions, including road maintenance, culvert replacements, and trail construction, would not have measurable effects on this species. Fishers, while currently rare, should see eventual improved habitat overall with the implementation of the project, even if there is some temporary reduction of fisher habitat quality.

Flammulated Owl

Introduction

In western Montana and Idaho, the tiny flammulated owl (*Otus flammeolus*) often nests in older, open, and relatively dry mixed-species forests. These stands nearly always support ponderosa pine, but sometimes have large Douglas-fir instead. Flammulated owls prey on small birds, moths, and grasshoppers for at least part of their life cycle. These prey species use more open forests or are more easily caught by flammulated owls in such open stands. Special habitat features used by flammulated owls include large-diameter trees with cavities at least as large as those made by northern flickers, occasional clusters of thick understory vegetation, and small open areas used for foraging (Exhibits Rs-2). Wright (1996) and Wright, et al. (1997) found that flammulated owls nested in areas with a higher proportion of low/moderate canopy cover assessed at a landscape scale and that occurrence correlates with the number of ponderosa pine trees over 15 inches DBH. Home ranges in this area are expected to exceed 14 acres (Samson 2006, Exhibit Rs-20) and average about 37 acres (McCallum 1994).

Timber harvest, wildland fire, and fire suppression can affect this species in both positive and negative ways. Timber harvest and stand-replacing fire can destroy nest structures and prey supplies. Flammulated owls disappear from stands after the large tree component is removed (Hayward and Verner 1994). On the other hand, frequent low-intensity fire in ponderosa pine/Douglas-fir stands can maintain open conditions required by flammulated owls (McCallum 1994). Flammulated owls have been located in selectively logged stands where the logging was relatively light and where numerous large trees and pockets of smaller trees remained, although the elimination of understory trees would remove thickets needed for foraging, roosting, singing, and cover (Wright, et al. 1997). Wright, et al. (1997) found that flammulated owls were present in approximately half of the selectively logged stands in her study area south of Missoula, Montana. Howie and Ritcey (1987), in a British Columbia study, found that most owls occurred in mature and old stands of Douglas-fir with 35 to 65 percent canopy closure that had been selectively harvested two to three decades prior.

Information Sources

Potential flammulated owl habitat was identified as warm and dry late-seral/structural stage forests dominated by Douglas-fir or ponderosa pine with moderate canopy cover levels (Exhibit Rs-2). Data used in this analysis included aerial photography; stand exams (FSVeg database); old growth field surveys in and near the area (Exhibit Q-2); field surveys of snags and downed logs in and near the area; the R1 Vegetation Map; and GIS coverages and data sets for features such as old growth habitat, general forest attributes, slope, aspect, habitat types, and road locations. Observations, monitoring, and habitat use information in and near the project area are found in Exhibit Rs-5. See the Forest Vegetation section of this chapter and Exhibit P-4 for more information. Exhibit Rg-9 provides additional information about the vegetation data used.

Analysis Area

The spatial extent of analysis of effects on flammulated owls is the same as that used for all sensitive wildlife species, as described above. For this project, the analysis of effects on flammulated owls spans as far as 100 years, at which time areas regenerated by this project are likely to be used by this species.

Affected Environment

Population Status

In Montana, the flammulated owl is a Species of Concern (Exhibit Rs-22). There have been 643 flammulated owl observations submitted for Montana, with numerous sightings in western Montana within the last five years and indirect evidence of breeding well distributed across this portion of the state.

The 2005 Forest Service Region 1 survey effort yielded a total of 243 flammulated owl detections which were widely distributed across western Montana and north-central Idaho. This owl is believed to have very low relative abundance on the Flathead National Forest and was detected on 4.9 percent of the suitable habitat survey plots (Exhibit Rs-5); this equates to a low rate of detection (Cilimburg 2006). Personnel at the Avian Science Center in Missoula conducted additional surveys on six national forests in Region One in 2008, with similar results, but did not include the Flathead National Forest due to this owl's low probability of detection on the Forest. The presence or absence of this owl may be related to the distribution of suitable habitat at a landscape scale. Prior to the 2000 fires, Wright (1996) conducted a two-year study of flammulated owls on the Bitterroot National Forest. Using a "callback survey," she recorded approximately 100 flammulated owl observations. Ninety percent of these observations were clustered (greater than three owls per transect). A multi-scale evaluation of compliance with NFMA requirements to provide a diversity of plant and animal communities on the Flathead National Forest (Exhibit Rg-1) concluded there is no scientific evidence the flammulated owl is decreasing in numbers in Region One and that well-distributed, abundant flammulated owl habitat exists on today's landscape. Habitat modeling showed that flammulated owl habitat is naturally limited on the Flathead National Forest (Samson 2006 [updated 2008]), but there is currently no evidence that their population on the Flathead Forest is in decline.

Flammulated owl presence in the project area has not been confirmed. Flammulated owls are particularly difficult to locate because they are nocturnal, have low population densities, and display secretive behavior. One common technique used to detect them is to elicit vocal responses by broadcasting taped owl vocalizations at night. Flammulated owls have a relatively "quiet" call that is difficult to detect at a distance. In addition, this owl may spook in response to the presence of other owls which are their predators, such as barred owls. Call-back surveys for this species were done in June 2002 in the most likely habitat areas in the nearby Logan Creek area (Exhibit Rs-5). In June 1992, a flammulated owl was detected in the Little Wolf Creek drainage, about 15 miles southwest of the Martin Creek drainage on the adjacent Kootenai National Forest (Exhibit Rs-5). The next closest observations were of three or four owls about 40 miles to the southwest. These owls were located in mixed-conifer stands dominated by Douglas-fir, western larch, and lodgepole pine, but lacking in ponderosa pine.

Nearly identical stands are distributed across the Martin/Radnor Wildlife Analysis Area. In addition, flicker and pileated woodpecker-sized nest and roost cavities are very common across the analysis area (Exhibit Q-2).

For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see Exhibits Rg-1, Rg-3, and Rs-16.

Habitat

Habitat modeling done by the Forest Service suggests habitat for the flammulated owl is abundant and well-distributed in USFS Region One. Samson (2006 [updated 2008], Exhibit Rs-20) estimated that 0.3 percent of the Flathead National Forest provided suitable habitat based on FIA on-the-ground plot data. On the Flathead National Forest, the stands preferred for nesting by flammulated owls are naturally limited by climate, terrain, and soil conditions. This species and its habitat appear to be well distributed and abundant on today's landscape. On the Flathead National Forest, flammulated owl habitat is naturally limited.

Approximately 1726 acres across the Martin/Radnor Wildlife Analysis Area meet the description of areas where flammulated owls were found nearby (Exhibits Rs-2 and Rs-5). None of these stands are dominated by mature or old growth ponderosa pine, although such trees are scattered at low densities across the area. Most of the potential habitat is on State or private lands in the lower elevations of the analysis area. Assuming a home range of about 40 acres, there are 176 home ranges well distributed across the analysis area, four of which are on NFS lands (Exhibit Rs-2). Fire suppression in the area continues to result in many older forests becoming filled in with thick understories and mid-stories. This increases the risk of extensive tree mortality due to stand-replacing fire or pathogens.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No actions, such as timber harvest, precommercial thinning, road construction, or road access changes, are proposed with this alternative. Continued accumulation of plant growth in the understory and mid-story over time would further reduce habitat value for this species while increasing the chance that potential nest structures would be consumed by stand-replacing fire. Large Douglas-fir trees are likely to continue to succumb to Douglas-fir beetles and root disease at a rate that could reduce the quality of flammulated owl habitats. The vulnerability of potential nest tree loss to firewood cutting is discussed in the section on *Snags and Downed Wood Habitat* in this chapter.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Alternatives B and C would have vegetation management (all shelterwood harvest) in stands that have potential for current use by flammulated owls (Table 3-88). In Alternative B, this could temporarily negate the habitat value of two potential home ranges (Exhibit Rs-2). Longer-term negative effects on potential flammulated owl habitat would be reduced in both action alternatives because silvicultural prescriptions have been designed to retain many or all of the larger, wind-firm trees wherever they exist, and also some of the understory and mid-

story trees. The removal of mid-story competition is also expected to increase the resilience of Douglas-fir and ponderosa pine. Vegetative manipulation that would open up stands and remove understory vegetation would generally benefit flammulated owls in the long term, although harvesting itself has the potential of removing nest trees. If active flammulated owl nesting is discovered in any proposed unit, activities would be modified if needed to protect nest stand conditions and maintain reproduction efforts. In this project, no healthy, dominant ponderosa pine would be harvested, since all live ponderosa pine over seven inches DBH are to be retained unless they compromise safety. The same is prescribed for all live and dead Douglas-fir greater than 25 inches DBH. In Alternative B, temporary road "C" would pass through about 1000 feet of potential flammulated owl habitat, but this is entirely inside Unit 6, a shelterwood regeneration harvest.

Table 3-88. Timber Harvest Units in Potential Habitat for Flammulated Owls (Exhibit Rs-2).

	Alternative A	Alternative B	Alternative C
Vegetation Management (all Shelterwood Harvest)	(None)	77 acres (Units 6, 22, and 23)	12 acres (Unit 23)
Number of Potential Home Ranges across Analysis Area	17	15	17

Over the longer-term, precommercial thinning in the drier stands would make many stands much more likely to support flammulated owl nesting in the future. See the *Forest Vegetation* section of this chapter for more information. With the reduced tree density and more open canopy created by harvest and by precommercial thinning, remaining trees would be subject to less competition for limited water and nutrients, improving their ability to withstand long-term drought and improving their resilience to stand replacing wildland fire and to other causes of a changing environment.

Motorized access changes would help protect snag and downed wood habitat in flammulated owl habitat along about 0.6 miles in Alternative B and along about 0.8 miles in Alternative C. Other actions, including roadwork, culvert replacements, access management changes, seeding, shrub planting and slashing, and trail construction, would not have measurable effects on this species.

Gray Wolf

Introduction

For gray wolves (*Canis lupus*), adequate prey base and security from risk of mortality are the two major components that provide survival and recovery value (USDI FWS 1987; Witmer, et al. 1998). Wolves in the Rocky Mountains appear to select landscapes with relatively lower elevation and flatter terrain. Habitat preferences appear to relate more to prey than to cover. The predominant prey of wolves in the northern Rockies is white-tailed deer, with lesser amounts of moose, elk, beaver, and smaller animals. A wolf pack would usually move up to six miles to a number of rendezvous sites, typically meadows, until the pups can travel with adults. Within their home ranges in and near Glacier National Park, wolves concentrated their hunting in wintering areas of white-tailed deer (Kunkel and Pletscher 2001). Another

important habitat component appears to be corridors for travel and dispersal, typically with vegetative cover and relatively shallow snow. The effects of timber harvest, insect epidemics, and fire on wolves are best defined by effects on their prey, much of which depend on early seral/structural stages interspersed with cover, shelter, and water. Although lesser-used roads and trails can facilitate wolf travel, frequently used roads can reduce wolf habitat security and increase the potential for mortality (Thiel 1985).

Analysis Area

The spatial extent of analysis of effects on gray wolves is the same as that used for all sensitive wildlife species, as described above. This analysis spans up to 20 years, at which time areas affected by this project are likely to provide hiding cover. In addition, human activities associated with this project that could disturb or displace wolves would have ceased.

Information Sources

The effects on gray wolf are discussed in relationship to acres and the spatial arrangement of hiding cover lost, as well as ease of human access, as described in the section above for *Commonly Hunted Big Game* (Exhibits Rb-1, Rb-3, and Rb-7). Road information can be found in Exhibit Rg-5. Effects on connectivity cover are in Exhibit Rg-7. Exhibit Rg-9 provides additional information about the vegetation data used.

Affected Environment

Population Status

Five areas in mountainous regions of Washington, Idaho, Montana, and Wyoming currently support populations of wolves (Exhibit Rs-14). The USFWS recently concluded that the population of wolves in these states has achieved biological recovery objectives. Wolf population trend is upward, and the recolonizing population in northwestern Montana continues to expand. At the end of 2011, there were a minimum of 287 packs (109 breeding pairs) and 1774 wolves in the Northern Rockies Distinct Population Segment (Exhibits Rg-1 and Rs-14). Most of the increases in Montana's wolf population occurred in the northwest Wolf Management Unit 1, which includes the project area.

Montana laws allow wolves to be killed during an official hunting season, if the wolf is seen killing or threatening to kill livestock or dogs, to protect human life, and for wolf-livestock conflicts as authorized by Montana FWP. To avoid relisting, Montana would carefully monitor its wolf population and would maintain at least 150 wolves and 15 breeding pairs.

The Martin Creek area has sufficient prey to support denning wolves year round, although no wolf dens have been located there or on any other part of the Tally Lake Ranger District. Records of wolves in and near the analysis area are in Exhibit Rs-5. For more detailed population, monitoring, management, and legislation information, see Exhibits Rg-1 and Rs-14.

Habitat

The project area contains key habitat components in sufficient abundance and distribution on an annual basis to sustain a viable wolf population. Key components of wolf habitat (USFWS 1987) are: 1) a sufficient, year-round prey base of ungulates and alternative prey; 2) suitable and somewhat secluded denning and rendezvous sites; and 3) sufficient space with minimal exposure to humans.

About 75 percent of the Martin/Radnor Wildlife Analysis Area currently functions as hiding cover and/or thermal cover, well distributed across most of the analysis area (Exhibit Rb-3). Potential wolf prey is plentiful and well distributed in the analysis area. These are primarily ungulates (white-tailed deer, mule deer, moose, and elk) and beavers. Ungulate populations, especially white-tailed deer, appear to be at healthy numbers (Exhibits Rb-2). No specific ungulate calving or fawning sites have been identified in the analysis area, as these appear to be dispersed. Moose, beaver, and several smaller prey species are also yearlong residents. Several beaver ponds are scattered throughout the analysis area. For more information about potential prey species, cover, and security from disturbance, displacement, and mortality, see sections in this chapter on *Commonly Hunted Big Game* and *Neotropical Migratory Birds and Riparian Habitat.*

The relatively dense network of roads in the Martin/Radnor Wildlife Analysis Area provides many opportunities for wolves to forage on road kill, while also posing a danger to the wolves themselves (Exhibit Rg-5). Road restrictions in the analysis area are generally effective (Exhibit Rg-6). For the situation across the larger cumulative effects area for these species, see the Cumulative Effects section below, which also includes information about road densities by Geographic Unit.

Environmental Consequences

Indirect and Direct Effects of Alternative A (No Action)

No actions, such as timber harvest, fuel reduction, road construction, or road access changes are proposed with this alternative. The lack of new openings and canopy thinning could mean less forage available for prey eaten by wolves, but this does not appear to be limited in the Martin/Radnor Wildlife Analysis Area. Indirectly, taking no action to reduce fuels would increase the potential for stand-replacing fires to occur, which could result in large areas of decreased suitability or unsuitable habitat, and possibly mortality associated with heat intensity. The level of effects would be dependent on the size and intensity of such a wildland fire. See the *Commonly Hunted Big Game* section of this chapter for more information.

Indirect and Direct Effect of Alternatives B (Proposed Action) and C

Timber harvest, fuel reduction, and road construction in these alternatives would affect cover used by large mammals such as wolves and their prey, as discussed in the section in this chapter on *Commonly Hunted Big Game*. The short-term loss of hiding cover would occur on 90 (Alternative C) to 591 acres (Alternative B) (Table 3-61 in the *Commonly Hunted Big Game* section of this chapter, above, and Exhibit Rb-3). In both action alternatives, this includes some units that would alter forested connections, although alternate routes would

remain in all cases (Exhibit Rg-7). There would be an eventual increase in the quality of hiding cover in many harvest units. Several commercial harvest units would remove hiding cover, but hunting season security habitat usable by wolves and several of their prey species would remain essentially the same or would improve, due to motorized access management changes. Prescribing the retention of many large live trees, snags, and downed wood help provide for some cover in the units. In all action alternatives, shrubs would be planted in and near some harvest units near riparian areas if funding is available. This would enhance big game forage, feeding and nesting sites for songbirds, and hiding cover values for a wide variety of wildlife species.

Temporary displacement of individual animals might occur during preparation or implementation of activities. There would be no direct or indirect effects on wolves from disturbance to key habitat areas such as den sites, rendezvous sites, or whelping sites in or beyond the area where this project is proposed. On new permanent roads (3.1 miles in Alternative B and 0.3 miles in Alternative C), over-snow motorized travel may disturb or displace wolves or their prey. Motorized access changes would help deduce potential disturbance to wolves along about 2.9 miles in Alternative B and along about 2.8 miles in Alternative C.

Based on the nature and duration of the proposed project, the mortality risk for wolves would remain low-to-moderate. If gray wolf denning or rendezvous sites are identified in the project area in the future, existing Forest Plan standards and guidelines would be implemented to ameliorate potential adverse effects. Other aspects of the project would not have measurable effects on wolves.

Harlequin Duck

Introduction

The harlequin duck, Histrionicus histrionicus, is a sensitive wildlife species on the Flathead National Forest. Across North America, the range of the harlequin duck has decreased dramatically from historical levels (Reichel and Genter 1993). It is a Partners In Flight Priority 1 species and a Montana Species of Concern with an S2B status, meaning it is at risk because of limited and/or potentially declining population numbers, range and/or habitat.

For nesting and brood-rearing, harlequin ducks appear to prefer swiftly flowing mountain streams of second order or greater, gradients of one to seven percent, some areas of shallow riffles (Fairman and Miller 1990), clear water, and gravel to boulder-size substrates (Bruggeman 2008). Female harlequins and their young typically live on oxbows and ponds adjacent to mountain streams until the ducklings are old enough to feed and travel in fast stream currents. Habitat use increases with overhanging vegetation, undercut stream banks, and log jams, with instream loafing sites available on boulders or gravel bars adjacent to swiftly flowing water. In Montana, Wyoming, and southern Idaho, these ducks use waters bordered by shrubs, or pole or immature-sized lodgepole pine, Engelmann spruce, and Douglas-fir. The likelihood of an area being used for breeding increases with proximity to occupied habitat. Absence of human disturbance may also increase likelihood of use for nesting, although harlequins appear to be more tolerant of human activities when in brood-rearing

areas. Timber harvest, insect epidemics, and wildland fire can affect this species through destruction of nest structures and changes in availability of large woody material. These factors can also decrease aquatic food sources through changes in water quality, quantity, and temperature.

Information Sources

The effects on harlequin ducks were evaluated by overlaying GIS-generated maps of potential stream and river habitats with proposed vegetation management units and road construction (Exhibit Rs-15). Observations, monitoring, and habitat use information in and near the project area are found in Exhibit Rs-5. For more information about effects analysis methods, conclusions and cumulative effects, see the *Aquatic Resources, Neotropical Migratory Birds and Riparian Habitat,* and *Snags and Downed Wood Habitat* sections of this chapter.

Analysis Area

The spatial extent of analysis of effects on harlequin ducks is the same as that used for all sensitive wildlife species, as described above. The analysis of effects on harlequin ducks and their habitat extends out about 15 years, at which time riparian conditions and effects of the alternatives are likely to stabilize.

Affected Environment

Population Status

On the Flathead National Forest, there have been repeated observations of eight broods from five locations in the North Fork and South Fork drainages in the last ten years. Martin Creek and the Stillwater River have not been surveyed for potential harlequin habitat nor for presence of the species, although Montana FWP planned to do late-season monitoring of these reaches in 2014, looking for presence of adults and possible young (Hammond, pers. comm. 2013). The closest known observations are about four miles to the northeast. The closest suspected reproduction is in the Swift Creek drainage about four miles east of the Analysis Area. See Exhibit Rg-1 for multi-scale population and monitoring information about harlequin ducks.

Habitat

The only potential nest habitat for harlequin ducks across the Martin/Radnor Wildlife Analysis Area is in far lower Martin Creek and the Stillwater River between Upper and Lower Stillwater Lakes (a reach not typical of the lazy Stillwater) (Exhibits Rs-5 and Rs-15).

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

Alternative A would have no direct effect on harlequin ducks or their habitats. No actions, such as timber harvest or road construction are proposed with this alternative. This would leave riparian habitat across the Martin/Radnor Wildlife Analysis Area to continue with

relatively natural processes. Indirectly, taking no action to reduce fuels would increase the potential for stand-replacing fires, which could result in areas of less suitable or unsuitable habitat. The proposed improvements on roads would not occur, nor the culvert replacements, and thus sedimentation would continue to impact aquatic habitat and water quality. For more information about the effects of no action on species like the harlequin duck, see the *Aquatic Resources* section of this chapter.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Activity associated with about 16 acres of proposed timber harvest Alternative B and 307 acres and 23 acres of timber harvest and 144 acres of precommercial thinning in Alternative C would be likely to disturb harlequins that may nest along Martin Creek (Exhibit Rs-15). No other proposed activities are likely to disturb nesting harlequins.

Alternatives B and C are likely to produce small amounts of sediment over one to two years, mostly due to culvert replacements and to BMP work close to Martin Creek. Over the longer term (two to ten years), these actions would reduce sedimentation compared to the No-Action Alternative. Any short term sediment delivery is not expected to have any effect on populations of fish or other prey. Protection of riparian habitats would occur through a combination of protective measures in the Montana Streamside Management Zone Law, Montana Water Quality Act, and INFISH standards (See *Aquatic Resources* section of this chapter).

Other actions, including access management changes, seeding, shrub planting and slashing, dust abatement, and trail construction, would not have measurable effects on this species.

Northern Leopard Frog, Northern Bog Lemming, Western (Boreal) Toad, and Townsend's Big-eared Bat

Introduction

The northern leopard frog (*Rana pipiens*), northern bog lemming (*Synaptomys borealis*), western (boreal) toad (*Anaxyrus [bufo] boreas*), and Townsend's big-eared bat (*Plecotus townsendii)* are discussed together because of similarities of many aspects of their habitat needs and many potential effects. For more information about these species and their habitat at various scales, including that of the Flathead National Forest, see Exhibit Rg-1.

In western Montana, ***northern leopard frogs*** (Exhibit Rs-12) primarily occur in low elevations or valley bottom dense sedge wet meadows or cattail marshes. They reproduce in slow-moving or standing water that includes lakes or ponds (temporary or permanent), springs, backwaters, or beaver ponds in streams. Adults feed in damp meadows and wet forests nearby.

The ***northern bog lemming*** (Exhibit Rs-4) is a rare rodent found in wet meadows containing standing water and extensive coverage of sedges and species such as sphagnum moss. Important habitat components include fallen logs and other woody debris. They winter above ground but below the snow, and summer beneath the surface. Since about 10,000 years ago, this species has become a glacial relict with localized primary habitat.

The ***western (boreal) toad*** breeds in lakes, ponds, streams, and road ditches, with a preference for shallow, warm areas with mud bottoms. Although they are more commonly found near water, adult western toads are largely terrestrial and travel considerable distances from water (Muths 2003, Schmetterling and Young 2008). After the breeding season, toads select habitat that includes open forest canopies or openings in the landscape that are close to water, often on south facing slopes, and with a high density of burrows, rocks, logs, or root wads that provide cover.

Townsend's big-eared bats (Exhibit Rs-11) forage on insects high in living forest canopy near wet meadows (Dobkin, et al. 1995). Caves, tree cavities, rock outcrops, buildings, or mines may provide sites for roosting, communal nurseries, or winter hibernation (Reel, et al. 1989; Tuttle and Taylor 1994).

Timber harvest, insect epidemics, wildland fires, and road construction and maintenance can affect these four species through soil compaction, changes in vegetative cover, or by altering the quantity and quality of water flowing into wet meadows. In addition, timing of recruitment of large woody material into wetland edges can be altered. Snags used by bats as roosting structures can be removed, as can live trees and shrubs used as foraging substrates (Hayes and Loeb 2007). Because they use upland habitats for much of their lives, individual toads can be killed directly by timber harvest activities, road construction or maintenance activities, and wildland fire. Roads can be obstacles for toads as they are slow moving and vulnerable to being run over by vehicles, and they may also be more susceptible to predation when crossing roads. Borrow pits and road ditches apparently attract toads to breed in areas where they may be entirely unsuccessful (Stevens, et al. 2006). Other factors associated with amphibian population decreases include pollution, pesticides, habitat destruction and alteration, increases in UV radiation, the introduction of predators or competitors, and infectious bacteria and fungus (Carey 1993; Muths 2003; Pilliod, et al. 2003).

Information Sources

Most of the effects on northern leopard frogs, northern bog lemmings, western toads, and Townsend's big-eared bats were evaluated by overlaying GIS-generated maps of riparian landtypes (NL1E and NL1A) with proposed timber harvest units and temporary road construction (Exhibit Rr-3). These are nearly level riparian habitats in flat valley bottoms and with relatively fine substrates. Observations, monitoring, and habitat use information in and near the project area are found in Exhibit Rs-5. For more information about effects analysis methods, conclusions and cumulative effects, see the *Aquatic Resources, Neotropical Migratory Birds and Riparian Habitat,* and *Snags and Downed Wood Habitat* sections of this chapter.

Analysis Area

The spatial extent of analysis of effects on northern leopard frogs, northern bog lemmings, western toads, and Townsend's big-eared bats is the same as that used for all sensitive wildlife species, as described above. This area was chosen because of the mobility of some these species, but it is also appropriate for riparian-dependent species with scattered populations and limited habitat and mobility. For the northern leopard frog, northern bog lemming, and western toad, the analysis of effects extends out 15 years, at which time riparian conditions and

effects of the alternatives are likely to stabilize. The analysis of effects on the bats and their habitat extends out 50 years, enough time for new trees to grow and for some of the trees left in the units to acquire decay and other characteristics that make them useful to bats as roosts.

Affected Environment

Population Status

Historically, the ***northern leopard frog*** was widespread in Montana, especially in the Flathead and lower Clark Fork river drainages, but the species appears to have been extirpated throughout most of the western part of the state (Maxell, et al. 2003; Werner, et al. 2004). In recent years, this species has been documented at very few western Montana sites: near Kalispell (a lake complex), near Eureka (a set of small ponds about 30 miles to the northwest), and near the Ninepipe National Wildlife Refuge. None have been documented on the Flathead National Forest since about 1950, although potential habitat occurs within the Martin/Radnor Wildlife Analysis Area. Extensive amphibian surveys have been completed on the forest, district, and within the analysis area over the past 20 years (Exhibit Rs-5). See Exhibit Rg-1 for multi-scale population and monitoring information about leopard frogs.

The ***northern bog lemming*** has few populations in the lower 48 states, known from eight locations in Washington, four locations in Idaho, and 13 locations in Montana (Reichel and Beckstrom 1993). Two documentations exist for this species on the Flathead National Forest, a trapping record from 1992 at the head of Bowen Creek, approximately four miles southwest of the Martin/Radnor Wildlife Analysis Area. This species was also found north of the Bowen Creek site in the Sunday Creek drainage on the Kootenai National Forest and in two or three locations on the west side of Glacier National Park (Reichel and Beckstrom 1993). The Analysis Area appears to contain suitable habitat scattered throughout, although most of these sites may not have all of the necessary habitat components. See Exhibit Rg-1 for multi-scale population and monitoring information about northern bog lemmings.

According to historical records, the ***western (boreal) toad*** (Exhibit Rs-13) was widely distributed and very common in Montana and other western states. Across the Flathead National Forest, juvenile or adult boreal toads have been observed in 31 of the 65 sub-watersheds (6th-code HUCs) surveyed on the Forest during annual citizen-science surveys since 1994. These observations included more than 150,000 tadpoles and nearly 500 adult toads. Toad observations during these surveys fluctuate considerably from year to year depending upon a variety of factors, including naturally fluctuating water levels at individual sites, weather variations and events, and a variable level of observer effort. A multi-scale evaluation of compliance with NFMA requirements to provide a diversity of animal communities (Exhibit Rg-1) concluded that management actions taken on the FNF would provide the habitat composition, structure, and processes for the boreal toad according to the suitability and capability of NFS lands. This report stated that there appears to be little risk of population loss and species viability would be maintained. Western toad adults and high numbers of tadpoles have been found in numerous locations in and near the Martin/Radnor Wildlife Analysis Area (Exhibit Rs-5). Many reports in the Martin/Radnor Wildlife Analysis Area were also of tadpoles found in roadside ditches or adults found away from breeding habitat.

Townsend's big-eared bats have a widespread distribution but they have not been recorded in the Martin/Radnor Wildlife Analysis Area. There are numerous wet meadow feeding areas

with adjacent snags for roosting within the analysis area (See Exhibit Rs-11). Roosting habitat may be provided by tree cavities, rock outcrops, or old buildings. In Montana, this bat is a Species of Concern (Exhibit Rs-22). Intensive population surveys of bats are difficult to conduct because of the nocturnal behavior of bats, their large home ranges, and difficulty of species identification while in flight. Montana Natural Heritage Program records include documented observations of about 40 bats from six sites across the Flathead National Forest, based upon cave surveys and observations in buildings (Exhibit Rs-5). Townsend's big-eared bats were found in bat surveys at numerous locations on the adjacent Kootenai National Forest. Statewide, this bat is found at numerous locations in western Montana and also at scattered locations across other parts of the state. See Exhibit Rg-1 for multi-scale population and monitoring information about Townsend's big-eared bats.

Habitat

In the Martin/Radnor Wildlife Analysis Area, just over 650 acres appear to provide year-round habitat for bog lemmings and northern leopard frogs, as well as breeding habitat for western toads and prime feeding sites for Townsend's big-eared bats (Exhibits Rr-3, Rs-11, Rs-12, and Rs-13). This potential habitat was identified as Riparian Landtypes NL1A and NL1E (USDA Forest Service 1995b), which are relatively level areas in flat valley bottoms with relatively fine substrates (Table 3-89). Western toad reproduction has been found in over 86 locations on Flathead National Forest lands and over 80 percent of these have been in NL1E or NL1A. All land in the project and cumulative effects area is close enough to potential breeding ponds to be potential upland habitat for western toads and potential foraging habitat for Townsend's big-eared bats.

Table 3-89. Riparian Landtypes NL1A and NL1E in the Martin/Radnor Wildlife Analysis Area (Exhibit Rr-3).

Landtype	Gradient	Substrate Material	Vegetation Community	Total Acres	% of Analysis Area
NL1A	Nearly level, valley bottom 2-4% slopes	Clays, silts, fine and medium sand	Subalpine fir	91	0.4%
NL1E	Nearly level, valley bottom 2-4% slopes	Clays, silts, fine and medium sand	Willow and sedges	562	2.1%

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

Alternative A would have no direct effect on northern leopard frogs, northern bog lemmings, western toads, or Townsend's big-eared bats, or their habitats. No actions, such as timber harvest, road construction, or road rehabilitation, are proposed with this alternative. This would leave riparian habitat across the Martin/Radnor Wildlife Analysis Area to continue with relatively natural processes. However, the proposed BMP improvements on roads would not occur, nor the culvert replacements and fine sediments would continue to enter the creeks and wetlands. Ongoing upland actions such as firewood cutting, road maintenance, and motorized access that may impact western toads would continue at current levels. Indirectly, taking no action to reduce fuels would increase the potential for stand-replacing fires, which could result

in areas of less suitable or unsuitable habitat and possible fatalities. For more information about the effects of no action on riparian area dependent species, see the *Aquatic Resources* section of this chapter.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

About four acres of proposed shelterwood harvest (Unit 1) in Alternative B is close to potential year-round habitat for bog lemmings and northern leopard frogs, as well as potential breeding habitat for western toads and prime feeding sites for Townsend's big-eared bats (Exhibit Rr-3). Tables 3-67 and 3-68 (in the *Neotropical Migratory Birds and Riparian Habitat* section, above) summarizes these effects, and more detail is provided in Rs-11, Rs-12, and Rs-13. Leopard frogs, western toads, and big-eared bats are inactive during the winter and typically hibernate in subterranean burrows or roost in snags, caves, or buildings. Project activities that occur during this period would have less impact on these species and their habitat than activities occurring during the spring or summer. In general, Alternatives B and C are likely to produce small amounts of sediment over one to two years, mostly due to culvert replacements and to BMP work. Over the longer term (two to ten years), these actions would reduce sedimentation compared to the No-Action Alternative. Any short term sediment delivery is not expected to have any effect on populations of these sensitive wildlife species. Protection of riparian habitats would occur through a combination of protective measures in the Montana Streamside Management Zone Law, Montana Water Quality Act, and INFISH standards (See Aquatic Resources section of this chapter).

Timber harvest, road construction, increased vehicle use, road maintenance, and road construction may kill individual adult and juvenile boreal toads using upland habitats. Such mortality would be infrequent and would not be expected to affect this species at the population level.

Specific to the Townsend's big-eared bat, proposed activities could reduce potential feeding habitat by removing live trees used as foraging substrates. Similarly, roosting habitat could be reduced by the removal of snags or live trees with roost characteristics. Disturbance or mortality of bats could occur if bats were using a roost snag or tree that was cut down. Road activities are not expected to alter the availability of mosquitoes and other insects eaten by bats. Effects would be site-specific, affecting individuals rather than colonies, and are not likely to lead the Townsend's big-eared bats towards listing (Exhibit Rs-11).

Other actions, including access management changes, precommercial thinning, seeding, shrub planting and slashing, dust abatement, and trail construction, would not have measurable effects on these species.

Wolverine

Introduction

Deep, persistent, and reliable spring snow cover (April 15 to May 14) is the best overall predictor of wolverine (*Gulo gulo luscus*) occurrence in the contiguous United States (Aubry, et al. 2007; Copeland, et al. 2010; USDI FWS 2013a), although evidence of a requirement for

deep snow beyond a den site is lacking (USDI FWS 2014b). Wolverines are opportunistic, consuming a variety of foods but primarily scavenged carrion (Hornocker and Hash 1981). Wolverines in Glacier National Park had average adult male home ranges of 193 square miles and adult female home ranges of 55 square miles (Copeland and Yates 2006). In Montana, natal dens occur above 7874 feet and are located on north aspects in avalanche debris, typically in alpine habitats near timberline (Inman, et al. 2007). Female wolverines forage close to their den in early summer, progressively ranging further from dens as kits become more independent (May, et al. 2010). Wolverines have a high dispersal capability and seem to be able to move successfully through highly altered landscapes. In the contiguous United States, valley bottom habitat appears to be used only for dispersal movements and not for foraging or reproduction (USDI FWS 2014b). For more information, see Exhibit Rs-19.

According to the USDI FWS (2014b), "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. The available scientific and commercial information does not indicate that potential stressors such as land management, recreation, infrastructure development, and transportation corridors pose a threat to the wolverine in the contiguous United States. Additionally, the scale at which most land management decisions (including Forest Service vegetative management activities) occur is relatively small compared to the average size of a wolverine home range and although impacts to individual animals may occur, they do not rise to the level to be a threat to the population (USDI FWS 2014b).

Information Sources

A GIS layer of mapped wolverine habitat using the Copeland, et al. (2010) model was used for persistent spring snowpack areas (Exhibit Rs-19). Also see the *Commonly Hunted Big Game* section of this chapter. Observations, monitoring, and habitat use information in and near the project area are found in Exhibits Rt-7 and Rs-19.

Analysis Area

The spatial extent of analysis of effects on wolverines is the same as that used for grizzly bears, as described above. This area is large enough to include a portion of a wolverine home range, but is not so large as to obscure the effects of alternatives. It is representative of the effects of wildland fire, natural tree mortality, timber harvest, roads/road management, recreation activities, and other effects factors across the landscape. For this project, the analysis of effects on wolverines spans as far as 20 years, at which time areas affected by this project are likely to provide hiding cover. In addition, human activities associated with this project that could disturb or displace wolverines would have ceased.

Affected Environment

Population Status

Federal actions concerning the wolverine date back to 1995, culminating in a proposal to list the wolverine as threatened on February 4, 2013 (USDI FWS 2013a). After further review of

all available scientific and commercial information, on August 13, 2014, the USFWS withdrew its proposal to list the wolverine as a threatened species under the Endangered Species Act under the Endangered Species Act (USDI FWS 2014b, Exhibit Rs-19). Because of this change, the wolverine returned to the Regional Forester's Sensitive Species List

Wolverines occur at low population densities in remote places and are rarely and unpredictably encountered where they do occur (Ruggiero, et al. 2007). Wolverines occur naturally in low densities, and current population levels and trends are not definitely known (USDI FWS 2014b). However, there is evidence that their population is increasing and that wolverines are expanding both within areas currently occupied as well as suitable habitat not currently occupied (USDI FWS 2014b). Wolverines are listed as a Species of Concern in Montana and have a state ranking of S3: "Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas" (MNHP 2014).

Wolverine sightings are occasionally reported along the Brush Creek Divide to the southwest of the Martin/Radnor Wildlife Analysis Area. These may have been young, dispersing individuals. The location of one harvested in 1990 was given as "Good Creek." There have been confirmed sightings over the past five years in the Whitefish Divide, approximately 10 miles to the east across the Stillwater Valley, and in the drainages of the North and Middle Forks of the Flathead River in Glacier National Park, upper Grave Creek, and Ten Lakes area. These are the closest large areas of modeled persistent spring snowpack, all of which have a considerable amount of ungulate winter range nearby.

For more information about this species and its habitat at various scales, including that of the Flathead National Forest, see Exhibits Rg-1, Rs-17, Rs-19, and Rt-19.

Habitat

The Martin Creek project area contains 2127 acres (or about three square miles) of habitat that is modeled to receive persistent spring snowpack in one to three years out of seven (Copeland, et al. 2010) (Exhibit Rs-19). Nearly 95 percent of this area appears to have persistent spring snow in only one or two years out of seven; nowhere in the project area is modeled to have persistent spring snow in more than three of seven years. Modeled persistent spring snow habitat in the Martin/Radnor Wildlife Analysis Area makes up less than 0.2 percent of the 1,442,449 acres of persistent spring snow habitat available on the Flathead National Forest. The highest elevation in the project area is about 6000 feet at its western extreme. This elevation is about 1000 feet lower than that of most wolverine natal den sites in Montana. The persistent spring snow habitat in the project area is naturally isolated from other areas of potential wolverine habitat because it is surrounded by low elevation lands. Given the large home ranges for wolverines and relatively short distances travelled by females caring for young, it is highly unlikely that the Martin Creek project area is used for denning by reproductive females.

It is likely that wolverines occasionally reported in the Salish Range are dispersers traveling through the area and taking advantage of opportunistic sources of food such as carrion. The area has no highway transportation corridors or any other aspects that may be barriers to movement between habitat patches for dispersing wolverines. Available cover is evenly distributed across the analysis area despite the larger blocks of recent timber harvest in the upper third of the Martin drainage and south and southeast of Martin Falls (Exhibit Rb-3).

About 75 percent of the area currently functions as cover (Exhibit Rb-3). For more information about the distribution of vegetative cover see the *Commonly Hunted Big Game, Old Growth Habitat,* and *Vegetation* sections in this chapter.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

No actions, such as timber harvest, fuel reduction, or road construction, are proposed with this alternative. Overall, availability of carrion and other food sources would not be measurably affected and the availability of hiding sites used by wolverines during dispersal would gradually increase. The fuel loading in many stands would increase the chance of large intense wildland fires in adjacent areas, which could have mixed results for wolverines. See the *Commonly Hunted Big Game* section in this chapter.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

Project activities, including changes in road use and management, would not affect habitat connectivity or wolverine dispersal, and would not create barriers to wolverine movement. Dispersing wolverines may travel through the project area and may feed there, but they are not likely to den or spend much time because the area of potential habitat is very small and isolated relative to the size of a wolverine's home range. Temporary displacement of individual wolverines could occur as a result of the proposed project, including public over-snow motorized travel on new permanent roads (3.1 miles in Alternative B and 0.3 miles in Alternative C). Displacement from habitat that mainly provides travel between areas of higher quality habitat would only affect individuals and is expected to be of a short duration.

Proposed vegetation management would remove some cover in modeled persistent spring snowpack areas (Table 3-90), but once areas become revegetated with grasses, forbs, and shrubs they would provide foraging habitat for mammals that wolverines are known to feed upon. Up to three miles of roads and trails would be constructed or added to the transportation system. With any of the action alternatives, the effects of proposed vegetation management would be minor (USDI FWS 2014b) because wolverines are not known to avoid logged or burned areas and they are unlikely to spend much time in the project area.

Table 3-90. Proposed activities in areas of persistent spring snowpack (Exhibit Rs-19).

Activity	Alt. A	Alt. B	Alt. C
Timber harvest	0 acres	187 acres	177 acres
Precommercial thinning	0 acres	85 acres	85 acres
Road construction	0 miles	0 miles	0 miles

Across the Martin/Radnor Wildlife Analysis Area, the action alternatives would remove or reduce the effectiveness of hiding cover ranging from 90 (Alternative C) to 591 acres (Alternative B) (Table 3-61 in the *Commonly Hunted Big Game* section of this chapter, above, and Exhibit Rb-3). Some of this may create forest edges and smaller openings. Considering the large scale of wolverine dispersal, these effects would not be measurable, nor would availabil-

ity of carrion and other food sources be measurably affected. The probability of large stand-replacing wildland fires would be reduced.

All other aspects of the project, such as roadwork, motorized access changes, and culvert replacement, would not be expected to affect wolverine. Temporary roads and skid trails are not expected to receive use by over-snow recreationists. For more information on effects relevant to the wolverine, including temporary road construction, see the sections of this chapter on *Commonly Hunted Big Game, Old Growth Habitat, Snag and Downed Wood Habitat,* and *Fire and Fuels*.

Cumulative Effects — Sensitive Wildlife Species

Cumulative effects relevant to all sensitive wildlife species (Exhibits Rs-9 and Rt-6) are described in the sections of this chapter on *Old Growth Habitat, Snags and Downed Wood Habitat, Neotropical Migratory Birds and Riparian Habitat, Commonly Hunted Big Game, Threatened Wildlife,* and *Aquatic Resources,* as displayed in Table 3-91. These include loss and alteration of habitat due to vegetation management and road construction; past wildland fires; hunting; recreational disturbance; and access for firewood cutting and furbearer trapping. Also see Exhibits Q-8, Rb-6, Rd-12, Rg-1, Rn-3, Rr-2, and Rt-14. For an assessment of these species' viability at the Forest level, see the Final Environmental Impact Statement for the Forest Plan Amendment 21 (USDA 1999a) and Exhibit Rg-1.

Table 3-91. Cumulative Effects Sections in this Chapter and Project File Exhibits for Cumulative Effects for Sensitive Wildlife Species (Exhibit Rs-9).

Sensitive Wildlife Species	Relevant Cumulative Effects Sections in this Chapter	Project File Exhibits
Bald Eagle	*Old Growth Habitat, Snags and Downed Wood Habitat, Neotropical Migratory Birds and Riparian Habitat, Aquatic Resources*	G-15, Q-8, Rd-12, Rr-2
Black-backed Woodpecker	*Snags and Downed Wood Habitat*	Rd-12
Boreal Toad	*Neotropical Migratory Birds and Riparian Habitat, Snags and Downed Wood Habitat, Aquatic Resources*	G-15, Rd-12, Rr-2
Fisher	*Old Growth Habitat, Snags and Downed Wood Habitat, Neotropical Migratory Birds and Riparian Habitat, Aquatic Resources, Threatened Wildlife*	Rt-6, Q-8, Rd-12, Rr-2
Flammulated Owl	*Old Growth Habitat, Snags and Downed Wood Habitat, Neotropical Migratory Birds and Riparian Habitat*	Q-8, Rd-12, Rn-3
Gray Wolf	*Commonly Hunted Big Game, Threatened Wildlife*	Rt-6, Rb-6
Harlequin Duck	*Neotropical Migratory Birds and Riparian Habitat, Aquatic Resources*	G-15, Rr-2
Northern Bog Lemming	*Neotropical Migratory Birds and Riparian Habitat, Aquatic Resources*	G-15, Rr-2
Northern Leopard Frog	*Neotropical Migratory Birds and Riparian Habitat, Aquatic Resources*	G-15, Rr-2
Peregrine Falcon	*Neotropical Migratory Birds and Riparian Habitat, Aquatic Resources*	G-15, Rr-2
Townsend's Big-eared Bat	*Snags and Downed Wood Habitat, Neotropical Migratory Birds and Riparian Habitat, Aquatic Resources*	G-15, Rd-12, Rr-2

Sensitive Wildlife Species	Relevant Cumulative Effects Sections in this Chapter	Project File Exhibits
Wolverine	*Commonly Hunted Big Game, Threatened Wildlife, Snags and Downed Wood Habitat,*	Rb-6,Rt-6, Rd-12

While other factors outside of Forest Service control may affect individuals of these sensitive wildlife species, the direct, indirect, and cumulative effects of the Martin Creek project, considered singly or in concert, would not likely result in a trend toward federal listing nor reduced viability for the populations or species. In addition, no geographic or man-made barriers exist within or near the Martin/Radnor Wildlife Analysis Area that would preclude movements by these species to adjacent populations.

Regulatory Framework and Consistency — Sensitive Wildlife Species

In accordance with FSM 2673.42, determinations have been made on the degree of impact the proposed activities may have on sensitive species (Table 3-92 and Exhibits Rs-1 and Rs-3). Along with Chapter 1, Chapter 2, and the sub-section above on each species, these determination statements meet the requirements of the Biological Evaluation for Sensitive Wildlife Species. These statements are based on available information on the distribution, presence in the project area, habitat requirements, and management strategies for these species, as well as the project design and location. These determination statements are for the segment of the population using the Affected Area, not the entire population, and an additional analysis that assessed viability at the forest scale (Exhibit Rg-1). All alternatives are consistent with NFMA diversity requirements for wildlife, as described in the *Old Growth Habitat* section of this chapter.

Table 3-92. Biological Evaluation Determinations for Sensitive Wildlife Species (Exhibit Rs-3).

Sensitive Wildlife Species	Alternative		
	A	B	C
Bald eagle	MIIH	MIIH	MIIH
Bighorn sheep	NI	NI	NI
Black-backed woodpecker	BI	MIIH	MIIH
Western (boreal) toad	MIIH	MIIH	MIIH
Common loon	NI	NI	NI
Fisher	MIIH	MIIH	MIIH
Flammulated owl	MIIH	MIIH	MIIH
Gray wolf	MIIH	MIIH	MIIH
Harlequin duck	MIIH	MIIH	MIIH
Northern bog lemming	MIIH	MIIH	MIIH
Northern leopard frog	MIIH	MIIH	MIIH
Peregrine falcon	MIIH	MIIH	MIIH
Townsend’s big-eared bat	MIIH	MIIH	MIIH
Wolverine	MIIH	MIIH	MIIH

NI = "No Impact”; MIIH = "May Impact Individuals or Habitat but would not likely result in a trend toward federal listing or reduced viability for the population or species”; BI = "Beneficial Impact.”

Bald eagles and gray wolves no longer receive protection from the Endangered Species Act, but this project is consistent with the Forest Plan and all other applicable direction, such as the Bald and Golden Eagle Protection Act of 1940 and the Migratory Bird Treaty Act.

Recreation

Introduction

A variety of recreation activities are enjoyed by the public in the Martin Creek drainage that include driving for pleasure, sightseeing, hiking, hunting, fishing, fire wood collecting, berry picking, and dispersed camping. Recreational opportunities within the analysis area that are most likely to be affected by proposed management activities are use of roads for these activities. Most recreational activities are dispersed along the roads and in general forest areas.

Information Sources

Information for this analysis was gathered through observations made during routine maintenance and surveys of general forest and recreation areas. Trail locations and improvements were cataloged using GPS equipment and are contained in the Infra USDA corporate databases and updated annually. Infra is a web-based data set with reporting and GIS tools that enable forest managers to query accurate information about constructed features, trails, roads, cultural properties, recreational features, and range allotments. Road and trail mileages reported were gathered through use of the Flathead National Forest's GIS database. In the summer field season of 2011 and 2012, dispersed recreation sites within the project area were inventoried and their condition documented. The Forest Motor Vehicle Use Map (MVUM) shows where dispersed camping currently is allowed.

Analysis Area

This analysis evaluates the recreation resources occurring in and directly adjacent to the Martin Creek drainage. The area is shown on the alternative maps located in Chapter 2. Some recreation features, such as roads and trails, are located along the perimeter of the analysis area, or in proximity to the project area, and are included in this analysis of the recreation resource. The timeframes for impacts of the proposed activities on the recreation resource are for the period when project implementation would be taking place.

Affected Environment

The Recreation Opportunity Spectrum (ROS) is used as a means of describing recreational settings and activities (USDA Forest Service 1986). ROS classifies the Marin Creek analysis area within "Roaded Natural Appearing." Visually, much of the area is culturally modified but attractive in appearance with moderate evidence of the sights and sounds of man (please refer to the *Scenery* section later in this chapter). There are no developed recreation facilities within the project area, such as campgrounds, and only one trailhead with a short interpretive trail to Martin Falls. Interaction between users is low to moderate in the general forest area.

Areas of Special Recreational Interest

Trails

The Martin Falls Interpretative Trail is approximately 500 feet long and accesses Martin Falls off of FS Road #910. In 2003, interpretive signs were installed discussing the natural and ecological processes in the area. This trail is the most used recreation site in the project area due to its accessibility, short length, and scenic value. It is a popular picnic and sight-seeing spot.

Fishing

The primary fishery in the project area is in Martin Lakes. These lakes are used for year-round fishing of cutthroat and brook trout. Streams in the project area are not as commonly fished due to the small size of the fish. For more information regarding the fisheries in the Martin Creek project area please refer the *Aquatic Resources* section of this chapter.

Boating

There is a rudimentary, user-created trail at Upper Martin Lake located at the terminus of FS Road #2872C. This is the primary access for anglers and small watercraft such as float tubes, small kayaks, or canoes. Due to the steepness of this user trail, it is not currently very common for anglers to carry watercraft down to the lake. Erosion from this trail is causing sediment to enter the lake. Motorized boat use is not known to occur on this lake.

Camping

There are no developed campgrounds within the analysis area. Camping opportunities include dispersed car camping along roads and within 300 feet of open forest roads as identified on the Ranger District's MVUM, available at FNF offices. There are numerous inventoried user-created dispersed sites that are used mostly during hunting season. Dispersed camping is currently allowed through-out the project area. Due to steep terrain and dense vegetation, most dispersed camping activity is located in close proximity to open Forest Service roads.

Snowmobiling

Snowmobiling has no special restrictions within the Martin Creek area during the snowmobile season. Most of the roads are snow covered and unplowed during the winter, thus snowmobiles can access these forest roads until snow melts and wheeled vehicles can drive the roads in the spring. Montana State Law restricts snowmobiling when roads are plowed. The snowmobiling season is typically December 1 to May 14, with a few roads closing on March 31, in the Martin Creek drainage. Please see Exhibit M-3 for the Tally Lake Ranger District Over Snow Vehicle Use Map. There are currently no managed or groomed snowmobile trails within the analysis area.

Open/Closed Roads

The majority of recreational activity within the analysis area occurs on roads, both open and closed to motorized vehicles. Primary activities associated with the use of the road system include accessing trailheads, fishing, hunting, pleasure driving, snowmobiling, mountain

biking, and firewood gathering. The open and closed road system in the Martin Creek area is used during the fall for big game and upland bird hunting. There is a seasonally closed road, #2989, which has been used for accessible hunting for people with disabilities.

Environmental Consequences

Direct and Indirect Effects of Alternative A (No Action)

Alternative A does not propose any new activities and does not change current management in the project area. Recreation resources would not be improved and new trail designations and reconstruction would not occur. Management and maintenance of the existing recreation facilities would remain the same as recent years.

A slightly increasing amount of recreation use is expected to occur in the future. The current recreation infrastructure would become slightly less adequate to meet recreation needs as use increases over the same facility base. Some increased amount of trail erosion and degradation on user created trails may occur as use increases.

Direct and Indirect Effects of Alternative B (Proposed Action)

Recreation management proposals in Alternative B include trail construction at Upper Martin Lake. This would effectively end use of a user-created trail, replacing it with a constructed and graded access that would be more desirable for boaters and anglers. The new construction of a graded trail and rehabilitation of 150 feet of user developed trail that connects a dispersed camping site to the lake would allow for safer access and reduce erosion and vegetation loss. This new trail would be a National Forest System Trail.

There are currently no trails except for the Martin Falls trail in the project area. Trails near the project area within the Miller Creek Demonstration Forest are trails #805, #806, #807, and #808. These four short interpretative trails have low use by the general public but are occasionally used by school groups and visiting foresters.

Vegetation treatment proposals are displayed on the Alternative B map (Figure 2-1) in Chapter 2. The vegetation management proposals that directly affect possible recreational opportunities include prescribed burning, precommercial thinning, and timber harvesting using shelterwood, seed tree, and clearcut methods. Vegetation treatments could create more distant scenic viewing opportunities along the roadways which are usually perceived by most users as more interesting and enjoyable. Vegetation treatments could also create openings, increase sight distances, and enhance hunting opportunities.

Road access in Alternative B would change from the existing condition. The 3.1 miles of new permanent roads would be added to the forest road system and made available for non-vehicular access. The 0.9 miles of temporary road construction would be used specifically for timber hauling and unavailable for recreation travel after use. The rehabilitation implementation of Best Management Practices (BMPs) to approximately 44 miles of roads would positively affect the public by making driving forest roads a more enjoyable and safer experience.

The proposed changes for motorized access on existing roads could restrict recreation and firewood gathering opportunities. Approximately 3.0 miles of road currently open year-round or seasonally, would be closed with a berm. These are NFS Roads 9628A, 9627, and 2872D.

Direct and Indirect Effects of Alternative C

The developed recreation site improvement proposals for Alternative C are the same as those described for Alternative B (please refer to the description above).

Road access in Alternative C would be similar to Alternative B with some changes. There would only be 0.3 miles of new permanent roads added to the forest road system and made available for non-vehicular access; and 0.6 miles of temporary road construction that would be used specifically for timber hauling and unavailable for recreation travel after use. The rehabilitation implementation of Best Management Practices (BMPs) to approximately 44 miles of roads would positively affect the public by making driving forest roads a more enjoyable and safer experience.

The proposed changes for motorized access on existing roads could restrict recreation and firewood gathering opportunities. Approximately 5.0 miles of road currently open year-round or seasonally, would be closed with a berm. These are FS Roads 9628A, 9629, 2872D, and 2872 at its intersection with 2872D.

The extent of the number of miles of road construction, road rehabilitation (BMPs), and affected acres by vegetation treatments would be less; please refer to the Table 3-93 below, Table 2-4, and Table 2-5 for further comparison of alternatives.

Table 3-93. Alternative Features that would Directly Affect Recreational Opportunities.

Feature	Alternative A *No Action*	Alternative B *Proposed Action*	Alternative C
Temporary road construction	0	0.9 miles	0.6 miles
Permanent road construction	0	3.1 miles	0.3 miles
Road rehabilitation (BMPs)	0	44.0 miles	41.0 miles
Closure of seasonally open roads	0	2.1 miles	2.5 miles
Closure of yearlong open roads	0	.8 miles	2.3 miles
Conversion of road to trail	0	0.0 miles	0.5 miles
New trail construction	0	150 feet	150 feet

Cumulative Effects of Alternatives B (Proposed Action), C

Past, present, and reasonably foreseeable actions have contributed or would contribute to the recreation conditions in the Martin Creek drainage. The accumulation of activities in the area has lead to improved recreation opportunities and experiences in some regards and degraded them for others. The management activities proposed in the two action alternatives are consistent with past management activities and would not be introducing new recreation features. These activities are addressed in the paragraphs below with discussion regarding the current proposal's influence on the recreation resource. Please refer to Exhibit L-1 for an accounting of all past, present, and reasonably foreseeable actions and their relationship to recreation.

District recreation personnel would monitor system trails and other areas for resources issues and unauthorized use. Compliance efforts would be implemented through signage, direct visitor contact, and law enforcement patrols.

Timber Harvest- Removal of commercial wood products on all ownerships in the Martin Creek drainage has had the greatest influence on recreation of all human activities, resulting from the development of a network of roads. Most of the drainage can be accessed either by vehicle or non-motorized means; such as horse, foot, or bicycle. Almost all roads were constructed for vegetation management purposes, although the benefit for recreation opportunities and access has been substantial. Timber harvesting has also benefited some aspects of recreation, most notably big game hunting (please refer the *Commonly Hunted Big Game* section of this chapter). Because past timber harvest areas have been regenerated into new forests, the cumulative effect on recreation from timber harvest proposals in the Martin Creek project would be minimal as the new clearings would be replacing former clearings that have regenerated.

Road Maintenance and BMPs- Providing quality, safe roads for the recreating public would continue with the management proposals in the Martin Creek project. Roads used for timber hauling would be improved to meet Best Management Practices, thus ensuring protecting water quality for fishing as well as a pleasurable driving experience. There are no cumulative effects to the recreation experience from continued road maintenance and application of BMPs.

Trail Construction and Maintenance- Most initial trail construction in the Martin Creek drainage is user-created and occurred prior to the beginning of road construction in the 1950s. No new trails have been constructed in the past 60 years. The rehabilitation and addition of the Upper Martin Lakes trail to the trail inventory would cumulatively allow for a higher quality trail experience, safety, and improved access for all users.

Hunting, Trapping, and Predator Control- Big game hunting is the major recreation experience in the area during the fall. Trapping is conducted on a more limited basis. Regulation of big game populations by the Montana FWP has been effective in maintaining a quality hunting experience. Improved access and new areas cleared or partially cleared of vegetation would enhance the hunting experience after implementation of proposed activities. There are known wolf packs in the area and wolf hunting and trapping is expected to increase.

Access for Hunters with Disabilities- Currently Forest Road #2989 is utilized for disabled hunter access using a key check out system during the big game hunting season. This is a popular program and increases the recreational opportunity for these users. Even if this particular opportunity changes to a different location, there would be no cumulative effects.

Fishing- Fishing on the two bodies of water known as Martin Lakes is a common activity. With improved access due to a new trail, fishing is expected to increase. Fishing in the analysis area streams is less popular as fish typically do not attain a large size.

Snowmobiling- Recreational use of snowmobiles is not a major activity in the Martin Creek drainage due to relatively low elevations, inconsistent snow pack, and dense vegetation. Snowmobile use is popular with hunters and trappers. Some improvement of the snowmobiling experience would be cumulatively realized by new road construction and clearings created by the proposed vegetation treatments.

Hiking, Mountain Biking, and Horseback Riding- The opportunities for these activities has been ongoing within the project area since the current road system was initiated and occurs mostly on general forest areas. The amount of use has remained fairly constant in the past 20 years. The cumulative effect of the proposed activities would be to increase the amount of non-motorized opportunities resulting from the new road construction. Any disruption to these recreational pursuits from vegetation treatment implementation would be temporary.

Dispersed Camping- The amount of user created camping areas along main forest roads is expected to remain at a constant level. These sites have been created in desirable areas that serve a purpose such as access to a hunting area, firewood gathering, or next to water. Dispersed camping could be affected by vegetation treatment activities by displacing recreationists temporarily. An interdisciplinary review of dispersed camping opportunities as shown on the Tally Lake Ranger District's Motor Vehicle Use Map resulted in no changes being necessary to protect resources.

Regulatory Framework and Consistency

The Forest Plan established Forest-wide recreation goals, objectives, and standards that relate directly to the Martin Creek Resource Management Project. Listed here are the resource goals, objectives, and standards that provide the framework for managing the recreation resources in the Martin Creek area.

Recreation Resource Goals (pg. II-5):

- Provide a range of quality outdoor recreation opportunities within a forest environment that can be developed for visitor use and satisfaction.
- Provide a range of quality recreation opportunities, including motorized and non-motorized, in an undeveloped forest environment.

Recreation Forest-Wide Standards (pg. II-21)

1 Use the ROS (Recreation Opportunity Spectrum) as a guide to provide the full array of recreation opportunities on the Forest.

2 Encourage Forest users not desiring a wilderness setting to use non-wilderness National Forest System lands which can provide for their recreation needs.

7 Emphasize "low impact" techniques in dispersed recreation areas.

10 As per Executive Order 11644, through FNF Travel Planning Direction, and in conformance with the ROS designations for specific areas, designate use restrictions on roads, trails, and specified areas along with designating areas for ORV use.

Recreation Management Area Standards (pg. III-1)

In addition to the forest wide-standards, the Forest Plan provides direction for specific Management Areas. Management Areas in the project area include MA 7, MA 12, MA 15, and MA 17. These management areas include lands suited for developed and dispersed recreation that meet the ROS classification of Roaded Natural Appearing. Please see Appendix B for a description of the management areas.

Management Area 7 has a goal that states dispersed recreation activities in a roaded natural-appearing environment be permitted. Specific standards for MA 7 for recreation include:

- Develop and implement ORV (Off Road Vehicle) and road management direction that provides security for wildlife but continues to provide reasonable access. Provide for

current recreation uses such as motorized recreation, berry picking, hunting, hiking, and firewood gathering. Enhance cross country skiing and snowmobiling opportunities. Manage motorized use to reduce effects by obtaining support of clubs and other users.

Management Area 12 has goals that include the management of other resources must be compatible with the riparian habitat management standards. Specific standards for MA 12 for recreation include:

- Generally, trails will not be constructed in riparian areas except as needed to cross the area.
- Existing trails should be relocated outside of riparian areas if there are erosion problems that cannot be mitigated.
- Off-road vehicle use, except by snowmobiles, is generally incompatible except on roads or trails.
- Carefully evaluate any new developed recreation proposals to ensure the riparian area is protected.

The ***Management Area 15*** goal is for other resources to be managed in a manner consistent with the timber management goals. Roaded natural-appearing recreation opportunities will be provided. Specific standards for MA 15 for recreation include:

- Trail maintenance and construction are compatible so long as the timber management objectives are met.

Management Area 17 consists of riparian areas that will be protected and maintained, including fish and wildlife habitat. Specific standards for MA 17 for recreation include:

- Generally trails will not be constructed in riparian areas except as needed to cross the area.
- Off-road vehicle use, except by snowmobiles, is generally incompatible except on roads or trails.
- Recreation opportunities will be provided. Management of other resources must be compatible with the riparian timber management objectives.

The proposed activities in all alternatives comply with the recreation standards and guidelines discussed above.

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Scenery

Introduction

The topography of the Martin Creek area was shaped by the continental ice mass that left behind a landform of scoured and rounded mountains. These mountains are typically forested with dense stands of timber that offer limited natural texture, color, line, and variety in shape. Viewing beyond the foreground is limited to man-made openings such as roads and recent timber harvest activities. These landscapes are referred to as "common" landscapes where landforms and features are not of unusual or spectacular scenic quality. One unique feature in the Martin Creek area is Martin Falls, which provides an easily accessible view of a large waterfall.

The Martin Creek landscape can be viewed from an infinite number of viewpoints when traveling through the area. The main viewing of the area is from forest roads.

Information Sources

Information for the visuals and scenery resource were gathered systematically from established viewpoints. These viewpoints are described in greater detail below.

Analysis Area

The analysis area for the visual and scenic resources includes the area described for the vegetation resource. Views of the analysis area from outside the planning boundary shown in Figure 2-1 are very limited. For this analysis, several viewing locations were considered. Five viewpoints were chosen along the main Martin Creek road as having potential to view proposed activities that would alter the scenic landscape. The time frames for this analysis are from the beginning of implementation of activities to a point in the future when grass, shrubs, and small trees are established in areas disturbed by treatments; approximately 2030.

Affected Environment

Introduction and Regulatory Framework

Analysis and evaluation of the visual resource for this project applies a process described in Landscape Aesthetics, A Handbook for Scenery Management (USDA Forest Service 1995a). This system provides for the evaluation of physical features of the landscape called scenic attractiveness classes together with the levels of concern people have for scenery. This information is synthesized to develop Scenic Integrity Levels (SILs). The Forest Plan established Scenic Integrity Levels for each Management Area (called Visual Quality Objectives or VQOs in the Forest Plan). The proposed actions are within a variety of Management Areas (MA). The following table shows Scenic Integrity Levels established in the Plan. The guidelines for meeting these levels are described in the Landscape Aesthetics Handbook.

Refer to the Forest Plan for locations of the various Scenic Integrity Levels as they are assigned by the various MAs. In general, the visible parts of the project area are specified as Moderate, Low, and Very Low SILs. This information is displayed in the following table for the MAs present in the Martin Creek area.

Table 3-94. Scenic Integrity Levels for Management Areas

Scenic Integrity Levels	Description
High**	Refers to landscapes where the valued landscape character "appears intact." Deviations may be present but must repeat form, line, color, texture, and pattern common to the character so completely that they are not evident. Previously referred to as "retention."
Moderate	Refers to landscapes where the valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed. Previously referred to as "partial retention."
Low	Refers to landscapes where the valued landscape character "appears moderately altered." Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed. They should be compatible or complementary to the landscape character. Previously referred to as "modification."
Very Low	Scenic Integrity "appears heavily altered." Deviations may strongly dominate the landscape character. They may not be appropriate in shape, edge effect, or patterns. However, deviations must be shaped and blended with landforms so that elements such as unnatural edges or landings do not dominate the composition. Previously referred to as "maximum modification."
Unacceptably Low **	This scenic integrity level refers to landscapes where the valued landscape character being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern, or scale from the landscape character. Landscapes at this level of integrity need rehabilitation. This level should only be used to inventory existing integrity. It must not be used as a management objective.

** There are no areas in the Martin Creek area classed at this Scenic Integrity Level.

Table 3-95. Scenic Integrity Level by Management Area (i.e., visual goals for Management Areas as outlined in the Forest Plan).

Management Area	Emphasis/Location	Scenic Integrity Level
7	Roaded Timberlands in Visually Sensitive Areas	Moderate
12/17	Riparian Areas	Moderate
15	Timber Production with Roads	Low to Very Low

Historical Conditions and Existing Conditions

The analysis area has been subject to natural wildland fires for the last several thousand years. Historic fire mapping shows the Martin Creek analysis area has experienced one landscape level wildland fire (greater than 500 acres) in the past 120 years or more (see the *Fire and Fuels* section earlier in this chapter). The areas that did burn prior to 1885 and the 1926 wildland fire have all regenerated back to dense, tall forests and are not evident due to the fairly even distribution of similar sized trees.

Since the mid 1900s, humans have modified the scenery of the Martin Creek area. Timber harvest activity and road construction began about 1955 and was most active in the 1960s and 1970s. Much of the timber harvest used the clearcutting method which had an adverse effect on the visual resource. About half of the analysis area has had some type of timber harvest activity, although not all was regeneration harvest that would have had an impact on the scenery. On national forest land, past timber harvest areas now generally meet the scenery intent of the Forest Plan as these areas have adequately regenerated and the majority of NFS land is MA15 with a SIL objective of low to very low. Topography and existing vegetation adjacent to roads combine to screen views of much of the project area but some views of the larger landscape is available from along roads open to public vehicular travel.

Another human modification has been some residential development on private property in the southeasten part of the analysis area.

Viewpoint Descriptions

Viewpoints used for this analysis were selected based on the number of potential viewers and possible vegetation treatment as described in the alternatives. The vast majority of forest visitors to the Martin Creek area use the main Martin Creek road, FSR 910, and therefore all viewpoints are located along this road. The following describes the viewpoints that will be used for further analysis of the effects of proposed management activities on the scenery in the area. A viewpoint location map is available for review in Exhibit I-1. Viewpoint photos are available in I-2.

Viewpoint One – Located at N48º33’15” - W114 º39’24”, this viewpoint looks northeast to the proposed shelterwood harvest unit 6. The harvest unit is located above a rock outcrop that has been used in the past as a source of road surfacing material. The unit is not visible from the viewpoint due to topography. The national forest land is designated as MA15.

Viewpoint Two – Located at N48º33’41” - W114 º41’48”, this viewpoint was located to view shelterwood units 10 and 11 to the west. Due to topography and a dense stand of second growth timber in the foreground, these units are not visible from the viewpoint. The national forest land is designated as MA15. The timber stands viewed from these locations appear natural with no management activities observed.

Viewpoint Three – Located at N48º33’33” - W114 º41’58”, this viewpoint was located to view unit 11 to the north. Due to a dense stand of second growth timber in the foreground, this unit is not visible from the viewpoint. The national forest land is designated as MA15. Spring and summer viewing would be even more obscured as what is depicted at Exhibit I-2 as deciduous vegetation would have their leaves.

Viewpoint Four – Located at N48º33’06” - W114 º43’09”, this viewpoint was located to view shelterwood units 22 and 23 to the northwest. Although much of the view of the middle- and background is obscured by foreground forest, some views through this timber are possible. Timber harvest from past years is obvious. The national forest land is designated as MA15.

Viewpoint Five – Located at N48º31’41” - W114 º45’52”, this viewpoint was located to view commercial thinning unit 43, which is located on both sides of the Martin Creek road. This view is strictly a foreground view of the proposed harvest activity adjacent to the road. The

current timber composition is smaller, second growth. The national forest land is designated as MA15.

The following table shows the existing conditions and the Forest Plan desired SIL for the viewpoints in the project area.

Table 3-96. Viewpoint Existing Conditions.

Location	Existing Visual Condition Rating	Forest Plan Desired Minimum SIL
Viewpoint One	Moderate (Slightly Altered)	Low to Very Low
Viewpoint Two	High (Appears Intact)	Low to Very Low
Viewpoint Three	High (Appears Intact)	Low to Very Low
Viewpoint Four	Moderate (Slightly Altered)	Low to Very Low
Viewpoint Five	High (Appears Intact)	Low to Very Low

Environmental Consequences

All the action alternatives involve prescriptions and management activities that would result in a change from the existing appearance of the area. All of the activities of the alternatives are designed to meet the scenery level objectives as designated in the Forest Plan.

The following information describes the short-term effects or changes as a result of implementation of the action alternatives as seen from the viewpoints.

Techniques to lessen visual impacts would be applied to meet the guidelines of the various levels of scenic integrity as shown in the Forest Plan. These measures are also employed to manage the landscape in order to meet the scenery goals for the short-term (up to four years) and long-term time frames. The measures are described in Chapter 2 under Features Common to All Action Alternatives.

Openings created by timber harvest and road construction have impacts on scenery. These impacts are brought about by contrasts created between natural forested landscapes and managed landscapes. Some contrasts could be created by new management activities adjacent to older activities that could be up to 50 years old. These contrasts consist of the human perception of changes in color, form, line, and texture. Past human activity has affected the scenery in the Martin Creek area to varying degrees.

Effects on scenery from timber harvest and related activities would vary in duration and intensity corresponding to the tree cover left on site after harvesting. The seed tree and clearcut reserve (light retention) silvicultural methods retain the least amount of vegetation and therefore create contrasts between natural and managed landscapes. This can vary depending on the viewers' location, steepness of the slope, and the position of the harvested area on the slope. Shelterwood and commercial thinnings (moderate to heavy tree retention) leave more vegetation and appear more natural over time and add variety to the scenery. This is especially true when these methods are used adjacent to older harvested areas. Sapling thinnings (very heavy tree retention) would be nearly unnoticeable except when viewed from the foreground.

Disturbances to vegetation and soil begin to recover almost immediately. The duration of this process is directly related to the extent of disturbance. In two or three years, herbaceous vegetation would cover most sites. Within 25 to 30 years, tree cover would grow to the point where many roadside views are screened and the impact on the scenery would be generally unnoticed except for variances in tree heights. While harvested areas would rehabilitate over time, roads would continue to impact the scenery.

Direct and Indirect Effects of Alternative A (No Action)

Due to no removal of vegetation or road construction, the process of forest succession would continue on NFS land. The areas that have been heavily to moderately altered by past timber harvesting would blend into the landscape over time, but would retain much of their current form and line for several decades. This is assuming the area remains unaffected by wildland fire and no additional timber harvesting occurs on private land. Tree mortality from insects and disease would be more evident in much of the area than if one of the action alternatives were implemented. Alternative A would not reduce the risk of stand-replacing wildland fire. Fuels would continue to build up from tree mortality and undergrowth creating a higher risk of stand-replacing wildland fire than the action alternatives. In the event of such an occurrence, visual change to the landscape would be dramatic. This change may be naturally appearing, but fires of large magnitude may be visually unappealing to some viewers, and could create vast expanses of even-aged stands with little visual diversity that would exist for many decades.

Direct and Indirect Effects of Alternatives B (Proposed Action) and C

The direct and indirect effects to scenery for Alternatives B and C as seen from the viewpoints are discussed below. In the short term, implementation of these alternatives would create changes to the visual condition of the project area. Openings in the canopy of various sizes resulting from clearcut, seed tree, and shelterwood harvests may be visible. Treatments utilizing the commercial thin and sapling thin methods would be less evident. A description of the appearance of the various proposed treatments can be found in the *Vegetation* section near the beginning of this chapter.

Exhibit I-2 shows terrestrial photos taken from each of the viewpoints.

Viewpoint One- Shelterwood harvest unit 6 was evaluated for its possible visual impact from this viewpoint. Unit 6 is not a component of Alternative C. The topography from the viewpoint to the unit is very steep and includes several cliff features in the middleground. As the topography obscures the unit from the viewpoint, the low to very low SIL objective for MA 15 would be achieved.

Viewpoint Two- Three timber harvest units (9, 10, and 11) were evaluated from Viewpoint Two. All of these units are located on MA 15. Units 10 and 11 are shelterwood treatments and unit 9 is a commercial thinning. Unit 10 is not a component in Alternative C. The foreground view to the west and north of the viewpoint is a dense stand of second growth timber that totally obscures the view of the units. Vegetative treatment of the foreground stand is not reasonably foreseeable. The low to very low SIL objective would be met.

Viewpoint Three- This viewpoint was selected as a second location to evaluate the view to units 10 and 11. The foreground view to the north of the viewpoint is a stand of second growth timber that mostly obscures the view of the units. Some of the background can be distinguished but any timber harvest activities would not be discernible, particularly in the summer when more leafy vegetation is present. Vegetative treatment of the foreground stand is not reasonably foreseeable. The low to very low SIL objective would be met.

Viewpoint Four- This viewpoint was selected to evaluate the view to shelterwood unit 22, which is located on MA 15. Unit 22 is not a component of Alternative C. The images at Exhibit I-2 show several attempts to view the background through a foreground of hardwoods and conifers. One location does allow a narrow unobstructed corridor view of unit 22. The view of the unit from the viewpoint, particularly in the summer when more leafy vegetation is present, is limited and timber management activities would not be noticeable to most forest visitors unless they were outside of their vehicles. Vegetative treatment of the foreground stand is not reasonably foreseeable. The low to very low SIL objective would be met.

Viewpoint Five- This viewpoint was selected to evaluate the foreground view of the commercial thinning proposed for unit 43. Timber harvest is proposed in both action alternatives. The low SIL meets forest plan objectives for the MA 15 land in the view. Unit 43 is located on both sides of Road 910. Commercial thinning would remove both understory and overstory trees but leave enough of an overstory that the appearance of a forest is still intact. Foreground views would be allowed well in to the stand as much of the understory trees and other vegetation are removed. The low to very low SIL objective would be met.

Cumulative Effects of Alternatives B (Proposed Action) and C

As mentioned earlier in this section, past management activities; such as timber harvest and road construction; have placed unnatural shapes and textures on the landscape in many areas. Visibility of some of these features would continue and not change, such as permanent roads. Other features are more dynamic in their appearance as vegetation is regenerated and grows, thus becoming less evident on the landscape.

Other past, present, and reasonably foreseeable actions have contributed to the scenic character of the Martin Creek drainage. These actions would be addressed in the paragraphs below with discussion regarding the current proposal's influence on the scenic resource. Please refer to Exhibit I-3.

Timber Harvest- As described above for Direct and Indirect Effects, the scenic views in the Martin Creek drainage as seem from the viewpoints shows limited amounts of past timber harvest activity, due primarily from vegetative or topographic screening. Other views not in the vicinity of the proposed Alternative B or C timber harvest units do show past evidence of timber harvest, however these areas are improving their scenic attractiveness as new seedlings and saplings have become established. The new timber harvest proposals in this project would not cumulatively create a departure from the established SIL for the areas proposed for harvest as the direct and indirect effects described above are so limited.

Road Construction- New temporary and permanent road construction could create color, line, and pattern changes in the viewing landscape. However, none of this new construction is visible from any of the viewpoints described above or any other viewpoint that could be

commonly accessed by the public in vehicles. The current transportation system visual impact would not be increased; therefore, no cumulative effects would be realized.

Wildland Fire Suppression- As a result of fire suppression activities, less of the Martin Creek landscape has experienced wildland fire than if no suppression had taken place. The appearance of the landscape would be more open with fewer contrasting lines as commercial timber harvesting of live trees would have been replaced by salvage logging dead trees. The appearance of a landscape after a large wildland fire is perceived differently by different individuals, with some considering the wildland fire a natural event and within the scope of ecosystem function, while others prefer a green, lush landscape. As wildland fire would continue to be suppressed, typically with a very high initial success rate, actions related to the alternatives would not change the landscape view in relation to new wildland fire events.

Prescribed Burning- The visual impacts from prescribed burning are typically changes to the color and texture of the area treated. These impacts are usually evident only in the very short term as the dark colors are replaced by new vegetation in two to three years. Due to this short term effect and past actions have fully recovered, the cumulative effects of the treatments prescribed in Alternatives B and C do not affect the scenic resource.

Sapling Thinning- Sapling-sized trees ranging in height from five to twenty feet are typically felled and left in place during thinning operations. Needles on felled trees usually turn red, then brown, for a period of up to five years. Thinning slash on the ground as viewed from the foreground is a departure from a pleasing appearance. The resulting stand in the future would feature a more diverse color and textural appearance due to a larger variety of tree species and a larger size class. Past and current sapling thinning would not cumulatively create a departure from Forest Plan scenic standards.

Snowshoe Hare Research- Of the activities associated with this research, only the sapling thinning aspects would possibly have an impact on the scenery resource. The effects of this activity are described above. Past and current snowshoe hare research would not cumulatively create a departure from Forest Plan scenic standards.

Mineral Extraction- The Martin Talus and Martin Stockpile areas are the only sources of rock and gravel in the Martin Creek drainage. Martin Stockpile is closed and Martin Talus is inactive. These pits and quarries are permanent departures from the scenic landscape. Road construction activities may result in the use of material from Martin Talus, however no pit expansion would be required and no cumulative effects related to the scenic resource would occur. Martin Talus is directly adjacent to the Martin Creek road approximately 1.6 miles southeast of Martin Falls.

Reed Canary Grass Control Project- Treatments could include prescribed burning, mowing, herbicide application, and coverings with black plastic sheets. These activities, as viewed in the foreground, could have short-term visual impacts; however, the activities could create a more natural appearance in the meadow/pond due to the eradication of Reed Canary Grass and the return of more native vegetation. Due to the above reasons the project would not cumulatively create a departure from Forest Plan scenic standards.

Road Decommissioning- This action has had a positive effect on the scenic resource as decommissioned roads typically revegetate and, over time, become more difficult to discern

in middle and background viewing. No roads are scheduled for decommissioning in any of the alternatives; therefore no cumulative effects from road decommissioning are realized.

Private Land Development- Construction of buildings on the viewing landscape could introduce color, line, and pattern departures. No alternative proposes building construction on National Forest System land. Development of private land may continue.

Special Use Permits- An underground water line and a power line corridor on NFS land are the two special use permits in the Martin Creek project area. The water line is not seen and the power line corridors are along existing or past roadway corridors. Some cutting of vegetation in the corridors may periodically be necessary. The powerline and periodic maintenance is consistent with the views of the transportation network and would not cumulatively impact the scenic resource.

Fuels Reduction Treatments- Vegetation and down fuel removal projects without timber harvest has occurred on both private and federal land. These treatments typically cut and pile small trees and branches and are only visible from foreground views. Treatments are only discernable for a short amount of time as lower vegetation grows back. Fuel reduction activities in association with other vegetation treatments would not cumulatively have an adverse effect on the Forest Plan scenic standards as vegetation grows back and the standards for the MAs where this takes place allows for an SIL of very low to low.

Agriculture- Farming and ranching activities have the potential to reduce the diversity of color, texture, and pattern as well as introduce new line features on the landscape. The very minor amount of agriculture activities are only evident on private land; therefore, landscape view departures from the proposed activities in the alternatives would not cumulatively affect the scenic resource.

Regulatory Framework and Consistency

Regulatory Framework for the Scenery resource was discussed on the first and second pages of this section.

The No Action Alternative and the proposed activities in the action alternatives would comply with the visual resource objectives in the Forest Plan. The only scenic altering activities would possibly occur on MA 15 designations and the minimum scenic goal for MA 15 is "low to very low." As described above, each of the views from the designated viewpoints meets this goal.

Heritage Resources

Introduction

Heritage resources involve the conservation of archeological, cultural, architectural, and historic sites and artifacts. This section describes the existing heritage resource conditions of the Martin Creek area and how the no action and action alternatives would affect the various components of this resource. The effects analysis focuses on those areas where potentially ground-disturbing activities, such as timber harvesting, are proposed. Activities that only involve the use of hand crews and no heavy equipment, such as sapling thinning, would typically not receive consideration from heritage resource personnel.

Information Sources

The Flathead National Forest is taking a multi-phase approach to cultural resource compliance [36 CFR 800.3(c)] for the Martin Creek area analysis. This is possible because of the site-specific nature of cultural resources and cultural resource compliance. The first phase is a reconnaissance level inventory of known cultural resources and a sampling of areas with a high probability for the occurrence of additional cultural resources. A pre-survey file search for information on previously recorded heritage sites in the proposed project area is also conducted. This phase includes initial consultation with the Confederated Salish and Kootenai Tribes to identify any concerns they may have regarding traditional cultural properties, traditional use plants, and areas of spiritual importance in the analysis area. The second phase occurs prior to actual project implementation and requires a thorough inventory of all proposed undertakings so as to locate, record, and evaluate the historical significance of any identified heritage resources. It is at this time that Section 106 consultation with the Montana State Historic Preservation Office (MtSHPO) would be completed to determine the historic significance and National Register eligibility of any identified sites, potential project effects to such sites, and methods for avoidance or management of adverse effects (Exhibit K-1). The Region One Programmatic Agreement (R1PA) between the USDA Forest Service, the MtSHPO, and the Advisory Council for Historic Preservation (ACHP) provides a streamlined consultation process.

The field inventory strategy is defined in the Site Inventory Strategy (SIS) (Exhibit K-2) and involves pedestrian reconnaissance in areas proposed for future timber harvest or other ground-disturbing activity. Regardless of the degree or type of harvesting prescription, heritage resource personnel inventory the affected areas based upon topography with "high probability areas" (ridge tops, peaks, stream terraces) receiving 100 percent coverage, "medium probability areas" (slopes less than 30 percent, rock outcrops, erosional surfaces) receiving 40 percent coverage, and "low probability areas" (slopes in excess of 30 percent, north-facing slopes, heavily timbered slopes with abundant deadfall and understory) receiving 10 percent coverage.

Any heritage resource sites discovered during the two-part inventory are recorded and their National Register eligibility status evaluated in consultation with MtSHPO (Exhibit K-3).

Analysis Area

The analysis area for heritage resources, which encompasses all lands within the boundaries of the Martin Creek Resource Management Area defined in Chapter 1, was selected because all proposed management activities would occur within this area. The effects on heritage resources would not extend beyond the project boundary. The duration of effects on heritage resources from proposed actions would be for the time that the actions are taking place, in this case between approximately 2015 and 2020.

Affected Environment

Previously Identified Heritage Resources

Prior to the two-phase inventory, the Forest Heritage Resource staff conducted an in-house files search for information on known, previously recorded heritage resources in the Martin Creek area. General Land Office plat maps, BLM Land Status Records, historic forest maps, and the forest's cumulative site and survey atlas were all referenced for site information.

The file search identified two recorded cultural sites in the Martin Creek area. Both are historic period sites. None are considered eligible for listing on the National Register of Historic Places. There have been at least nine previous cultural resource inventories in the analysis area.

Results of Survey Methodology

As of this writing, a complete pedestrian inventory for discovery of important cultural resources has been completed for those portions of the Martin Creek area that could be impacted by the proposed actions in Alternatives B and C and meet the SIS described above. No new cultural properties were identified during the field inventory (Exhibits K-4, 5, and 6). None of the known, recorded sites are eligible for listing on the National Register of Historic Places. Surveys focused on areas proposed for ground-disturbing activities, such as timber harvest units and road construction.

Discussions with the Confederated Salish and Kootenai Tribes (CSKT) are on-going but have not identified any concerns in the project area. Consultation with the CSKT will continue (Exhibit K-7).

Environmental Consequences

As described in the regulatory framework section below, the Forest Service is required under several statutes to protect and manage cultural sites. These requirements are carried forward in the Flathead Forest Plan standards for heritage resources (Forest Plan, pages II-18 to II-21).

Heritage resource inventories are required by the Forest Plan prior to all ground disturbing projects in order to locate and identify historic or Native American sites or artifacts. Once sites or artifacts are identified in a project area, protective measures are carried out that would ensure preservation of the values associated with the site.

Heritage resources can be diminished in value by any change in their historical, architectural, archaeological, or cultural character. Adverse impacts to heritage resource sites can result in damage or complete destruction of the sites; effects of this damage may be irreversible.

Direct and Indirect Effects of All Alternatives

Implementation of the No Action alternative would neither directly nor indirectly affect cultural resources because there would be no change to the integrity of important cultural resources as a result of no activities being implemented. Implementation of an action alternative would also neither directly nor indirectly affect cultural resources because there would be no change to the integrity of important cultural resources as a result of avoidance or mitigation of activities in the vicinity of heritage resources.

It is recognized that even the most intensive field surveys may not locate all cultural sites. The portions of this project that would be implemented through a timber sale contract under any action alternative would include the "B6.24# Protection Measures for Plants, Animals, Cultural Resources, and Cave Resources" clause which enables the Forest Service to modify or cancel a timber sale contract to protect heritage resources, regardless of when they are identified.

Cumulative Effects

As all effects to cultural resources have been or would be either avoided or mitigated, there would be no cumulative effects to identified heritage resources in the Martin Creek area from any proposed activities (Exhibit K-8). However, any such potential effects would be identified as part of the consultation process with MtSHPO and the CSKT and appropriate avoidance or moderating measures would be developed.

Regulatory Framework and Consistency

The USDA Forest Service is mandated to comply with the National Historic Preservation Act of 1966 (NHPA) [Public Law 89-665]. "Section 106 of the NHPA requires that Federal agencies with direct or indirect jurisdiction over Federal, federally assisted, or federally licensed undertakings afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity for comment on such undertakings that affect properties included in or eligible for inclusion in the National Register of Historic Places (NRHP) prior to the agency's approval of any such undertaking" [36 CFR 800.1]. Historic properties are identified by a cultural resource inventory and are determined as either eligible or not eligible for the National Register. Eligibility is reviewed, and concurrence given, by MtSHPO. Sites that are determined eligible are then either protected in-place or adverse impacts must be mitigated. This process takes place prior to any decisions relative to the project.

The Flathead National Forest operates under the terms of the R1 Programmatic Agreement between Region One of the Forest Service, the MtSHPO, and the Advisory Council for Historic Preservation. The Programmatic Agreement provides a streamlined process for complying with section 106 of the National Historic Preservation Act as amended (NHPA). The efficiencies provided by the PA should allow more time for the Forest Heritage program to fulfill the Forest’s responsibilities under section 110 of NHPA.

The CSKT have reserved treaty rights under the Hellgate Treaty of 1855. These include hunting, gathering, and grazing rights. The Forest Service also has obligations under the American Indian Religious Freedom Act (AIRFA) of 1978 to "protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian" [Public Law 95-442]. Executive Order 13007 of 1996 further directs federal agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and to avoid adversely affecting such sites.

The Confederated Salish and Kootenai Tribes of Montana have been identified as a tribal group concerned about the management of heritage resources on the Flathead National Forest. The tribes were contacted in the initial planning stages of the Martin Creek project in order to establish lines of communication between the two parties, to advise them on the scope of the undertaking including potential effects, and to make their resource concerns (if any) an official part of the project record. Consultation with recognized tribal governments is further defined and required by the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 [Public Law 101-106], the 1992 amendments to the National Historic Preservation Act (NHPA), and the 1999 revisions to the implementing regulations in 36 CFR Part 800; Protection of Historic Properties.

The Flathead Forest Plan incorporates the requirements under the following statutes: the National Historic Preservation Act of 1966 (as amended) and the American Indian Religious Freedom Act (1978). Forest Plan standards applicable to this project which reflect the mandates under the above statutes include:

- Inventory procedures: "Cultural resource inventories will be conducted on all ground disturbing projects that are generated, licensed, permitted, or allowed to occur by the Forest Service."
- Evaluation procedures: "Identified cultural resources will be evaluated in relation to published criteria for eligibility to the NRHP."
- Protection/preservation measures: "Known, significant cultural resource sites on the Forest will be protected from inadvertent or intentional damage or destruction."
- Coordination/consultation procedures: "The Forest will make an effort to coordinate cultural resource issues and concerns with appropriate Native American groups, other Federal and State agencies, the historical and archaeological communities, and the general public."

Protection of historic and prehistoric heritage resources is prescribed in a number of laws including the National Historic Preservation Act of 1966 (as amended in 1980). Implementing regulations for the NHPA are codified in 36 CFR 800. Forest Plan standards and guidelines are designed to meet the requirements of these regulations. All Martin Creek Resource Management Project proposed activities are consistent with the laws and regulations listed above and with those incorporated into the requirements of the Flathead Forest Plan. Section 106 compliance and consultation with MtSHPO for this project has been completed.

Economics and Social

Introduction

This section presents a description of the economic environment that could potentially be affected by the alternatives, along with an estimate of what those effects might be. The focus is on the economic relationship of the Flathead National Forest to the economy within and around the Forest, and the economic influence of goods and services the Forest provides.

No significant issues associated directly to economics were identified in the scoping process, although issues involving the amount of timber harvested are closely related. Other issues such as motorized access and quality of the environment are somewhat related.

Information Sources

Economic information was gathered primarily from the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), and the Bureau of Business and Economic Research (BBER) at the University of Montana. Population data were provided by the U.S. Census Bureau. Economic efficiency inputs (revenues and costs) were derived from 1) the Region 1 transaction evidence appraisal system (timber revenue), and 2) cost information provided by various resource specialists on the Forest from recent experience with similar projects.

The evaluation of direct, indirect, and cumulative effects on economics used the most recent and available information, as well as data related to past, present, and reasonably foreseeable activities that have occurred or may occur in the economics analysis area. Applicable past, present, and foreseeable events described in Table 3-1 at the beginning of this chapter were considered during the evaluation of the affected environment. The condition of the affected environment, together with applicable reasonably foreseeable events as described in the above-mentioned section, were considered during the analysis of the environmental effects of the alternatives. The listed activities that are not specifically analyzed or mentioned in the following discussion were considered to have no potential effect on the economics resource.

Analysis Area

The proposed action and its alternatives are located in the economic influence area of Flathead, Lake, Lincoln, and Sanders counties, Montana. The designation of the four county economic influence areas were based on the multiple criteria suggested in the Forest Service Economic and Social Analysis Handbook (FSH 1909.17). Criteria include the location of the economic center, wood processing facilities, residences of the forest products industry workforce, and the center of spending for retail and wholesale goods and services. The timeframes for this analysis are from the beginning of implementation of activities to the completion of the last reforestation survey in approximately 2021.

Affected Environment

The affected environment for the economics analysis will be discussed in terms of the economic community and forest products industry affected by the project.

The Economic Community

The Flathead National Forest geographically includes parts of six Montana counties: Flathead, Lincoln, Lake, Missoula, Powell, and Lewis and Clark. The proximity of the project to Missoula, Powell, and Lewis and Clark counties precludes them from the economic influence area, whereas Sanders County is included. About three-fourths of the area of the forest, and most of the economic effects of Forest programs and projects, occur in Flathead County. The Forest influences Lake County to a lesser degree and only minimally affects the other counties.

The Flathead National Forest is an important part of the Northern Continental Divide Ecosystem, which covers most of northwest Montana. This area has substantial economic value on a regional, national, and international scale when recreation and tourism, wildlife, and aesthetic values are considered along with a substantial timber management program. However, it is beyond the scope of this analysis to evaluate markets for all these resources because they have not been identified as substantial economic issues in respect to the Proposed Action. The emphasis is on the economic effects that the Proposed Action and the alternatives would have on the wood products industry and economic communities that would be primarily affected.

County Level Economic Indicators

Part and full-time employment in the four counties grew rapidly from 1970 to 2011 (Table 3-97). The total employment in the four counties increased from 30,186 in 1970 to 85,529 in 2011 (U.S. Dept. of Commerce 2012 and U.S. Dept. of Labor 2012; Exhibit N-01). This is a growth rate of approximately 183 percent, outpacing population growth, which grew at 90 percent. A substantial decrease in total employment occurred between 2007 and 2010, with a loss from 93,001 to 85,335. Flathead County in particular has consistently been one of the counties in the state with rapid employment growth in the last 41 years (271 percent). The 2010 unemployment rate in all four counties peaked at a rate of 11.4 percent and was much higher than the statewide Montana rate of 6.8 percent (Table 3-98). This local rate in 2010 was the highest in the last 20 years and much higher than the recent low of 4.2 percent in 2006. Some improvement in the employment rate at all three levels has recently been reported.

Table 3-97. Total Full-Time and Part-Time Employment.

County	1970	1980	1990	2000	2011
Flathead	15,627	24,608	33,017	48,918	57,899
Four County Aggregate	30,186	42,373	54,213	76,707	85,529

Source: U.S. Department of Commerce 2012a, U.S. Department of Commerce 2012b, and U.S. Department of Labor, 2012

Table 3-98. Recent Average Annual Unemployment Rate.

Unit	2006	2008	2010	2012	2013
Montana	3.2%	4.5%	6.8%	6.0%	5.6%
Flathead County	3.6%	6.0%	11.0%	9.0%	7.9%
Four County Aggregate	4.2%	6.7%	11.4%	9.7%	8.9%

Source: U.S. Department of Commerce 2013a and U.S. Department of Labor, 2013

Several economic indicators show that although Flathead County has been leading in all statistics, all four counties have seen increases in real (inflation adjusted) earnings and income

in most recent years. Total real earnings for the four counties grew substantially each decade from 1970 until 2012 (Table 3-99).

Table 3-99. Total Earnings (millions of inflation indexed dollars).

County	1970	1980	1990	2000	2012
Flathead	$636	$984	$1128	$1698	$2220
Four County Aggregate	$1218	$1586	$1786	$2486	$3047

Source: U.S. Department of Commerce 2012a and U.S. Department of Labor, 2012

The per capita personal income (PCPI) economic indicator conveys information about the average personal income. This is what each citizen would receive if the total personal income generated by all residents (over age 15) in that county were divided equally among all residents. Historically, Flathead County and the State of Montana have had similar PCPI with the other three counties lagging behind both. In 2009, Flathead County had a lower PCPI than the State of Montana for the first time in several decades (Table 3-100).

Table 3-100. Per Capita Personal Income (adjusted for inflation).

Unit	1970	1980	1990	2000	2012
State of Montana	$22,465	$25,834	$27,659	$31,921	$39,133
Flathead	$21,362	$26,136	$28,048	$33,532	$37,555
Four County Aggregate	$19,877	$23,472	$25,910	$29,957	$34,347

Source: U.S. Department of Commerce 2012a, U.S. Department of Commerce 2012b, and U.S. Department of Labor, 2012

The project area is mainly located in Flathead County, where wood and paper products are an important component of the economic base. The Bureau of Business and Economic Research at the University of Montana reports wood and paper products accounted for 18 percent of the labor income in basic industries in Flathead County in 2011 to 2013 (Bureau of Business and Economic Research 2014). This is down two percent in the past two years. The next greatest sectors in the county were nonresident travel at 20 percent, the federal government at 18 percent, and other manufacturing at 17 percent. Please see Exhibits N-1, N-2, and N-6 for detailed labor and income information.

Timber Industry Trends

Historical Production and Capacity

Historically, annual timber offered for sale from National Forest System land in Montana averaged 477 million board feet per year between 1971 and 1991. In the period of 2000 to 2012 the timber offered dropped to 147 million board feet per year or slightly less than one-third of the historic level (Exhibit N-3). Volume offered on the Flathead National Forest historically was over 100 million board feet but since 2000 has averaged 34 million board feet per year (Exhibit N-4).

The Flathead National Forest timber processing area (TPA) is a nine county area in western Montana containing wood products manufacturing facilities that could potentially process wood harvested from the Flathead National Forest (Sorenson, et al. 2012 and Exhibit N-9).

The milling capacity of the 31 facilities in the TPA in 2011 was determined by Sorenson, et al. (2012) to be approximately 494 million board feet. The amount of wood processed in the TPA in 2011 was approximately 254 million board feet; an approximately 50 percent utilization rate. Mill capacity and production in 2009 statewide was estimated to also be approximately 50 percent (McIver, et al. 2013).

The percentage of milling capacity that is actually used, or remains available for use, affects the demand for logs and is a variable affecting log prices, which in turn, affects the quantity of logs supplied to mills.

Timber Industry Outlook

Sawlog prices have remained steady since January, 2010 but have increased recently (Exhibit N-5). The average current log price of approximately $345 per thousand board feet is greater than log prices of four to five years ago. The increase in prices is attributable to higher domestic lumber consumption related to the significant increase in housing demand and generally improved economic conditions. Projected demand for logs by the University of Montana Bureau of Business and Economic Research beyond the last quarter of 2013 is good.

At the end of 2012, estimated total employment in the wood products industry in Montana was about 6650 workers, up almost three percent from 2011. Among Montana's sawmills, lumber production for 2012 increased almost 10 percent. Montana's forest products industry executives are generally unsure about the industry's outlook for 2013, expecting sales to be about the same or slightly better than 2012 (Exhibit N-6).

The period of 2007 to 2011 represents the worst operating environment experienced by the North American and Montana forest products industry since the Great Depression (McIver, et al. 2013). It involved a two-year recession from 2007 to 2009, the related financial crisis, and a housing collapse with the lowest levels of new home construction since the Second World War (Keegan, et al. 2012). As of August 2012, there has been only a small increase in U.S. housing construction. Modest upticks are expected in domestic lumber markets during the remainder of 2012 and 2013, with substantial improvements not likely until 2014 or beyond, if U.S. home building recovers and global demand continues to increase. With slightly over half of capacity utilized in recent years; versus a historic level of over 80 percent during good markets, the industry would be expected to process substantially more timber when markets improve, provided adequate timber supply is available (Exhibit N-6).

Environmental Consequences

The following effects indicators were used to focus the economic analysis and disclose relevant environmental or social effects:

- Effects on Employment
- Effects on Labor Income
- Effects on Revenue Sharing
- Effects on Financial Efficiency

Direct and Indirect Effects of Alternatives on Forestry Services Employment and Labor Income

The activity of timber harvesting, as proposed, has the potential to create employment and income. These effects are both direct (workers employed in the forest products industry and government) and indirect (jobs and income created from the local spending of the forest products industry and government, and their employees). The effects on employment and income have the potential to affect the other economic variables such as economic structure, unemployment, and wages.

Analysis in northwest Montana (Keegan 2002; Stockmann and Montag 2005) shows that the processing of one million cubic feet (MMCF[1]) of timber by a sawmill generates approximately 50 to 80 job years[2] and 1.5 to 2.5 million dollars in labor income. This includes direct, indirect, and induced jobs[3] and labor income. These jobs and income include direct jobs and income in logging, wood processing, and transportation; jobs supporting these industries; and jobs and labor income generated from the spending of the workers. The following table is a summary of the maximum potential effects to total employment and labor income in the four county economic impact areas from the harvest and processing of timber proposed in the alternatives, with the greatest number of jobs and labor income attributable to Alternative B (Exhibit N-7). The No Action alternative, Alternative A, would not produce any jobs or labor income.

Table 3-101. Employment and Labor Income from Timber Harvest and Processing

	Alternative A	Alternative B	Alternative C
Timber Volume (MMCF)	0	1.056	0.437
Jobs	0	63	26
Labor Income	0	$2,600,000	$1,077,000

The two action alternatives would spend between $470,000 and $825,000 on service contracts to perform tree and shrub regeneration, replace culverts, stabilize cut and fill slopes, road maintenance/storage, trail rehab, and precommercial thinning. This would create approximately 16 to 30 jobs and between $548,000 and $987,000 dollars in labor income (see following table). A few additional jobs and income would be generated from weed management activities associated with the timber harvest.

In addition to the jobs and income generated by timber harvesting and service contracts, there would be jobs and income also generated by associated timber management activities. These include slash disposal, site preparation, and subsequent surveys. History shows that there is a good chance that a substantial amount of the economic effects of reforestation activities could occur outside of the Flathead County area, depending on the origin of service contractors and crews.

[1] Please refer to the Glossary in Appendix A for definitions of board feet and cubic feet of timber.
[2] A job year is a job that lasts the equivalent of one year. For example 10 job years could be 10 jobs for one year or one job for 10 years or any combination thereof.
[3] A job can be full-time or part-time, seasonal or permanent. It is not a “full-time equivalent.”

The potential jobs and income described above would be spread over approximately a seven-year period from 2014 to 2021.

Table 3-102. Employment and Labor Income from Forest Service Contracts

Activity	Alternative A	Alternative B	Alternative C
Cost of Tree Planting*	0	$215,208.00	$24,592
Cost of Shrub Slashing/ Planting	0	$166,000	$166,000
Cost of Precommercial Thinning	0	$286,240	$121,770
Cost of Culvert Replacements	0	$132,000	$132,000
Cost of Martin Creek Road Rip Rap	0	$10,000	$10,000
Cost of Road Maintenance/ Storage	0	$14,983	$15,655
Cost of Martin Lake Trail Rehab	0	$750	$750
Total Jobs from Service Contract	0	30	16
Total Labor Income from Service Contract	0	$987,000	$548,000

*Discounted seven years to 2021.

Direct and Indirect Effects of Alternatives on Revenue Sharing

Revenues from National Forest programs are distributed to counties annually in accordance with several Federal acts. Historically, the Twenty-five Percent Fund Act has been the greatest source of funds. However, the enactment of the Secure Rural Schools and Community Self-Determination Act of 2000 (Public Law 106-393) has substantially changed the revenue distribution. The Payment in Lieu of Taxes Act (PILT) also distributes funds to counties based on the amount of federal lands in each county. This amount is normally reduced by other certain payments (including 25 percent funds) paid in the prior year. The PILT fund program is administered by the Bureau of Land Management.

Due to declining Forest Service timber revenues in the west, Congress enacted the Secure Rural Schools and Community Self-Determination Act of 2000 to supplement the Twenty-five Percent Fund Act. This allowed electing counties to base their Twenty-five Percent Fund payments on an average of the highest three payment years from 1986 to 1999. This act has been reauthorized, with some changes, through Fiscal Year 2014. All counties affected by Flathead National Forest payments made this choice and now receive the newly calculated payment instead of what would have been normally received under the Twenty-five Percent Fund Act. As can be seen in the following table, this election made a substantial difference in payments.

PILT payments are made to local governments to supplement other receipt-sharing programs such as the Twenty-five Percent Fund or Secure Rural Schools Act Payments. Generally, the more revenue sharing funds received, the less would be the PILT payments. However, the formula is complex, varies from county to county, and will not be explained in this document.

A complete explanation of the PILT provisions and revenue sharing can be found in Schuster, 1995 and 1996.

Table 3-103. Distribution of Twenty-five Percent Fund (1997 to 2000) and Secure Rural Schools Act Payments (2001 to 2013) (thousand $) by County.

Year	Flathead	Lake	L and C	Lincoln	Missoula	Powell	Total
1997	$636	$48	$380	$3,388	$545	$318	$5,315
1998	$909	$72	$566	$3,651	$613	$394	$6,205
1999	$506	$39	$216	$4,008	$297	$186	$5,252
2000	$361	$24	$211	$3,181	$264	$155	$4,196
2001	$1,501	$120	$422	$5,659	$704	$456	$8,862
2002	$1,513	$121	$425	$5,703	$710	$459	$8,931
2003	$1,531	$122	$431	$5,772	$718	$465	$9,039
2004	$1,551	$123	$437	$5,847	$728	$471	$9,157
2005	$1,586	$127	$447	$5,982	$744	$482	$9,368
2006	$1,602	$127	$451	$6,042	$752	$487	$9,461
2007	$1,599	$128	$450	$6,029	$750	$486	$9,442
2008	$2,010	$54	$928	$6,298	$958	$1,485	$11,733
2009	$1,995	$54	$910	$6,433	$910	$1,653	$11,955
2010	$1,786	$57	$736	$5,036	$871	$1,315	$9,801
2011	$1,695	$57	$659	$4,174	$802	$1,163	$8,550
2012	$1,592	$47	$669	$4,429	$822	$986	$8,545
2013	$1,600	$38	$640	$4,261	$824	$881	$8,244

Source: http://www.fs.fed.us/srs/.

As all counties have made the election for even-payments under Public Law 106-393 and elected to continue this under reauthorization, changes in Forest Service revenues have had no effect through 2012 on payments-to-counties. Although Forest Service revenues change from alternative to alternative in this proposal, payments-to-counties, including PILT payments, would not change under P.L. 106-393 as reauthorized. It is not known if P.L. 106-393 would be reauthorized after 2014 when revenue generating activities of the proposed project would be completed. If Public Law 106-393 is not reauthorized, counties would return to payments based on the Twenty-five Percent Fund.

Direct and Indirect Effects of Alternatives on Financial Efficiency

The financial efficiency of each action alternative was analyzed using the present net value (PNV) of revenues and costs anticipated during the life of the project (until regeneration surveys are completed in about 8 to 10 years). PNV can be viewed as the positive or negative value of a particular alternative as a result of committing forest resources. The following assumptions were used in the PNV analysis:

a) This analysis determines the net economic returns of various alternatives based on resource costs and benefits which can easily be measured in dollar terms. Other amenity resources that are more difficult to assign a dollar value (e.g., wildlife, water, air) were not considered.

b) Net values were determined for the year 2012. Future monetary values were discounted four percent per year. The harvest schedules for each alternative were distributed over the years 2016 through 2018.

c) The revenues are those related to the sale of timber and the costs are those related to timber sale preparation, implementation, administration, post-sale treatments, noncommercial fuel treatments, campground improvements, etc. A complete list of revenues and cost cash flows by alternative are presented in Exhibit N-7. Revenue and cost data were developed specifically for this project and reflect current levels for this geographic area.

d) Stumpage values by alternative were estimated using the Region 1 timber sale feasibility spreadsheet (Exhibit N-8). These timber prices were then used in the Forest Service Project Economic Analysis Tool (PEAT) (Exhibit N-7) to determine present revenues, costs, and net values.

The following table shows a summary of the volume offered, total present value cost, total present value revenue, and PNV. These calculations represent ***all*** activities with quantifiable costs and revenues in the project area, ***not*** just those associated with the timber sale appraisal. Documentation for the calculations of the values presented in the following table is found in Exhibit N-7.

Table 3-104. Summary of Discounted Costs and Revenues for the Project Period

Economic Parameter	Alt. A	Alt. B	Alt. C
Timber Volume (MMBF)	0	5.5	2.3
Timber Volume (CCF)	0	10,568	4,376
Total Present Value Cost	0	-$910,991	-$494,530
Total Present Value Revenue	0	$417,202	$107,545
Present Net Value	0	-$493,788	-$386,986

The total present value for revenue in the above table represents the estimated value of a traditional timber sale bid package for each of the alternatives. These bid packages include the value of wood products in the commercial timber sale units plus the costs associated with required items in the timber sale contract, such as road construction, reforestation activities, erosion control, and slash disposal. The positive value for Total Present Value Revenue in the table suggests a traditional timber sale offered from the commercial wood product units in each of the action alternatives would be attractive to bidders at this time. Alternative B would result in the most revenue with Alternative C resulting in the least.

The total present value for costs in each of the alternatives is a negative figure as these are the sums of the present value of the cost of each of the activities ***not*** associated with the sale of commercial wood products. Some of these costs are displayed in Table 3-100 above and some of the costs are not contracted as they are performed by Forest Service personnel (such as prescribed burning). The present value of these costs is greatest in Alternative B and least in Alternative C.

The PNV of each alternative *as a whole* is a negative number. However, the purpose and need statements for this project (please see Chapter 1 of this EA), do *not* include generating a positive revenue to the federal treasury after *all* activities in each of the alternatives are paid

for. A stewardship approach may be used to offer some or all of the activities described in the alternatives in a contract where the costs can be offset by the value of the commercial products. Activities not associated with the timber sale, such as sapling thinning or trail improvements, could be funded using appropriated funds, trust funds, or other means.

Cumulative Effects

This section considers the effects on the economic environment resulting from the incremental impact of the alternatives, when added to other past, present, and reasonably foreseeable actions and trends.

Past and present human actions in and around the project area have had an effect on the social and economic environment. The human activity that has had the most influence on the local economy is timber harvesting. Other human activities have had, are having, or would have an effect on the economy (Exhibit N-10). Below are the past, present, and reasonably foreseeable actions considered in this cumulative effects analysis:

- Timber harvesting on public and private lands
- Vegetation treatments, such as tree planting and sapling thinning
- Road construction and maintenance
- Fire suppression
- Recreational-related activities
- Noxious Weed Treatments

Alternative A – No Action

The No Action alternative would result in some associated cumulative economic effects. There would be future costs associated with the management of the national forest resources. For example, the costs of controlling a stand replacement wildland fire moving through the project area from or toward private land could be substantial, especially with adjacency of structures. These costs could translate into benefits to local businesses as they supply material and supplies for the suppression effort. These economic effects are more likely if the no action alternative is selected.

Action Alternatives B and C

Management of the Flathead National Forest has had and would continue to have an impact on the economies of local communities. As described above in the affected environment section, timber harvest and other actions on the national forest contribute raw materials and provide employment.

The selection of an action alternative has the potential to affect timber-related employment, which include road construction and weed treatments, in the communities of the economic impact area. Maintenance of the amount of timber harvested from National Forest System lands would impact wood product employment and associated indirect employment. Cumulative loss in timber-related jobs could affect the remaining infrastructure and capacity of the local communities, and could disrupt the dependent local goods and service industries.

Service contract activities, such as tree planting and sapling thinning, have the potential to provide substantial seasonal income. These actions would cumulatively, with similar present

and reasonably foreseeable actions, maintain a skilled workforce that provides the activity at a reasonable price. Timber stand improvement actions also increase the value and amount of wood products in the future.

It is anticipated that timber harvested in the Decision for this project, would be combined under one contract with potential timber harvested from the Radnor Resource Management Project. The effect of combining volumes would be a net improvement of timber sale feasibility.

Because recreation facilities improvements, such as trail maintenance, would occur under an action alternative, an improvement of recreation opportunities could be realized. The recreation support economy, such as gasoline suppliers and equipment rental businesses, could see an increase in income if recreation opportunities are enhanced.

Regulatory Framework and Consistency

The development of timber sale programs and individual timber sales is guided by agency direction found in Forest Service Manual (FSM) 2430. Forest Service Handbook (FSH) 2409.18 guides the financial and, if applicable, economic efficiency analysis for timber sales. Forest Plan direction is to provide a sustained yield of timber products that is cost effective and responsive to the needs of the local economy (USDA Forest Service 1986). Alternative A would not be consistent with this Forest Plan direction. The two action alternatives offer varying levels of cost-efficient timber harvest (as described in the paragraphs above) and are consistent with being responsive to the needs of the local economy.

Environmental Justice and Civil Rights

Executive Order 12898, issued in 1994, orders federal agencies to identify and address any adverse human health and environmental effects of agency programs that disproportionately impact minority and low-income populations. The Order also directs agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife.

The Civil Rights Act of 1964 provides for nondiscrimination in voting, public accommodations, public facilities, public education, federally assisted programs, and equal employment opportunity. Title VI of the Act, Nondiscrimination in Federally Assisted Programs, as amended (42 U.S. C. 2000d through 2000d-6) prohibits discrimination based on race, color, or national origin.

None of the alternatives restrict or alter opportunities for subsistence hunting and fishing by Native American tribes. Tribes holding treaty rights for hunting and fishing on the Tally Lake Ranger District are included in the public participation process and have the opportunity to provide comments on this project.

Table 3-101 above, predicts more employment and income opportunities would be created by Alternatives B, and C than by Alternative A, with Alternative B providing the highest level of opportunity. Implementation of any action alternative would not likely adversely affect minority or low-income populations.

Chapter 4

Consultation, Coordination, and Response to Comments

Preparers and Contributors

The following Forest Service employees assisted with the development of this environmental assessment:

ID TEAM MEMBER:	TITLE:	AREA OF CONTRIBUTION:
Cory Anderson	Forester	Logging Systems/Economics
Ema Braunberger	Resource Information	GIS Analysis
Hans Castren	Forest Technician	Recreation
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Derek Milner	Soil Scientist	Soils
Amanda Smiley	Forester	Vegetation/Silviculture
Lisa Timchak	District Ranger	Project Oversight
Mike West	Fuels Planner	Fire and Fuels/Air Quality

Agencies, Organizations, and People Consulted

The Forest Service consulted the following groups, individuals, Federal, state and local agencies, and tribes during the development of this environmental assessment:

FEDERAL, STATE, AND LOCAL AGENCIES:
- United States Fish and Wildlife Service
- Montana Department of Natural Resources and Conservation
- Montana Department of Fish, Wildlife, and Parks*
- Montana Department of Environmental Quality
- Flathead County

TRIBES:
- Confederated Salish-Kootenai Tribes

BUSINESSES:
- F.H. Stoltze Land and Lumber Company
- Plum Creek Timber Company
- Daily Inter Lake
- Whitefish Pilot
- Montana Wood Products Association
- ACP Cedar Products Inc.

GROUPS:

Alliance for the Wild Rockies*
Swan View Coalition
American Fisheries Society, Montana
Montanans for Multiple Use
The Lands Council*
Flathead Economic Policy Center
Friends of the Wild Swan*
Defenders of Wildlife
Whitefish Lake Institute
Flathead Audubon Society
Trout Unlimited, Flathead Valley Chapter
Cottonwood Environmental Law Center*

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Response to Comments

Public comments express a distinct concept and represent identifiable concerns. Sample statements were selected for each public concern that best represented each distinct concept. In some cases, more than one sample statement was included to better capture the concern. Following the sample statements are a response to each concern from the project's Interdisciplinary Team. Those agencies, organizations, or individuals who provided comments are indicated with an asterisk (*) in the above lists. The individual or group that commented with an identifiable concern is identified in brackets at the end of the public concern statement.

The following public concerns were identified in the comment letters regarding the EA dated June, 2014. Page numbers used in the responses to the following public concerns are in reference to this EA dated March 2015.

Air Quality

1. Public Concern: Referenced from EA Page 3-93. *"There would be no direct effects to the air quality or human health from Alternative A. No prescribed burning would occur in this alternative, therefore no prescribed burning smoke emissions would be produced by this alternative. However, the potential of a large-scale wildland fire is greatest with Alternative A, and a large-scale fire could have*

far greater impacts on air quality than any action alternative. Air quality would not be impacted until a fire escapes initial attack efforts. At that time there would be a higher level of particulate matter released than pile burning because of the greater amount of fuel consumed. The eventual wildland fire would have a much different impact than controlled burning. Pile burning or understory burning impacts usually last for a short period of time, and are managed for the least amount of air quality impacts possible. Air quality from wildland fires could be impacted for weeks, as was experienced in various parts of the Northern Rockies in 1988, 1994, 2000, 2001, 2003 and 2007." Observation: The chances that air quality will be degraded are 100% when logging occurs. The chances of a wildfire occurring in the next 50 years are about 1% or 2%. [Artley]

> ***Response:*** *Representatives from Region One of the Forest Service participated in the Montana/Idaho Airshed Group. The Montana/Idaho Airshed Group shares information and coordinates activities to assure cumulative actions do not result in unacceptable effects on air quality in Montana. By participating in the Montana/Idaho Airshed Group, complying with the Montana Air Quality Bureau, and meeting the requirements of the State Implementation Plan and the Smoke Management Plan, the proposed activities would comply with the Forest Plan and the Clean Air Act.*
>
> *Seventeen wildfires have occurred in the Martin Creek project area from 1986 through 2012. Assuming that trend continues, the chances of a wildfire occurring annually within the project area are 65 percent. Please reference page 3-72 of the Fire and Fuels section of the EA.*

Aquatic Resources

2. Public Concern: Referenced from EA pages 3-108 to 3-109: *"In the No-Action Alternative, resource conditions described in the Affected Environment section above would persist. Timber harvest and thinning would not occur, which may reduce resiliency of forested vegetation in those stands (Grant, et al. 2013). Road improvements and culvert upgrades would not occur. Roads that are not upgraded to BMP standards would continue producing sediment at rates described in the affected environment. Eroding fillslopes along Road 910 would not be stabilized and chronic sedimentation would continue to impact aquatic habitat and water quality. Problem culverts and high risk culverts would remain and the risk to aquatic habitat and water quality would persist. No new road construction and associated erosion would occur."* Observation: this work should have been done in the past using appropriated wildlife funding. Competent biologists don't allow their resource to sustain damage while they wait for a timber sale proposal in the area so the NEPA document can indicate restoration will result from sale implementation. [Artley]

> ***Response:*** *The Flathead National Forest has a road maintenance program that is independent of project-level NEPA analysis. The forest prioritizes road maintenance activities each year based on public safety and resource protection needs. Programmatic road maintenance activities are beyond the scope of this project.*

3. Public Concern: The pre-decisional EA does not contain recent stream survey data that is essential to determine whether the stream conditions were harmed by timber sale activities. The only way to determine this is before and after measurements which require survey data before the timber sale is implemented. Include the measured results of recent stream surveys and display a stream monitoring schedule to be completed during and immediately following sale closure. [Artley]

> ***Response:*** *A variety of recent stream survey data is summarized in Chapter 3 (Designated Monitoring Reaches), and this data characterizes "pre-treatment" conditions. Subsequent measurements will be taken at these sites following project implementation, based on the*

monitoring schedule. This information will help determine the degree of project effects. Refer to Exhibit G-16 for stream surveys and Chapter 2 for monitoring requirements.

Economics

4. Public Concern: There is no "timber famine" as the USFS has been so fond of predicting for many decades. There is no shortage of raw materials for paper and wood products in the United States. Therefore, there is no reason to have commercial timber sales in the national forests. The USFS could stop logging today and the market would never react. [Artley]

Response: *Documentation for the Martin Creek project and the Flathead National Forest Plan does not predict a "timber famine" nor do they describe a shortage of raw materials for paper and wood products in the United States. The reasons for commercial timber sales on the Flathead National Forest are clearly stated in the goals, objectives, and desired future conditions of Chapter II of the Forest Plan. The economic analysis in the FEIS for the Forest Plan also describes the impacts to the local economy of the Flathead National Forest's timber sale program.*

A Forest Service publication (RMRS-GTR-95, "Survey results of the American public's values, objectives, beliefs, and attitudes regarding forests and grasslands: A technical document supporting the 2000 USDA Forest Service RPA Assessment," 2002) used a national telephone survey to gather information about Forest Service activities from all across the country from all Americans in a general and non-specific approach. A discussion found on page 13 of the report provides some insight as to the variety of views from the public that were received on the provision of natural resources: "Improve the capability of the Nation's forests and grasslands to provide desired sustainable levels of uses, values, products, and services." Also: "The American public sees the provision of natural resources to communities dependent on public land outputs as a somewhat important objective. The provision of resources is also somewhat important role for the USDA Forest Service."

As was clearly identified and concluded in the cited document, "The need to allow for diverse uses of public lands is an important objective as well as an important USDA Forest Service role." The need to allow for diverse uses of public lands would include forest restoration activities that may produce wood products as an outcome as outlined in the purpose and need statements found in Chapter 1 of this EA.

5. Public Concern: Increases in logging do not stabilize or enhance the economy of small communities located near national forests. [Artley]

Response: *The section on Economics of this EA clearly describes the local economic impact of the alternatives in terms of both direct and indirect numbers of jobs and labor income.*

6. Public Concern: If you were really concerned about local community stability and local job creation you would offer this sale as an SBA sale. Otherwise it's likely the sale will be purchased by a large timber corporation, logged using their own labor and the logs hauled many miles to be processed at a mill far removed from the small communities you claim to help. We both know "local community stability" and "local job creation" is part of the USFS script to trick the public into accepting tragic timber sales. [Artley]

Response: *The Small Business Administration (SBA) ensures that small businesses receive the opportunity to purchase a fair proportion of the total sales of Government property. The Forest Service maintains a SBA set-aside program, which ensures small business timber purchasers have the opportunity to purchase a fair proportion of the sales of National Forest*

System timber. Each Forest has established a share or proportion of timber volume that must be purchased by small business. If that share is not met by a certain time, a small business set-aside sale is triggered (FSM 2439 and FSH 2409.18). The Flathead National Forest tracks these numbers, follows this direction, and meets or exceeds all requirements established to ensure that small businesses have fair access to timber sales.

The economic analysis and timber sale appraisal process used for the Martin Creek project used the local timber processing facilities in Columbia Falls, Montana for the end-point of log haul. It is very unlikely logs and other raw wood products from the Flathead National Forest would leave the four county economic impact zone described in the EA.

7. Public Concern: Dr. Power conducted research to validate or disprove whether increased timber harvest will enhance and strengthen the economic stability of communities located near national forests in Washington state. His research shows that logging levels are inversely proportional to community stability. Your pre-decisional EA fails to tell the public why Dr. Powers' research conclusions are not applicable to the communities near the Flathead National Forest. [Artley]

Response: *This research was not used in the EA as it is not applicable to the communities near the Flathead National Forest for several reasons.*

First, this study was conducted using data from the 1990s in the State of Washington. The socio-economic conditions at that time and at that location are not directly transferable to the four county economic impact zone of the mid-2010s used for the Martin Creek project. The much larger populations of Washington with a much greater diversity of economic influences make comparison difficult. The structure of the economy is also different across the west as compared to the 1990s, with a higher percentage of service related jobs than manufacturing jobs.

Second, the employment and job income information created from the IMPLAN software and displayed in the Socio-Economic section of Chapter 3 of the EA clearly demonstrate an economic impact of timber harvesting on the local community. The University of Montana's Bureau of Business and Economic Research (BBER) annually produces estimates from Montana mill surveys on the amount of jobs and income associated with completing the harvesting and processing of wood product volumes, further demonstrating the impact of the wood products industry's economic impact. Cumulatively, the timber harvested from national forests would result in hundreds of jobs and millions of dollars of labor income annually. In the proportionally small economic conditions of the Flathead Valley, the impact of these jobs cannot be denied.

Third, there is no demonstration by Dr. Power in his paper that there is a relationship between the amount of timber harvest and community stability. If that economy improved at that time, many other factors would have been at play regarding the amount of economic improvements in those communities while harvests decreased. The late 1990s showed economic improvements nation-wide and those local communities at that time increased their stability regardless of timber harvesting from national forests.

Fourth, Dr. Power's efforts were centered on the communities and national forests which featured a large acreage of roadless areas. Roadless areas play a minor role in the landscapes surrounding the Martin Creek project area.

8. Public Concern: Either: 1) remove the following statement from the P&N: "Provide commercial and personal-use wood products for the local economy." OR 2) offer the sale as an SBA sale, OR 3) include the following papers (referenced above) in their entirety in an Appendix to the NEPA document. Line-officers must not withhold such important information from the public. Congress

promulgated laws to prevent zealous federal officials from behaving in such a manner to feather their nest. *"The Economic Impact of Trails-Forest Recreation's Growing Impact", "Seeing Forests for their Green: Economic Benefits of Forest Protection, Recreation, and Restoration", "The Economic Impact of Preserving Washington's Roadless National Forests."* [Artley]

> ***Response:*** *Please see the response to Concern #6 regarding Small Business Administration (SBA) timber sales.*
>
> *There is no need to include the referenced research papers in an Appendix of the Environmental Assessment as these documents are readily available to the public with a simple internet search.*

Fire and Fuels

9. Public Concern: *Referenced from the EA page 1-2: "Flathead County, in cooperation with area fire districts, land management agencies, and corporate timber land owners, responded with a county-wide fire protection plan. This plan, known as the Flathead County Community Wildfire Protection Plan (CWPP) (Exhibit O-2), defines areas where communities and other enclaves of residential development are at greatest risk from wildland fire, known as the Wildland Urban Interface (WUI). The WUI in the Martin Creek area affects a small portion within the project area but does affect a larger area east of the project boundary."* Comment: Have you told the public living in Flathead County why you won't consider a Dr. Cohen alternative? Have you told them that volume is more important to you than their lives? How will you explain to the residents who lost their homes that you knew about Dr. Cohen's research conclusions and decided to reject them because removing fine fuels does not produce volume? This comment document will be on file and made available to newspapers in read by people living in the WUI should a wildfire occur in the area. I suggest you read18 U.S.C. § 1001 again. [Artley]

> *Response: Dr. Cohen's research is discussed throughout the Fire and Fuels section of Chapter 3 of this EA. Home ignitability is addressed on pages 3-73 to 3-74. When referring to direct home ignitability, we concur with Dr. Cohen's research cited in the commenter's letter. However, the loss of structures on private property is also a function of fire behavior far away from these structures that may be national forest lands. Dr. Cohen published research (Cohen 1999 and Cohen 2000a, both citations found in the Literature Cited section of the EA) regarding the benefits of reducing the intensity of wildland fire and the firebrands that are generated from those fires. Firebrands can have a substantial effect on firefighter's ability in controlling wildland fires. Many of the vegetation and fuels treatments described in Chapter 2 of this EA will meet the purpose and need of the project for reducing hazardous fuels.*
>
> *Reducing the impacts of high-intensity wildland fire on the landscape has many benefits to the resources described in Chapter 3 of the EA. Man-made structures are not the only value at risk from fire. Wildlife habitat, aesthetic values, soils, and water quality can all be affected by wildfire.*
>
> *Actions on federal land are taken in conjunction with those efforts to reduce fire intensity and improve the likelihood of success in fire suppression, and in preventing fires from spreading from federal land to adjacent private land. Still, the primary and ultimate responsibility for home wildfire protection lies with private homeowners, not public land management agencies. The National Fire Protection Association's (NFPA) Firewise communities program encourages local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, and others in the effort to protect people and property from wildfire risks. The program is co-sponsored by the USDA Forest Service, the US Department*

of the Interior, and the National Association of State Foresters. Currently as of August 2014, there were six communities within Flathead County nationally recognized by the NFPA.

The Responsible Official, Forest Supervisor Chip Weber, states in his annual letter to Incident Commanders on the Flathead National Forest that firefighter and public safety is his top priority (Exhibit O-17).

10. Public Concern: Fuels reduction logging is ineffective. You know how fine fuels interact with fire. If you'd like to read about a dozen more Dr. Cohen quotes describing the foolish, silly notion that logging commercial sized trees has any effect on fire spread and intensity please read Attachments #11 and #3. [Artley]

Response: *We disagree with your statement that logging commercial sized trees has any effect on fire spread and intensity. Our disagreement is supported by the analysis in the Fire and Fuels section of Chapter 3 of the EA. When fuels are reduced, fires burn with less intensity and have shorter flame lengths. Consequently, firefighting forces are more likely to be able to control a fire. Please see Exhibit V-3, or the Flathead National Forest's project web site, for a response to all opposing views presented in Attachments #3 and #11.*

11. Public Concern: You reject the recommendations of a fire damage reduction expert from your own agency. Indeed, Dr. Cohen has chosen to speak the truth! He is a real public servant because he refuses to lie to the American people as so many other USFS line-officers do to trick them into believing logging large trees (that are least likely to burn) will protect them. The claim by the USFS that ladder fuels reduction is necessary is a joke. [Artley]

Response: *We disagree with your statement that ladder fuels reduction is a joke. Our disagreement is supported by the analysis in the Fire and Fuels section of Chapter 3 of the EA. Increasing crown base height and decreasing canopy bulk density reduces the likelihood of a passive, active or independent crown fire which increases the likelihood of success during the control phase of a wildfire. Also, please see Response to Comment #9 and #10 above.*

12. Public Concern: Analyze a Dr. Cohen fire damage risk reduction methods in detail. The goal as described in the P&N should not be fuels reduction. The goal of this project should be to take action that will save human lives and homes before a wildfire occurs. [Artley]

Response: *We disagree with your statement that the goal as described in the Purpose and Need should not be fuels reduction. Our disagreement is supported by the analysis in the Fire and Fuels section of Chapter 3 of the EA. The goal of this project does take action to reduce fuels increasing the likelihood of controlling a fire should it occur within the project area. Please see Response to Comment #9 above.*

Old Growth

13. Public Concern: Referenced from EA page 3-154: *"However, Alternative A would not reduce the risk of old growth stands to loss from insect, disease, or stand-replacement wildland fire. In the long-term, late seral stands used by goshawks for nesting would be more likely to burn in high intensity wildland fires, as insects and disease continue to kill trees and "ladder fuels" continue to grow into the tree canopy."* Observation: Fear is an effective way to control the public. You knew if you lied by omission the fear would be maximized. A competent wildlife biologist would tell the public the complete story: The chances that individual species of wildlife that depend on old growth habit will be harassed and driven away are 100% when logging occurs. …you do not tell the public that wildfire, disease and insect activity are beneficial natural disturbance events. How did old growth survive thousands of years of fires without logging? [Artley]

Response: *The analysis of effects of a "No Action" alternative is required by NEPA 1502.14(d). It provides the opportunity to consider what would likely occur if the proposed activity would not take place. It also provides a benchmark to enable the decision maker to compare the magnitude of environmental effects of the action alternatives, which are discussed in the EA.*

Positive and negative effects from fire, insects, and disease on old growth habitat and associated wildlife species are discussed in the "Introduction" for Old Growth Habitat in Chapter 3 of the EA (page 3-147). Also see the "Natural Disturbance Processes" portion of the Affected Area discussion for Vegetation in Chapter 3 of the EA for a discussion of the roles of fire, insect, and disease in creating and perpetuating healthy forested ecosystems (pages 3-13 through 3-16).

Effects of proposed timber harvest for the action alternatives on old growth habitat and associated wildlife species are discussed in the EA on pages 3-154 through 3-160. See Exhibits Q-7, Q-8, and Q-12 for more information about these effects.

Other

14. Public Concern: Rewrite Chapter 3 to include accurate, professional, complete, honest effects disclosures, or provide unbiased science (not authored by a USDA employee). [Artley]

Response: *A rewrite of Chapter 3 is not necessary as accurate, professional, complete, and honest effects disclosures are already provided. The interdisciplinary team who performed the effects analysis of the alternatives on the natural resources has extensive experience with the environmental processes of the Northern Rocky Mountains. The specialists involved with this project utilized scientific publications and information from a variety of sources, included those published by USDA employees. We assert USDA scientists are among the most unbiased and competent researchers in the world.*

15. Public Concern: Read the statements by 342 Ph.D. biological scientists in Opposing Views Attachments #1 and #2. Each of these scientists describes the resource damage (some permanent) that is inflicted on the forest ecosystem by logging and road construction activities. [Artley]

Response: *The Responsible Official and the interdisciplinary team have reviewed the statements and literature in these two attachments. Responses to Attachment #1 (opposing timber harvest) and #2 (opposing salvage logging) are addressed in Exhibit V. In the Decision Document for this project, the Responsible Official outlines how the best available scientific information was used to inform the assessments and decisions made for this project.*

16. Public Concern: You are being paid to serve 317 million Americans (your bosses), not special interest groups! With any other employer if you ignored your bosses you would be terminated. How is this situation different? [Artley]

Response: *In our over two-hundred year old form of government, the voting public elects a President and members of Congress to represent them at the federal level. The President and Congress pass laws and sign executive orders that reflect the will of the people. The departments and agencies within the executive branch, including the Forest Service, abide by those laws and orders. The regulatory compliance discussions of the resource sections of Chapter 3 of the EA as well as the Findings Required by Law, Regulation, and Agency Policy section in the Decision Notice all show how the Martin Creek project is in agreement with the desires of the American people.*

17. Public Concern: Include a discussion and supporting data showing whether the majority of the people in the area support or reject logging in the Flathead National Forest. If the Responsible Official ignores the will of the people and continues to spend their tax dollars on something they don't want, then include a discussion justifying why it's necessary to do so. The justification should explain why the recommendations of over 500 Ph.D. scientists represented in Opposing Views Attachments #1 and #10 aren't applicable to the Martin Creek sale area. [Artley]

> ***Response:*** *The local support for activities performed on the Flathead National Forest is not a vote. Please see the response to #16 above.*
>
> *Responses to the Opposing Views in Attachment #1 are provided in Exhibit V as well as on the Flathead National Forest project planning internet web page. An Attachment #10 was not provided by the commenter.*

18. Public Concern: Please post your responses to public comments online as well as maintaining hardcopy in the Project File. Members of the public who submit comments on a draft NEPA document make the effort to read the NEPA document closely and take the time to compose comments that reflect their issues. Unless you respond to these comments and allow the public to read your responses they don't know if their comments were read and "considered." …, if you choose not to allow the public to read your responses to their comments online then consider this a FOIA for your responses. Assure that they are posted within a day or 2 of the date the final EA is released and the objection period begins. [Artley]

> ***Response:*** *The response to comments on the EA dated June, 2014 is part of Chapter 4 of this EA. This EA is posted on the Flathead National Forest's web site.*

19. Public Concern: Please see Opposing Views Attachment #1. This attachment contains statements by 241 Ph.D. scientists who describe how natural resources in the forest are harmed or destroyed by logging activity. They describe how some natural resources will never function again after being subjected to repeated abuse by 30,000 pound industrial equipment with spinning wheels and tracks. Please keep in mind that these 241 scientists are just a small sample of independent scientist not affiliated with the USFS who feel this way and publically voice their opinions. …you reject the advice of these scientists and instead rely on the advice of a few timber employees financially motivated to sell timber. [Artley]

> ***Response:*** *Please see the response to Concern #15 above.*

20. Public Concern: Show how the sale has been modified so as not to inflict the probable resource damage described by the scientists in the Opposing Viewpoint Attachments. Indeed, information authored by hundreds of respected scientists describing the damage caused by activities that has frequently occurred on past timber sales with similar actions as those being proposed as part of the Martin Creek timber sale should influence this timber sale design to eliminate adverse natural resource impacts. [Artley]

> ***Response:*** *Each of the opposing views in each of the Attachments (a total of 339 opposing views) provided by the commenter have been addressed as to their applicability to the Martin Creek project. These responses are found in Exhibit V as well as posted on the Flathead National Forest's project web site. Updates to some sections of Chapter 3 of the EA have been made to address some of these views.*
>
> *The interdisciplinary team has incorporated the best available science for designing a project to eliminate or minimize to acceptable levels adverse natural resource impacts. This is well demonstrated in the resource sections of Chapter 3 of the EA.*

21. Public Concern: Include some source documents from the Opposing Views Attachments in the References section of the final EA. Also, cite the specific quotes presented for the source literature in the text of the EA you choose to include in the References. Not doing so and searching the source literature for benign statements to cite will continue your selective use of information that supports your timber sale and tricks the public. This will be gross negligence and a clear indication that you are hopelessly obsessed by volume. Finally, include links to each Opposing Views Attachments you choose to include in your reference section. The public deserves to be informed of this information. [Artley]

> ***Response:*** *Some of the literature referenced in the provided Opposing View Attachments are included in the Literature Cited section of the EA. Providing specific quotes from this literature in the text of the EA would not improve the understanding of the science being used but only increase the physical size of the EA. All of the Opposing Views are listed along with quotes from the articles in Exhibit V. These six documents are also posted on the Flathead National Forest's project web site. We feel this adequately informs any member of the public interested in these Opposing Views.*

22. Public Concern: We must begin to manage our National Forest lands to supply the needs of our citizens and wildlife. Current generations are benefiting from management that occurred twenty or more years ago. Vegetation manipulation is a must to have a healthy forest. [Buentemeier]

> ***Response:*** *We believe the proposals in the alternatives in this EA and the proposed selected alternative in the draft Decision Notice manages national forest lands to meet the purpose and need of the project, as described in Chapter 1 of the EA. Vegetation manipulation is a component of these alternatives.*

Recreation

23. Public Concern: Referenced from EA page 3-247: *"The current recreation infrastructure would become slightly less adequate to meet recreation needs as use increases over the same facility base. Some increased amount of trail erosion and degradation on user created trails may occur as use increases."* Observation: It's not illegal to spend recreation money improving the public recreation experience without being tied to a timber sale. [Artley]

> ***Response:*** *We agree it is not illegal to spend recreation money improving the public recreation experience without being tied to a timber sale.*

Scenery

24. Public Concern: Referenced from the EA page 3-247: *"Vegetation treatments could create more distant scenic viewing opportunities along the roadways which are usually perceived by most users as more interesting and enjoyable. Vegetation treatments could also create openings, increase sight distances, and enhance hunting opportunities."* Observation: The vast majority of Americans don't want their national forest logged for any reason at any location. Where did you get the notion that logging units and roads are "perceived by most users" as "interesting and enjoyable?" [Artley]

> ***Response:*** *The principles mentioned in this concern are described in Agriculture Handbook Number 701: Landscape Aesthetics, A Handbook for Scenery Management (December 1995).*

25. Public Concern: Referenced from EA page 3-257: *"Alternative A would not reduce the risk of stand-replacing wildland fire. Fuels would continue to build up from tree mortality and undergrowth creating a higher risk of stand-replacing wildland fire than the action alternatives. In the event of such*

an occurrence, visual change to the landscape would be dramatic." Observation: Isn't it handy to omit the fact that the great majority if public recreationists abhor viewing the after effects of logging. Never before have I encountered the No Action alternative rejected in the effects of a timber sale to visual enjoyment tied to possible future fire. You are an obedient timber sale enabler. [Artley]

> ***Response:*** *The analysis of the alternatives in the Fire & Fuels section of Chapter 3 of the EA is clearly in agreement with the referenced quote on page 3-257 of the EA. The risk of wildland fire is greater with the No Action alternative than with either of the action alternatives. The visual effects of wildland fire are unpredictable and could greatly change the visual quality of the landscape. The visual effects of the vegetation and fuels management proposals are predictable and have been determined in the scenery analysis to be acceptable.*

26. Public Concern: Referenced from the EA page 3-257: *"The direct and indirect effects to scenery for Alternatives B and C as seen from the view-points are discussed below. In the short term, implementation of these alternatives would create changes to the visual condition of the project area. Openings in the canopy of various sizes resulting from clearcut, seed tree, and shelterwood harvests may be visible."* Observation: How long is short term? [Artley]

> ***Response:*** *Over the course of the life cycles of forest vegetation in the Northern Rocky Mountains, short term is considered ten to twenty years while long term is 100 to 200 years. The quote above has been revised to read: "In the short term until growth of new trees and other vegetation reach sapling and pole sized, implementation of these alternatives would create changes to the visual condition of the project area."*

27. Public Concern: Referenced from EA page 3-257: *"Openings in the canopy of various sizes resulting from clearcut, seed tree, and shelterwood harvests may be visible."* Observation: May be visible! They are either visible or not. [Artley]

> ***Response:*** *As described in the Scenery section of Chapter 3 of the EA, most harvests units are not visible from viewpoints due to screening from existing vegetation or topographic features such as ridges or mountains. As the viewpoint photos show in Exhibit I, most units are completely or partially screened. "May" is used to describe if a harvest unit would be visible due to the uncertainty of the viewer taking the time to look through the screening vegetation. Each of the viewpoints were selected as the most likely place that a harvest unit could be observed from a commonly used access route.*

28. Public Concern: Referenced from EA page 3-258: *"The view of the unit from the viewpoint, particularly in the summer when more leafy vegetation is present, is limited and timber management activities would not be noticeable to most forest visitors unless they were outside of their vehicles."* Observation: Cars have windows and there will be people interested in scenic beauty on 4-wheelers and motorcycles. [Artley]

> ***Response:*** *Please see the response to Concern #27.*

29. Public Concern: Referenced from the EA pages 3-257 to 3-258: *Viewpoint One: "As the topography obscures the unit from the viewpoint, the low to very low SIL objective for MA 15 would be achieved." Viewpoint Two: "The foreground view to the west and north of the viewpoint is a dense stand of second growth timber that totally obscures the view of the units." Viewpoint Three: "This viewpoint was selected as a second location to evaluate the view to units 10 and 11. The foreground view to the north of the viewpoint is a stand of second growth timber that mostly obscures the view of the units." Viewpoint Four: "The view of the unit from the viewpoint, particularly in the summer when more leafy vegetation is present, is limited and timber management activities would not be noticeable to most forest visitors unless they were outside of their vehicles."* Observation: The viewpoints 1, 2, 3 and 4 were clearly chosen at locations where logging and new road construction are hidden from view.

The views from Hwy 93 and Stillwater Lake are the most important to have been analyzed, yet Hwy 93 and Stillwater Lake aren't even mentioned in the scenery effects section. [Artley]

> ***Response:*** *As mentioned in the response to Concern #27 above, each of the viewpoints were selected as the most likely place that a harvest unit could be observed from a commonly used access route. U.S. Highway 93 and Upper Stillwater Lake were not selected as viewpoints as the Martin Creek drainage cannot be observed at all from these two locations due to topographic and vegetation screening as well as the great distance between these two locations and the proposed treatment areas.*

Silviculture Prescriptions and Harvest Operations

30. Public Concern: Opposing Views Attachment #26 shows photos of 17 different clearcuts located on 16 national forests. Most lay members of the public who view these photos will conclude clearcuts are unacceptable scars placed on the forested landscape. Apparently, the clearcut unit on the Martin Creek timber sale is different than those pictured in Opposing Views Attachment #26. No competent USFS line-officer would suggest creating similar scars on the landscape. [Artley]

> ***Response:*** *It is a correct statement that Unit 18 is different than those pictured in Attachment #26. The design criteria established for timber harvesting in this project would assure more retention of standing live and dead trees, more retention of down woody material, minimal loss of soil due to erosion, and reforestation of the site would be within five years of the initial vegetation treatments.*

31. Public Concern: Provide data and text demonstrating that soil, slope, or other watershed conditions will not be irreversibly damaged by clearcutting. [Artley]

> ***Response:*** *These data and text are provided in the Soils and Aquatic Resources sections of Chapter 3 of the EA.*

32. Public Concern: Include a trade-off analysis that weighs public acceptance of clearcutting vs. the regeneration success of seed tree and shelterwood prescriptions. [Artley]

> ***Response:*** *A trade-off analysis that weighs public acceptance of clearcutting vs. the regeneration success of seed tree and shelterwood prescriptions is not possible. Please see the response to Concern #35 below.*

33. Public Concern: Provide data, text and maps demonstrating that protection is provided for streams, stream-banks, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment. [Artley]

> ***Response:*** *These data and text are provided in the Aquatic Resources sections of Chapter 3 of the EA and in project file Exhibit G.*

34. Public Concern: Provide data and maps demonstrating that cut blocks, patches, or strips are shaped and blended to the extent practicable with the natural terrain. [Artley]

> ***Response:*** *Data, maps, and photographs are provided in the Scenery section of Chapter 3 of the EA and in project file Exhibit I that demonstrate the Forest Plan visual objectives of a "low to very low" Scenic Integrity Level are being met. Vegetation treatment area boundaries are typically defined by stand conditions and topography in mountainous landscapes such as Martin Creek. The boundaries of treatment units follow natural terrain due to necessity of stand conditions and logging system requirements.*

35. Public Concern: Provide data and text demonstrating that clearcutting is the optimum silvicultural prescription for the area. [Artley]

> ***Response:*** *The clearcutting method is the optimum regeneration method for Unit 18. Desired stand and landscape conditions were developed using Forest Plan goals and objectives as well as input from the public and contemporary concepts in sustaining forest and aquatic ecosystems. When comparing the existing stand and landscape conditions to these desired conditions or management objectives, clearcutting trees is the optimum harvest method in some cases. It is prescribed in stands composed of species that will not respond well to intermediate treatments and that will be vulnerable to wind throw, such as shallow-rooted and thin-barked species like subalpine fir, spruce, and lodgepole pine. Western larch, Douglas-fir, ponderosa pine, and western white pine are the desired species in the future stands.*
>
> *Clearcut harvesting is intended to begin the conversion of the stand from dense, mature lodgepole pine (short lived and susceptible to fire and mountain pine beetle attack) to long-lived, vigorous, fire-tolerant species suited to these sites. The effects of implementing this harvest method are described in the EA in the Vegetation section of Chapter 3. Project Record Exhibit P contains further data and documentation of the silvicultural diagnosis process and analysis.*
>
> *Timber stands within the area have evolved within a fire-dependent ecosystem. Within the Martin Creek project area, Forest Plan objectives and requirements related to vegetation management are most clearly achieved through the use of even-aged management systems and, on some sites, through the use of intermediate systems. Even-aged systems such as clearcutting, seed tree, overstory removal, and shelterwood methods are part of the Selected Alternative.*
>
> *Silvicultural site-specific prescriptions for the Martin Creek Resource Management Project have been prepared by a certified silviculturist and reviewed by the ID Team members. Target stand conditions were developed based on management objectives and site characteristics. The prescriptions considered existing stand conditions, the target stands, and resource constraints in determining the biological and technological feasibility of all silvicultural systems, including uneven-aged systems, and their appropriateness for the site.*

36. Public Concern: Provide data and text demonstrating that soil, slope, or other watershed conditions will not be irreversibly damaged by seedtree and shelterwood silvicultural prescriptions. [Artley]

> ***Response:*** *These data and text are provided in the Soils and Aquatic Resources sections of Chapter 3 of the EA.*

37. Public Concern: Provide data and text demonstrating that seedtree and shelterwood silvicultural prescriptions are appropriate to meet the objectives and requirements of the relevant land management plan. [Artley]

> ***Response:*** *Please see the response to Concern #35 above.*

Threatened and Endangered Plants

38. Public Concern: The Forest Service should not move forward with this project until field surveys for TES plant species have been completed in all of the proposed treatment units. The EA states no all units were surveyed. See Chapter 3 page 60. Without the baseline data and knowing whether the

species occur in the remaining units, there is no way for the public to comment in any meaningful way. [Cottonwood Environmental Law Center]

> ***Response:*** *Field surveys covered 90% of proposed treatment acreage. The remainder of the units are precommercial thinning units. After surveying many other precommercial thinning units in the Martin Creek project and other projects, it was determined that the habitats in those stands were unsuitable for TES plants, as well as low risk for disturbance as many of them would be hand-treated. It would have been an inefficient use of time and funds to survey remaining units.*

Transportation

39. Public Concern: Please clear small patches on both sides of FS Road 910 (Martin Creek Road) for the first 3 or 4 miles after the private property to facilitate snow removal. Clearing the smaller diameter trees that are growing underneath the larger timber along the road would create occasional small areas where snow can be deposited when plowed during winter logging operations. [Schmidt]

> ***Response:*** *Winter timber harvest conditions are a required component of this project. The timber sale purchaser or stewardship contractor would work with the Forest Service Contracting Officer to accomplish acceptable snow plowing results using the equipment available to the contractor. Constructing snow deposit areas is not a part of the Martin Creek project.*

Wildlife

40. Public Concern: Referenced from EA page 3-187: *"Trees and snags would provide potential habitat for many species, and subsequently for secondary cavity nesters, including some Neotropical migrants. The probability of wildland fire would increase. However, the proposed BMP improvements on roads and culvert replacements would not occur, and fine sediments would continue to enter the creeks and wetlands at present levels."* Observation: what does sediment have to do with neotropical birds? Prescribed burning will surely burn neotropical bird nests and young birds in the nests. [Artley]

> ***Response:*** *As described in the Chapter 3 section on "Neotropical Migratory Birds and Riparian Habitat" in the EA, many species of Neotropical migratory birds use riparian habitats. Exhibit Rn-2 lists the 73 species of Neotropical migratory birds known or suspected to breed on the Flathead National Forest, and indicates which 43 species are associated with riparian habitats.*
>
> *There is a slight chance that some nests could be destroyed by springtime burning of hand piles in some precommercial thinning units. No broadcast burning is proposed and machine piles in commercial harvest units would be burned in fall or winter when birds are not nesting. This information was added to Chapter 3 of the EA (page 3-189) in response to your comment.*

41. Public Concern: Referenced from EA page 3-198: *"No additional actions, such as timber harvest, fuel reduction, precommercial thinning, road construction, or road access changes, are proposed with this alternative. The availability of denning and hiding sites would gradually increase, as would habitat used by numerous species preyed on by the lynx (Table 3-76, below in the Cumulative Effects section). In lieu of wildland fire or other stand-replacing disturbance, feeding habitat would gradually increase and then diminish in quality and quantity. The fuel loading in many stands would increase the chance of large hot wildland fires in adjacent areas, which could have*

mixed results for lynx habitat. Stand-replacement disturbances are more likely to occur under this alternative, which would have the greatest and longest negative effect on potential denning habitat. Ecological disturbances are often favorable to lynx, but the net effects could be negative in a managed landscape." Observation: Fear is an effective way to control the public. You knew if you lied by omission the fear would be maximized. A competent wildlife biologist would tell the public the complete story: The chances that lynx will be harassed and driven away are 100% when logging occurs. … you do not tell the public that wildfire, disease and insect activity are beneficial natural disturbance events. How did lynx survive thousands of years of fires without logging? [Artley]

> ***Response:*** *Positive and negative effects from fire, insects, and disease on Canada lynx habitat are discussed in the "Introduction" for Canada Lynx and Canada Lynx Habitat in the Threatened Species section of Chapter 3 of the EA (pages 3-193 through 3-194). Effects of proposed timber harvest on lynx and its habitat are discussed in the EA on pages 3-199 through 3-206. This includes a discussion of the potential for temporary displacement of lynx due to human activity. See Exhibits Rt-4, Rt-6, and Rt-15 for more information about these effects. See the response to #13, above, for an explanation of the analysis of effects of a "No Action" alternative.*

42. Public Concern: Referenced from EA pages 3-222 to 3-223: *"The fuel loading in some stands would increase the chance of large intense wildland fires, increasing the potential for effects on bald eagle and peregrine falcon feeding opportunities. See section on Aquatic Resources in this chapter."* Observation: the chances that the bald eagle and peregrine falcon will be harassed and driven away are 100% when logging occurs. Are the chances of a wildfire occurring in the next 50 years 1% or 2%? [Artley]

> *Response: We believe that what are referring to is the chance of a fire escaping initial attack are 1% to 2% since we are 98-99% effective with initial attack. Seventeen wildfires have occurred in the Martin Creek project area from 1986 through 2012. Assuming that trend continues, the chances of a wildfire occurring annually within the project area are 65% (Page 3-72 of the Fire and Fuels section of the EA).*
>
> *The potential for proposed activities, particularly timber harvest, precommercial thinning, and road construction, to disturb peregrines and bald eagles is discussed in Chapter 3 of the EA (pages 3-222 through 3-223). See the response to #13, above, for an explanation of the analysis of effects of a "No Action" alternative.*

43. Public Concern: Referenced from EA page 3-229: *"Fishers, while currently rare, should see eventual improved habitat overall with the implementation of the project, even if there is some temporary reduction of fisher habitat quality."* Observation: Does this means if you log 10,000 acres in the area fishers will become plentiful? [Artley]

> ***Response:*** *No. This statement applies to the long-term condition of up to 1.2% of the potential fisher denning/feeding habitat available across the Martin/Radnor Wildlife Analysis Area. The project's effects on fishers is described on pages 3-230 to 3-231 in the Sensitive Wildlife Species section of Chapter 3 of the EA, with more information provided in Exhibit Rs-8, Rs-9, and Rt-6.*

44. Public Concern: Referenced from EA page 3-190: *"Past precommercial thinning, understory fuel reduction, prescribed fire, tree planting, shrub planting, and noxious weed control had little or no long-term effects on riparian-associated wildlife and Neotropical migratory birds, while increasing tree growth and diversity of plant species used for cover, forage, and nest sites."* Referenced from EA page 3-191: *"Potential impacts to migratory species would be minimized through the adherence of Forest Plan Standards and Guidelines for snags/down woody debris, riparian reserve buffers, and limited ground disturbance. The project is de-signed to improve habitat conditions through the*

acceleration of late-successional habitat characteristics, while still maintaining current functional habitat. The intent of the Migratory Bird Treaty Act, the 2001 Executive Order, and the 2008 MOU to conserve and protect Neotropical migrants would be met under all alternatives. All alternatives would be consistent with NFMA direction for diversity of plant and animal communities and ecological sustainability." Observation: Prescribed burning will surely burn neotropical bird nests and young birds in the nests. The project design isn't important. Were the habitat conditions improved or not? [Artley]

> ***Response:*** *See the response to #40, above, regarding prescribed burning and Neotropical birds. As described in Chapter 3 of the EA (page 3-191), some habitat conditions will improve and some will not, with effects varying over space and time.*

45. Public Concern: Referenced from EA page 3-190: *"The project is designed to improve habitat conditions through the acceleration of late-successional habitat characteristics, while still maintaining current functional habitat."* Observation: Who cares what the project was designed to do. Was the bald eagle and peregrine falcon habitat improved by logging or not. If you claim it was it will be the first time I have heard of it. [Artley]

> ***Response:*** *The project's effects on bald eagles and peregrine falcons is described on pages 3-320 to 3-221 in the "Sensitive Wildlife Species" section of Chapter 3 of the EA, with more information provided in Exhibits Rs-3, Rs-7, Rs-9, and Rs-22. As stated on page 3-321 of the EA, the project would have no negative direct, indirect, or cumulative effects to bald eagle or peregrine falcon nesting habitat or wintering habitat. BMP road improvements and culvert replacements could have positive benefits for downstream food sources for bald eagles and peregrines. Seeding, tree and shrub planting, and shrub slashing would enhance habitat values for a variety of species preyed upon by bald eagles and peregrines.*

46. Public Concern: The Forest Service has not clearly stated the degree to which this project will adversely effect lynx or their critical habitat 40 CFR 1508.27(b)(9). The Forest Service did not indicate at what point the impacts would reach the level of significance and thus trigger the EIS requirement. [Cottonwood Environmental Law Center]

> ***Response:*** *The role of the USFS is to determine whether a project reaches a level of significance, not to delineate the point at which such a level would or would not be exceeded. Effects of the Martin Project on lynx critical habitat are described in the EA on pages 3-207 through 3-210 and detailed in Exhibits Rt-20 and Rt-4 (the Biological Assessment). Exhibits Rt-10 and Rt-20 detail the Martin Creek Resource Management Project's consistency with Northern Rockies Lynx Management Direction and considerations for Canada lynx critical habitat. We consulted with the USFWS on these impacts (Exhibits Rt-2, Rt-3, and Rt-4). The determination for Canada lynx and for lynx critical habitat is "May Affect – Likely to Adversely Affect" (Exhibit Rt-4) for the Martin Creek Resource Management Project. The USFWS was consulted with on these impacts (Exhibits Rt-2, Rt-3, and Rt-4).*

47. Public Concern: The EA states that confirmed reproduction (lynx) occurs in the action area, but it does not indicate how far away the den is from the management units. EA 3-142. Nor does the EA appear to offer any scientific support for the notion that displacement from management activities would only be temporary. Regardless of the temporal length of displacement, the agency has not supplied a convincing reason for why the displacement of occupied critical habitat would not be a significant impact that necessitates the need for an EIS. [Cottonwood Environmental Law Center]

> ***Response:*** *No specific lynx den location has been identified in the project area, although potential denning habitat for lynx is abundant across the LAU and across the portion of the LAU that is critical habitat (Exhibit Rt-8). The analysis of effects on lynx critical habitat focuses on the Primary Constituent Element (PCE) of lynx habitat -- boreal forest landscapes*

supporting a mosaic of differing successional forest stages. The USFWS defined these in its 2009 rule to contain a) presence of snowshoe hares and their preferred habitat conditions; b) winter snow conditions that are generally deep and fluffy for extended periods of time; c) sites for denning; and d) matrix habitat that occurs between patches of boreal forest. Displacement of lynx is not a critical habitat analysis factor. Effects of the Martin Creek Resource Management Project on lynx critical habitat are described in the EA on pages 3-207 through 3-210 and in Exhibits Rt-4, Rt-8, Rt-10, Rt-20). Possible temporary displacement from the immediate area of project activities, including its scientific background, was discussed for lynx and lynx habitat in the EA (Pages 3-201 and 3-203) and in Exhibits Rt-4 and Rt-10. The USFWS was consulted with on these impacts (Exhibits Rt-2, Rt-3, and Rt-4). The determination for Canada lynx and for lynx critical habitat is "May Affect – Likely to Adversely Affect" (Exhibit Rt-4) for the Martin Creek Resource Management Project. The USFWS was consulted with on these impacts (Exhibits Rt-2, Rt-3, and Rt-4).

48. Public Concern: The Forest Service should not go forward with any project until it has a programmatic management plan in place to protect critical habitat. The 2009 Rule designating critical habitat unequivocally states: *"Specific Management recommendations for areas designated as critical habitat are most appropriately addressed in subsequent management and recovery plans"*. 74 Fed. Reg. 8616, 8623 (2009). Without a programmatic management plan in place to protect critical habitat, the Forest Service runs the risk of destroying critical habitat in a piece-meal fashion. "[L]andscape level direction is necessary for the survival and the recovery of lynx in the northern Rockies ecosystem" See 2009 Biological Opinion for NRLA at 75. "The function of critical habitat is to provide for the recovery of the species." 74 Fed. Reg. at 8623. [Cottonwood Environmental Law Center]

Response: *To the best of our knowledge, the USFWS will develop an approved plan to promote Canada lynx recovery by 2018. Effects of the Martin Project on lynx critical habitat are described in the EA on pages 3-206 through 3-209 and detailed in Exhibits Rt-20 and Rt-4 (the Biological Assessment). The USFWS was consulted with on these impacts (Exhibits Rt-2, Rt-3, and Rt-4).*

49. Public Concern: The Forest Service states that "No alternative would reduce the potential of the Martin/Radnor Wildlife Analysis Area to function as a linkage zone for grizzly bears between adjacent population or recovery areas" EA 3-211. The conclusion is arbitrary because if bears are displaced by management activities, the area cannot function as a linkage zone for the displaced bears. In contract, if no action is taken, the area can continue to serve as a linkage zone. [Cottonwood Environmental Law Center]

Response: *Potential displacement effects on grizzly bears from the Martin Creek Resource Management Project, are described in the EA on pages 3-213 through 3-215 and in Exhibits Rt-4, R-5, and Rt-13). This includes the scientific basis for the conclusion that current levels of human disturbance across the Martin-Radnor Wildlife Analysis area are compatible with grizzly bear recovery in that they would provide a demographic connectivity linkage between the NCDE and Cabin.*

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