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Department of
Agriculture

Forest Service

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Glacier Loon Fuels Reduction and Forest Health Project

Supplemental Environmental Assessment

Swan Lake Ranger District, Flathead National Forest
Missoula County, Montana

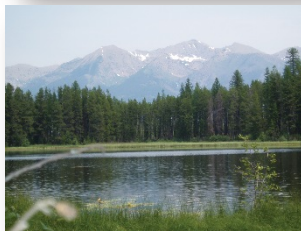


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FOREWORD

CHANGES TO THE ENVIRONMENTAL ASSESSMENT

In response to findings of the District Court's orders in September and December 2014, in *Swan View Coalition et al. v Weber (D. Mont. 2014)*, the Forest Service has prepared this Supplemental Environmental Assessment (SEA) for the Glacier Loon Fuels Reduction and Forest Health Project.

The original Environmental Assessment (EA) from 2012 has been supplemented to assure the Court and the public that the Forest Service has provided the hard look that is required; more specifically, to reanalyze the effects of the project on grizzly bears, bull trout, bull trout critical habitat, lynx and lynx critical habitat, and water howellia. This Supplemental EA also considers any new information that may have been identified since the previous EA and considers the potential cumulative effects of the reasonably foreseeable Beaver Creek Landscape Restoration Project.

The following changes have been made to the 2012 Environmental Assessment:

FORWARD

A Foreword has been added to the EA to provide a summary of the project's development and timeline, including appeals and litigation.

CHAPTER 1

This chapter has been updated to describe the status of the two grizzly bear subunits affected by project activities via the Swan Valley Grizzly Bear Conservation Agreement. In addition, the brief description of the proposed action has been updated to indicate that no vegetation management activities would occur within 300 feet of occupied or unoccupied water howellia ponds and at the end of the chapter is the reference that project falls under the 36 CFR 218 administrative objection regulations (the 2012 EA was under the 36 CFR 215 administrative appeal regulations).

CHAPTER 2

This chapter has been updated to include additional information about the public involvement process and activities that have occurred or have been proposed since the August 2012 EA was released to the public. Additionally, this chapter has been updated to include additional design criteria to mitigate or reduce impacts to water howellia. This chapter reflects modifications made to the timing of the project due to delays from litigation and includes a statement about the need to have Regional Forester approval to create an opening that exceeds 40 acres in size.

CHAPTER 3

This introduction to this chapter has been updated to include any past, present, and reasonably foreseeable activities that may have occurred since the original analysis was conducted.

Each resource section includes a description of the changes that were made. The Threatened and Endangered Wildlife Section, the fisheries section, and the Threatened and Endangered Plant sections have the most updates, but all resource analysis reflect updated information and consideration of potential cumulative impacts.

PROJECT FILE

The project record has been amended to include additional documents needed to support the analysis completed for this Supplemental Environmental Assessment.

Changes made from the 2012 EA are displayed in red type in this Supplemental Environmental

Assessment. Changes from the July 2017 Supplemental Environmental Assessment are made in blue type.

PROJECT HISTORY

The Glacier Loon Fuels Reduction and Forest Health Project was initiated in 2011 to reduce the risk of a high-severity landscape within the Wildland Urban Interface (WUI) as identified in the community wildfire protection plan, improve forest health and resistance to insect epidemics, and provide wood products to local timber industry. Letters, news releases, and field trips to the project area were means to garner public interest in the project. Following the scoping period, the Forest Service received 47 responses.

An environmental assessment (EA) was prepared to analyze the effects of three action alternatives designed to address the objectives mentioned above in different ways and the no action alternative. The EA was released to the public in August 2012 for a 30-day comment period and a total of thirty one comments were received on the EA and helped the decision maker shape the Selected Alternative. The Decision Notice and Finding of No Significant Impact was signed by the Forest Supervisor on February 13, 2013, and the selected alternative was a modification of Alternative D. The Forest Service's 45-day administrative appeal period was initiated at the time the Decision Notice was published in The Daily Inter Lake (newspaper of legal record).

Five appeals were received on the Glacier Loon Fuels Reduction and Forest Health Project between March 7 and 28, 2013 (Project File Exhibit W-1 through W-10). These appeals raised a myriad of issues including lynx, lynx critical habitat, big game thermal cover, water howellia, grizzly bears, and sensitive species.

On May 22 and 23, 2013, the Glacier Loon Decision was affirmed by the Appeal Deciding Officer (Project File Exhibit W-16 through W-25) with instructions to increase buffered distances between vegetation management treatment units and unoccupied water howellia ponds to 300 feet (occupied water howellia ponds were already buffered by 300 feet in the original EA). Vegetation management treatment units were resurveyed to assure they met this instruction before they were implemented. The supplemental EA has been updated with this instruction.

Prior to the response of the appeals by the Appeal Deciding Officer, on March 19, 2013, four of the five people/organizations who filed administrative appeals filed a 60-day Notice of Intent (NOI) to sue under the Endangered Species Act; in June they filed an amended NOI. In response to the second NOI, the Flathead National Forest gave notice to plaintiffs that the forest was re-evaluating the Glacier Loon Project's compliance with the Endangered Species Act and was in the process of preparing an amended biological assessment to be submitted to the USFWS.

Plaintiffs filed an initial complaint in the United States District Court on June 24, 2013 and amended their complaint on September 12, 2013 (CV- 13-129-M-DLC). The Plaintiffs challenged the U.S. Forest Service and the U.S. Fish and Wildlife Service on two separate aspects:

- Authorization of the Glacier Loon Fuels Reduction and Forest Health Project on the Flathead National Forest, and
- Failure to conduct environmental analysis and Endangered Species Act (ESA) consultation for decisions regarding the "Legacy lands" acquisition, agreed operating procedures, and subsequent logging projects on these lands by The Nature Conservancy (TNC).

After briefing was completed, two stewardship sales began operation in the summer of 2014. However, on September 25, 2014, the Court granted summary judgement in favor of the government on all of Plaintiffs' claims except four, two of which relate to the Glacier Loon Project. The other two claims are related to the land acquisition by The Nature Conservancy within the project area as well as other places in the Swan Valley. However, on January 5, 2016, the U.S. Forest Service received a letter announcing that the fiber supply agreement between TNC and

Plum Creek had been terminated and that there were no plans for future harvest on Legacy Lands (Project File Section AA). The court's ruling that NEPA analysis and ESA consultation is required for the agreed operating procedures (AOP) is not associated with the Glacier Loon Project and therefore will not be analyzed in this SEA.

Regarding the Glacier Loon Project, the Court held the Forest Service improperly reached a "no effect" determination for water howellia and bull trout and erroneously determined that numerical objectives under Amendment 19, which provides protections for grizzly bears, did not apply to certain subunits in the Project area. As a result, the Glacier Loon Project was enjoined and the two stewardship sales were suspended. The court specifically concluded that the "matter is remanded to the agencies to perform the necessary analysis and follow the necessary procedures under the ESA for water howellia, bull trout, ...and to reassess its Section 7 analysis regarding the grizzly bear in light of the application of the correct access objective under Amendment 19."

Following the summary judgement, the Forest Service prepared amended biological assessments for bull trout/bull trout critical habitat (January 29, 2015), water howellia (February 12, 2015) and grizzly bears (February 4, 2015) and re-consulted with the U.S. Fish and Wildlife Service (USFWS). The determinations to these species were modified to a "not likely to adversely affect" for bull trout/bull trout critical habitat and water howellia and a "likely to adversely affect" for grizzly bears. The USFWS provided concurrence letters for bull trout/bull trout critical habitat and water howellia and a biological opinion for effects to grizzly bears (June 15, 2015). After these amended biological assessments were completed, a review was undertaken to consider whether these updated biological assessments raised any new circumstances or information requiring a supplement to the environmental assessment. In this new information review the Forest Service determined there were no "significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts" that warrant corrections, supplementation, or revision to the Glacier Loon EA.

After completing the ESA consultations, the federal government prepared a motion to the court to dissolve the injunction and while the court agreed in its January 13, 2016 order that the agencies met their Section 7 ESA obligations they indicated that NEPA's statutory obligations require the preparation of a supplemental EA due to the application of the incorrect Forest Plan Amendment 19 access objectives in the original EA. The project remains enjoined.

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CHAPTER 1

PURPOSE AND NEED FOR ACTION

PROJECT AREA

The Glacier Loon Fuels Reduction and Forest Health Project Area lies within the boundaries of the Glacier Loon and Buck Holland Grizzly Bear Subunits. It extends south and west of Condon on the west side of MT Highway 83 to the south end of Lindbergh Lake. The project area is located in Missoula County in Sections 2-6 T18N, R17W, Sections 1-3, 5-9, and 16-17 T18N, R18W; Sections 01-4, 7-23, 26-35 T19N, R17W; Sections 2-4, 9-15, 22-27, and 33-36 T19N, R18W; Sections 18-19 and 29-32 T20N R16W; and Sections 1-2, 11-15, 22-27, and 33-36 T20N R17W; Swan Lake Ranger District, Flathead National Forest (Map 1-1. Vicinity Map).

HISTORIC CONDITION

Fires were frequent in the Upper Swan Valley until the early 1900s, with the earliest fire evidence dating from about 1241 AD. On average, a fire occurred about every 8 years (range of 3 to 23 years) between 1586 and 1929 in the Upper Swan Valley. The last major fire occurred in 1929 (Barrett 2002). Barrett (1998) reported that 1768, 1814, 1850, 1889, 1919, and 1929 were important fire years in the Swan Valley. One study included two sampling locations within the analysis area, both in the vicinity of Lindbergh Lake. In this area, fire occurred about every 20 years (range of 6 to 50 years) between 1687 and 1919, with the last major fire occurring in 1919. The 1919 fires burned approximately 25,000 acres near Lindbergh Lake and to the north. Map 3-1 displays the approximate locations of some of the major fires in those years within the project area.

Fires were a result of natural causes, such as lightning and traditional burning by Indians (Arno et al. 1997; Ayres 1899; Barrett 1998, 2002; Barrett et al. 1982). Most Indian fires occurred in the valley grasslands and lower-elevation forests dominated by ponderosa pine, Douglas-fir, and western larch. These fires were likely ignited to improve big game browse, berry production, food gathering and hunting, improved travel, communication and horse grazing (Barrett 1981).

Within the project area, several fires burned in the relatively recent past. In 1953, the Herrick Run Fire burned approximately 780 acres on the western shore of Lindbergh Lake. This fire started near the shore and burned upslope and was primarily a high severity fire. In the summer of 2003, the Crazy Horse Fire burned approximately 11,000 acres total with approximately 3,200 acres occurring within the project area. The Holland Peak Fire burned roughly 1600 acres on the east side of the Swan Valley four miles from the Glacier Loon Project Area in the summer of 2005. **In 2012, the Condon Mountain Fire burned approximately 5,200 acres north of the project area on the east side of Highway 83 (this fire is not in any of the analysis areas used by Glacier Loon).** These fires are the most recent large fires in the Upper Swan Valley. In 2008, the smaller Lindbergh Lake Fire burned upslope on the west side of the lake with 45 acres occurring at the south end of the project area. These most recent fires burned mosaically, yet had considerable areas of high severity.

Historical accounts indicate the epidemic insect outbreaks have occurred in the area in the past. The most well-documented epidemic was an outbreak of spruce bark beetles in the Swan Valley following a large scale wind event in 1949 (Project File Exhibit R-3). Mountain pine beetle outbreaks also occurred in the Swan Valley throughout the 1980s. It should be noted that two

major diseases currently affecting forest trees are non-native and were not historically present within the analysis area. Larch casebearer was introduced from Europe and arrived in the Swan Valley in 1968. This defoliator's population peaked in the 1970s and is declining. White pine blister rust was introduced in 1910 and has since had a dramatic effect on the forest composition within the Swan Valley. Western white pine populations in the mid to lower elevations and whitebark pine in the upper elevations have been significantly degraded by this disease.

H. B. Ayers reported observation of the Swan Valley in 1899 during his mission to survey the timber of the then Lewis and Clark Forest Reserve. His journals describe large expanses of the Swan Valley dominated by large trees of ponderosa pine, Douglas-fir, and western larch grown in an open canopy on the valley, benches, and foothills and denser stands of shade-tolerant species on the stream bottoms and high elevations.

"The lands of the upper valley, where the rather scant covering of larch and lodgepole pine at first gives the impression of very poor soil, but upon close examination it is found that the sparseness of tree growth is largely due to frequently occurring fires which have thinned the forest." (Ayers 1899)

Many other natural and human-induced disturbance factors have influenced forest vegetation in and around the project area, including wind, floods, invasive species, residential and commercial development, transportation systems, grazing, and timber harvest.

EXISTING CONDITION

The Upper Swan Valley Landscape Assessment (SEC 2004) described the general forest conditions at a landscape scale by grouping the project area into what was termed "Ecosystems." The assessment identified five "Ecosystems" in the Upper Swan Valley. Three of those forested "Ecosystems" are represented in the Glacier Loon Project Area. The following are summary descriptions of those "Ecosystems" and are described as they would be encountered traveling from east to west, or upslope.

The warm/cool-moist valley bottoms include the undulating flat lands of the valley floor with its many wetlands. This area is forested with a large diversity of conifer and deciduous tree species. Openings in the forest are numerous, largely due to human settlement. These areas contain a mix of western larch, western white pine, lodgepole pine, Douglas-fir, ponderosa pine, Engelmann spruce, grand fir and subalpine fir on the more well drained sites. The neighboring riparian zones are bordered with cottonwood, birch and aspen. Disturbances in this area included primarily low and mixed severity fire, and occasionally high severity fire. High intensity winds have also occurred at intervals and caused extensive blowdown.

The cool-moist midslopes include a transition between the warm-moist valley bottoms to the east and the cold-steep forested uplands to the west. Tree species in this area include Douglas-fir, lodgepole pine, western larch, western white pine, Engelmann spruce, grand fir, western red cedar and subalpine fir. Disturbances in this area included a combination of low, mixed, and high severity fires. High severity winds causing blowdown have also occurred in the area.

The cold-steep uplands form a narrow band between the barren rocky ridges and peaks on the Mission Mountains and the more heavily forested areas on the lower slopes. Vegetation is scattered and clumped across the landscape. Trees and shrubs develop in areas where there is soil. Tree species include whitebark pine, Engelmann spruce, lodgepole pine, mountain hemlock, and subalpine fir. Disturbances in this area include a combination of mixed and high severity fires. Fires tended to be less frequent, and usually occurred during dry periods.

DESIRED CONDITIONS

The desired future conditions described for the Flathead National Forest Land and Resource Management Plan (Forest Plan) in conjunction with other Forest Plan goals, standards, objectives, and Regional direction provide the parameters for identifying and defining project-specific desired future conditions. The desired future conditions help guide management of the project consistent with the Forest Plan, the key issues, and the current ecological conditions of the Glacier Loon Project Area.

FOREST PLAN DIRECTION

The Forest Plan embodies the provisions of the National Forest Management Act (NFMA), 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. Forest Service Manuals (FSM) and Handbooks (FSH) and provide direction and were applied to the development of this project.

The majority of the project area lies within MA 22 (Mission Mountain Wilderness - 12,321 acres) where no activities are planned, followed by MA 15C (7,108 acres) and MA 15 (4,098 acres) where cost-efficient production of timber while protecting the productive capacity of the land and timber resource is the emphasis. Treatments are planned within Management Areas 5, 9, 15, 15C, and 17 which are within the suitable timber base of the Flathead National Forest. Please refer to Chapters 2 and 3 for more detailed discussion of management areas.

ECOLOGICAL RESTORATION

Recently adopted national and regional mandates of the U.S. Forest Service stipulate that ecological restoration will be the central driver of wildland and forest stewardship (USDA Forest Service 2012). This is of strategic importance because national forests are the backdrop and neighbor to many rural and urban communities, providing a broad range of value and benefits, including clean drinking water for millions of people across the U.S., vital wildlife habitat and a variety of recreation opportunities, all of which are basic to the health of our communities. Our job is to sustain the ability of America's forests and to deliver the full range of ecosystem services for generations to come. This ability is increasingly at risk. Approximately 65 million acres of national forest system (NFS) lands are at high or very high risk of catastrophic wildfires. A changing climate, invasive species, and other stressors are affecting large areas of National Forests and Grasslands. Mortality of conifer trees caused by the bark beetle has escalated in the last decade, resulting in nearly 18 million acres on the national forests incurring damage.

To address these needs, the Forest Service has recently adopted a series of actions allowing for increases in the pace of restoration efforts, including:

- Expanding collaborative landscape partnerships;
- Implementing a new forest planning rule;
- Implementing the Watershed Condition Framework;
- Improving efficiency of the NEPA planning process;
- Implementing the Forest Service bark beetle strategy;
- Expanding stewardship contracting; and
- Expanding markets for forest products generated by restoration projects.

The Forest Service definition of ecological restoration is broad in scope. As stated in FSH 1909.12 ecological restoration is:

The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecological restoration focuses on reestablishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystems sustainability, resilience, and health under current and future conditions.

Ecological resilience is normally defined as the capacity of a system to cope with stress and to bounce back when the stress diminishes. It is measured by the rate at which a system returns to equilibrium following perturbation. Stressed ecosystems are less resilient than unstressed ecosystems.

Inherent goals of Forest Service Restoration Policy include ecosystem health, ecosystem services, and sustainability. Ecosystem health, in addition to resilience, has two other major criteria: vigor and organization. Vigor is measured in terms of energy flow in terms of nutrient cycling and productivity. Organization refers to ecosystem complexity, which tends to increase with secondary succession in terms of number of species and the variety and intricacy of interactions. Stressed ecosystems typically display reduced species richness, fewer symbiotic relationships, and more opportunistic species.

Ecosystem services refer to functions that benefit the human community, such as detoxification of chemicals, water purification, production of game species, and reduced soil erosion. They include: (a) Provisioning Services –food, fresh water, fuel, and timber; (b) Regulating Services – climate, water, pollination, and disease regulation; (c) Supporting Services –soil formation and nutrient cycling; and (d) Cultural Services –educational, aesthetic, cultural heritage values, recreation, and tourism. Stress generally reduces both the quality and quantity of these services.

In the face of climate change and population pressures there has now developed a complex matrix of natural and anthropogenic disturbance within which management regimes must be superimposed to meet National Forest and National Policy objectives. Restoration of degraded lands means rebuilding functional ecosystems, but not necessarily restoring sites to resemble their original conditions in all aspects. Forest Service goals are less concerned with establishing historically functioning ecosystems as establishing ecosystems that are resilient in the face of current and projected disturbance regimes.

PURPOSE AND NEED

Based upon the existing condition of the project area and consistent with Forest Plan direction and the goals of Forest Service Restoration Policy presented above, the Swan Lake Ranger District's ID Team identified the following Purpose and Needs.

■ HAZARDOUS FUELS REDUCTION

- o Reduce the associated risk of high-severity landscape wildfire risk within the Wildland Urban Interface (WUI) as identified in the Seeley Swan Fire Plan.
- o Provide for a safer environment for the public and firefighters should a wildfire occur within the proposed treatment areas.
- o Increase the probability of stopping wildfires on NFS lands before they burn onto private lands.

■ IMPROVE FOREST HEALTH

- o Improve and/or maintain the general health, resiliency, and sustainability of forested stands.

- o Reduce the risk of insect epidemics and severe disease infestations within the project area.
- **PROVIDE WOOD PRODUCTS FOR LOCAL ECONOMIES**
 - o Provide forest products to the local timber industry – contributing to short-term forest products and providing for long-term sustainability of timber on NFS lands.

PROPOSED ACTION

The Swan Lake Ranger District's ID Team has identified the following management activities to move toward desired future conditions in the Glacier Loon Project Area.

- Vegetative treatments on approximately 2102 acres of NFS lands within the project area (See enclosed Maps 2 and 3); an estimated 1710 acres of proposed activities are located within the WUI.
- Harvest activities implemented using tractor and cable logging systems. Fuel reduction activities implemented using mechanical and hand treatments.
- Slash treated through a combination of the following; whole tree yarding (or possibly yarding of tops), lop and scatter, masticating, and/or excavator piling. Fuel accumulations at landings addressed through burning, chipping/masticating, and/or removal from NFS lands. Prescribed fire treatments include broadcast burning, pile burning and/or jackpot burning.
- Treatment units accessed through an estimated 11.5 miles of temporary road construction. National Forest System roads used for road haul. Road decommissioning proposed on an estimated 4.1 miles of NFS roads.
- Best Management Practices (BMPs) implemented on an estimated 37.7 miles of haul routes to meet Timber Sale Requirements.
- All activities comply with the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA).
- Minimal harvest activity within Riparian Habitat Conservation Areas (RHCAs) in upland areas. Some temporary road locations to occur within RHCAs and cross streams.
- No vegetation management activities to occur within 300 feet from occupied or unoccupied water howellia ponds.
- Resource Enhancement Projects to improve fish habitat and riparian conditions.

PROJECT SCOPE

SCOPE OF THE PROPOSED ACTION

The Glacier Loon Subunit, where the Glacier Loon Project is proposed, is currently “Inactive” and becomes “Active” again in 2021 through 2023 under the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA). The Buck Holland Subunit is “Active from 2018 through 2020, and becomes “Inactive” again in 2021. When project activities are scheduled to occur in a time when a subunit is “Inactive”, then standards and guidelines for an Inactive grizzly bear subunit would be followed, as per the SVGBCA. All roads used would be managed consistent with the requirements of the SVGBCA.

Post-harvest activities, such as burning and planting, should be completed 1 year following harvest activities. Reforestation activities would be completed no more than 5 years after logging is completed in each unit.

SCOPE OF THE ANALYSIS

The Council on Environmental Quality (CEQ) regulations implementing the NEPA require that all Federal agencies consider the following three types of actions to determine the scope of the analysis (40 CFR 1508.25).

CONNECTED ACTIONS

Connected actions include closely-related actions that automatically trigger other actions that may require NEPA analysis; cannot or would not proceed unless other actions taken previously or simultaneously, or are interdependent parts of a larger action and depend on the larger action for their justification. These actions are part of the proposed action and include all activities needed to complete the proposed project and provide for resource protection during and after project completion.

Project Design Criteria described in Table 2- 16 are associated with the action alternatives.

SIMILAR ACTIONS

Similar actions are actions with similarities to other actions that provide a basis for evaluating their environmental consequences, such as similar timing or geography. A number of these actions have been identified and evaluated in the analysis of environmental consequences (EA, Chapter 3). These are current and reasonably foreseeable actions described in the following section on cumulative actions.

CUMULATIVE ACTIONS

Cumulative actions are past, present, and reasonably foreseeable actions that may have cumulatively significant impacts when considered with the Proposed Action. The effects of these actions on NFS lands have been evaluated in the environmental analysis of the Proposed Action and its alternatives. Actions considered in the cumulative effects analysis are presented in more detail in Chapter 3.

APPLICABLE LAWS AND EXECUTIVE ORDERS

A partial list of Federal laws and Executive Orders (EO) pertaining to project specific planning and environmental analysis on Federal lands follows. 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 Chapter 3 of the EA.

- Multiple-Use Sustained Yield Act of 1960.
- National Historic Preservation Act of 1966 (as amended).
- National Environmental Policy Act of 1969 (as amended).
- Clean Air Act of 1970 (as amended).
- Endangered Species Act of 1973 (as amended).
- Forest and Rangeland Renewable Resources Planning Act of 1974 (as amended).
- National Forest Management Act of 1976 (as amended).
- Clean Water Act of 1977 (as amended).
- American Indian Religious Freedom Act of 1980.

- Archeological Resource Protection Act of 1980.
- Cave Resource Protection Act of 1988.
- Executive Order 11593 (cultural resources).
- Executive Order 11988 (floodplains).
- Executive Order 11990 (wetlands).
- Executive Order 12898 (environmental justice).
- Executive Order 12962 (aquatic systems and recreational fisheries).

PERMITS

The following permits may be required prior to project implementation in order to ensure Federal and State laws are met:

MONTANA STREAMSIDE PROTECTION ACT (SPA 124 PERMIT)

Any project including the construction of new facilities or the modification, operation, and maintenance of an existing facility that may affect the natural existing shape and form of any stream or its banks or tributaries (Montana Department of Fish, Wildlife, and Parks).

FEDERAL CLEAN WATER ACT (SECTION 404 PERMIT)

Any activity that will result in the discharge or placement of dredged or fill material into waters of the United States, including wetlands (U.S. Army Corp of Engineers).

SHORT-TERM WATER QUALITY STANDARD FOR TURBIDITY (318 AUTHORIZATION)

Any activity in any State water that will cause unavoidable short-term violations of water quality standards. "State water" includes any body of water, irrigation system, or drainage system, either surface or underground, including wetlands, except for irrigation water where the water is used up within the irrigation system and the water is not returned to other state water (Montana Department of Environmental Quality).

STORM WATER DISCHARGE GENERAL PERMITS

Any person, agency, or entity, either public or private, proposing a construction, industrial, mining, or other defined activity that has a discharge of storm water into surface waters. Under the authority of the Montana Water Quality Act, permit authorization is typically obtained under a Montana Pollutant Discharge Elimination System (MPDES) "General Permit" (Montana Department of Environmental Quality).

INFORMATION SOURCES

The analysis and decision processes for this project are based on the consideration of the best available science. The manner in which best available science is addressed can be found within the disclosure rationale throughout the SEA, biological assessments (BA), biological opinions (BO), and the project file.

OBJECTION REGULATIONS

This project contains actions which would implement the Flathead National Forest Plan and are subject to subparts A and B of 36 CFR 218, administrative objection regulations.

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CHAPTER 2

ALTERNATIVES CONSIDERED

INTRODUCTION

This chapter describes and compares the alternatives considered for the Glacier Loon Fuels Reduction and Forest Health Project. The alternatives for the Glacier Loon Project were developed from the issues identified by the ID Team, the public, and other agencies. The ID Team grouped the alternatives into one of two categories depending upon how they met the Purpose and Need for the project and their feasibility. These categories are:

1. Alternatives considered in detail and
2. Alternatives not considered in detail.

Rationale is given for those alternatives not studied in detail.

This chapter also includes a description and maps of the alternatives considered, activities common to all alternatives, and a comparison of these alternatives focusing on the major issues. This comparison of alternatives provides a basis for choice among the options for the decision maker and the public (40 CFR 1502.14).

PUBLIC INVOLVEMENT AND SCOPING PROCESS

The 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 during the EA process. Scoping should begin early and continue until a decision is made. To date, the public has been invited to participate in the following ways.

PUBLIC MAILING

On September 16, 2011, information on the Glacier Loon Fuels Reduction and Forest Health Project, including a map of the proposal, was mailed out to approximately 100 individuals, agencies, and groups (Project File Exhibit B-2).

Because of the interest generated by the initial mailing, information on the Glacier Loon Fuels Reduction and Forest Health Project including a map of the proposal was mailed out to an expanded mailing list on October 13, 2011.

PUBLIC INVOLVEMENT IN ALTERNATIVE DEVELOPMENT

On September 8, 2011, a Field Trip to the Glacier Loon Project Area was conducted. Nine Forest Service employees and 7 members of the public attended.

A “Request for Comments” on the Glacier Loon Fuels Reduction and Forest Health Project was mailed out on September 16, 2011, to approximately 188 members of the public, organizations,

or special interest groups. A “Request for Comments” on the Glacier Loon Fuels Reduction and Forest Health Project was published in *The Daily Inter Lake* on September 21, 2011 (Project File Exhibit B-2). Based upon the public interest in this project, another public meeting was held on October 7, 2011. In addition to Forest Service personnel, 10 members of the public were in attendance. On October 13, 2011, a postcard was mailed out to over 270 individuals notifying the public about a second Field Trip on October 31, 2011 and extending the public comment period to November 7, 2011. A subsequent Field Trip was held to the Glacier Loon Project Area on October 31, 2011; 31 members of the public, as well as 5 Forest Service employees attended.

Notification of this project proposal appeared in the USDA Forest Service's Schedule of Proposed Actions (SOPA) on October 1, 2011, and quarterly since that time (Project File Exhibits B-5).

PUBLIC INVOLVEMENT ON THE 2012 EA

The Swan Lake Ranger District received 31 comments on the Glacier Loon Environmental Assessment, either in the form of letters, e-mails, telephone contacts, or comment sheets. These comments were responded to in the 2013 Glacier Loon Decision Notice. For further discussion on the administrative appeal process following the 2013 decision notice and then subsequent litigation, please see the forward section of this supplemental EA.

ISSUES

The ID Team reviewed and compiled a list of potential issues based upon comments from the public, organizations, and government agencies. These issues were then evaluated against the following criteria to determine the appropriate method for resolution:

- Is the issue relevant to and within the scope of the Purpose and Need, the decisions being made, and does it pertain directly to the Proposed Action?
- Is the issue already decided by law, regulation, or existing plans? Is it supported by scientific or factual evidence?
- Could the issue be resolved through design and location of activities in the Proposed Action or mitigated by avoiding the impact of not taking action, minimizing the impact by limiting the action, rectifying the impact by rehabilitation, reducing the impact by maintenance, or compensating for the impact by replacement?

Issues representing an unresolved conflict with the Proposed Action have been brought forward as “major issues” and were used to help formulate the alternatives to the Proposed Action. Project File Exhibit D-1 provides a detailed description of the issues identified during the scoping process and describes how those issues were accounted for during the analysis process.

KEY ISSUES FOR ALTERNATIVE DEVELOPMENT

During the issues content analysis and disposition process, the ID Team and District Ranger identified the following “key” issues, for which action alternatives were developed.

SCENIC VALUES AND WATER QUALITY

The statements below are examples of comments received during scoping, which articulated issues or concerns relative to Scenic Values and Water Quality (Project File Exhibit D-1).

- As a full time resident of Lindbergh Lake, and having spent many years working with our Congressional Delegation, The Trust of Public Lands, and many others, we were

successful in securing money from the Land and Water Conservation Fund to purchase 2,542 acres around Lindbergh Lake from Plum Creek Timber Company. The specific objective was to protect this land, more specifically: water quality, endangered and threatened species, and the visual plane (Project File Exhibit C-5).

- While I know there will be more specific testing with the environmental assessment after the first of the year, I have major concern about maintaining the high integrity of our water quality. Additionally, I am concerned about what erosion of the logged areas might do to lake water quality, as well as the cutting and use of new/temporary roads. Additionally, I am concerned about what erosion of the logged areas might do to lake water quality, as well as the cutting and use of new/temporary roads (Project File Exhibit C-21).
- I was an active participant in the effort to protect Lindbergh Lake from development by Plum Creek Timber in the early 1990's and also strongly oppose the proposed logging and road construction on the western slope of Lindbergh Lake. Our past efforts is very accurate and I feel it is imperative you adhere to a thorough review of the effects this will have on our water quality and on one of the most pristine habitats left in this country (Project File Exhibit C-23).
- We are also extremely concerned about your proposed logging to within 150 feet from the shores of Lindbergh Lake. In the process of logging so close to the shoreline, you will destroy many old growth Ponderosa and could cause erosion that would be dangerous to the water quality of the lake. Lindbergh Lake is a pristine lake from which we draw our drinking water. We are concerned that aggressive logging and building of roads in this area would be detrimental to the drinking water (Project File Exhibit C-29).
- I also have grave concerns about the threat to the quality of our drinking water from the project as it affects the entire lake (Project File Exhibit C-43).
- In 1996 portions of Sections 22, 27, 26, and 35 were acquired after much effort on the part of The Lindbergh Lake Community with 15 million dollars in Land and Water Conservation Funds and with the aid of our congressional delegation. The purpose was to preserve what is a unique ecosystem within the lower 48, from development, and logging activities planned by Plum Creek Timber. The water in Lindbergh Lake is our source of drinking water where it is consumed untreated and unfiltered by the lake residents. It represents one of the last remaining sources of natural potable water in the United States. This great effort and subsequent public expenditure was with the intent of protecting the views and watershed from precisely the activities proposed in The Glacier Loon Project.
- We specifically will vigorously oppose by whatever means necessary the planned activities in action areas 71, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, and further discussions will be necessary for the planned actions for areas 66-70. We find the clear cut plans for 84-87 on the western shore shocking and unacceptable (Project File Exhibits C-2 and C-15)
- I am opposed to the proposed treatments for Sections 84 – 87 as well as potentially Sections 80/81 (I apologize for my uncertainty). At any rate, it is the part of these sections that 'spills over' the top of the ridge and shows up as a section of intensively logged forest on the high visual impact west side of the lake. I would additionally wish to exempt the visual section of 80/81 – rather, keep any logging of these sections behind the FS road so it cannot be seen from the Lake (Project File Exhibit C- 21).
- I think that the suggested treatments in areas 84-87 and 89 should be completely reassessed. I do not support the proposals in these areas. These areas are a major part of the public view at Lindbergh Lake. Campground users and the general public enjoy the beauty of these spots as do the residents of the lake. Area residents in the Seeley Swan Valley count Lindbergh as one of their favorite recreational lakes, largely due to the immense beauty. Roads added in this area to accomplish the logging will not improve the

overall environment, be a great expense and a visual impairment (Project File Exhibit C-31).

- The proposed work in these areas would, first and foremost, have a dramatic effect on the Lindbergh Lake viewshed. This is a concern not only for Lindbergh Lake residents such as myself, but for the many non-residents who use the lake. One of the most important qualities of the lake is the sense of wilderness one gets when paddling or boating on the lake – of an 'untouched' lake, particularly the entire west side and south end beyond the few residences. I can think of few lakes where such an experience is available to people who may not be able to hike into, much less get out in a boat onto, a true wilderness lake. Based on the visual simulations provided, the proposed Glacier Loon project work would essentially destroy this quasi-wilderness experience for everyone who lives on or visits the lake (Project File Exhibit C-33).
- It is quite clear that proposed roads and logging units on the slopes above Lindbergh Lake are not acceptable from a visual quality perspective, especially to those who recreate on or have homes on the lake (Project File Exhibit C-34).
- I wonder whether you have given enough consideration to value of scenic qualities of the hillsides that border Lindbergh Lake. Many people use the campground and go boating on the lake. The lake is also used to get to the trailhead at the head of the lake to get into the Mission Mountains Wilderness. The people who have cabins enjoy the beauty of the forest on the west side of the lake. Logging on those slopes will definitely detract from their beauty. The logging done on Herrick still shows the scar after all those years. Great consideration should be given to the esthetic values of a scenic forest on lands facing the lake. I hope you will change your plan and leave the viewshed slopes as beautiful as possible (Project File Exhibit C-45).

WILDLIFE SECURITY

The statements below are examples of comments received during scoping, which articulated issues or concerns relative to Wildlife Security (Project File Exhibit D-1).

Alternative D is an alternative which responds to the Purpose and Need and focuses on wildlife security, retention of hiding cover and habitat connectivity, riparian habitat protection, and retention and recruitment of old growth habitat and lynx forage. Alternative D proposes the treatment of stands that would not continue to provide wildlife habitat in the short-term (5-10 year) without management intervention. Forested stands that would likely continue to provide habitat for longer than 5-10 years, without management intervention, were deferred from treatment at this time, in order to maintain hiding cover, connectivity of habitat, and wildlife security.

- Again, having hiked all through the area and many years ago seeing a grizzly bear up close in one of the actual places in which there will be cutting, I am deeply concerned that this will be injurious to those whose lives actually depend on the flora and undisturbed topography of the proposed treatment area (Project File Exhibit C-30).
- We are concerned about maintaining minimum threshold habitat and connectivity for wildlife, especially as this relates to forest carnivores. Through our work and experience, we recognize the Glacier Loon project area as one of the few functioning forest carnivore habitats left in the Swan River watershed (Project File Exhibit C-24).
- Please examine how this project will affect all ESA listed, MIS, and sensitive species (Project File Exhibit C-1).
- All the wildlife species in the project area require corridors to move for foraging, denning, nesting and seasonal habitats. Where are these corridors? What is the habitat quality in them? What size are they? Are they wide enough to protect from edge effects and provide security? Are they fragmented by roads or past logging units? How much canopy cover, thermal cover or hiding cover is in them? How much down woody debris

and snags are in them? What type of habitat is considered suitable? Where is the current lynx foraging and denning habitat located? How will it be maintained, how will it be improved, how is it connected or how will it be impacted by this project? What are the effects to critical habitat for lynx? Will it be adversely modified? Lynx avoid clearcuts. This project will expand clearcuts and negatively impact lynx (Project File Exhibit C-3).

- In addition, we support liberal buffers around all wetlands, which we know to provide hiding cover; structural complexity; unique vegetative and bird communities; and small rodent diversity occurring within the mixed conifer terrestrial and riparian wetland ecotone (Project File Exhibit C-24).

OTHER CONCERNS EVALUATED

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

SOILS

Commenters also expressed concern over how the proposed activity would affect soil quality and productivity (Project File Exhibits C-1, C-3, and C-19). Design Criteria are incorporated into the EA to address these concerns. In addition, all applicable laws and regulations would be met in the design and implementation of the project.

FISHERIES

Comments were received regarding how the proposed activity would affect fisheries (bull trout spawning and rearing habitat) and affects to wetlands and Riparian Habitat Conservation Areas within the Glacier Loon Project Area (Project File Exhibits C-1, C-3, C-11, C-28, and C-34). Design Criteria are incorporated into the EA to address these concerns.

NOXIOUS WEEDS

Commenters expressed concern over the spread of noxious weeds associated with project activities (Project File Exhibits C-1, C-19, C-22, and C-31). Again, Design Criteria are incorporated into the EA to address these concerns. In addition, the activities associated with the Glacier Loon Project would adhere to direction contained in the Flathead National Forest's Noxious and Invasive Weed EA and Decision Notice (DN).

SNAGS AND COARSE WOODY DEBRIS

Comments were received on insuring that adequate amounts of snags and coarse woody debris are maintained in units (Project File Exhibits C-1, C-3, and C-19). Design Criteria have been incorporated into the EA to address these concerns. In addition, all applicable laws and regulations would be met in the design and implementation of this project.

OLD GROWTH

Commenters expressed concern over how proposed activities would affect old growth stands and old growth dependent wildlife species (Project File Exhibits C-1, C-3, C-11, C-21, and C-34). No activities would occur in old growth stands with this project. However, The EA describes the old

growth stand conditions in the Old Growth Section of Chapter 3. Habitat conditions for old growth associated species and snag dependent species in the analysis area are also analyzed and discussed in the EA. The Glacier Loon Project is consistent with the National Forest Management Act and with Forest Plan Amendment 21 – Old Growth Management.

ECONOMICS OF HARVEST

Commenters expressed concern over the economic feasibility of the project relative to reduced product value and local markets for the timber. Commenters also requested analysis of public revenue that would be generated by the project and requested a cost-benefit study (Project File Exhibits C-1, C-3, C-19, C-24, and C-27). These concerns are addressed in the Economics Section in Chapter 3 of this document.

RESTORATION

Comments were received regarding how the individual treatments and Project as a whole are consistent with the Southwestern Crown Collaborative CFLRP proposal, Landscape Strategy, and prioritization; how the treatments proposed will restore more natural forest conditions outside the wildland-urban interface, and how the proposed treatments will maximize the retention of large trees, as appropriate for the forest type, consistent with the requirements of FLRA, especially to the extent that the trees promote fire-resilient stands (Project File Exhibits C-3 and C-22). These concerns are addressed in the Vegetation Section in Chapter 3 of this document.

RANGE OF ALTERNATIVES

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

An EA must also “rigorously explore and objectively evaluate all reasonable alternatives.” The courts have established that this direction does not mean that every conceivable alternative must be considered, but all selection and discussion of alternatives must permit a reasoned choice and foster informed decision making and informed public participation.

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

The range of alternatives presented in this chapter was determined by evaluating public and internal comments and the Purpose and Need for the project. This project is intended to meet the Purpose and Need while maintaining resource conditions that are within the range of natural (historical) variability (HRV). Other influences include Forest Plan goals, objectives, existing and desired conditions, standards and guidelines; Federal laws, regulations, and policies; and economic variability. Within these parameters, the alternatives developed by the ID Team display a reasonable range of outputs, treatments, costs, management requirements, Design Criteria, and effects of resources.

In addition to the alternatives considered in detail, the ID team examined other alternatives during the analysis process. Although these alternatives contributed to a reasonable range, they were eliminated from further consideration for the reasons listed below.

ALTERNATIVES NOT CONSIDERED IN DETAIL

This section discusses additional alternatives that were considered, but not given detailed study.

These alternatives were initially proposed to address issues identified during the public scoping and ID Team process, but were not considered in further detail for the reasons explained in the following narratives.

INCREASED ACREAGE OF FOREST HEALTH AND HAZARDOUS FUELS REDUCTION TREATMENTS

Based on both public and internal input, an alternative was considered that increased and/or intensified the acreage treated for forest health and hazardous fuel reduction. Both within and outside the WUI, additional treatments were considered in a number of forest stands. However, based on preliminary public input and interdisciplinary team field reconnaissance and analysis, the proposed action deferred treatment in areas totaling approximately 4,500 acres.

These areas were dropped from further consideration for a variety of reasons including: access and economic issues, riparian areas, old growth stands, lynx habitat, visual impacts, and areas where the existing stand conditions met the project objectives. In addition some areas were deferred primarily due to their proximity to the Crazy Horse Fire which occurred in 2003. This led to a recommendation to defer treatment in this area until more time for recovery from the effects of the fire had occurred.

One area specifically identified for consideration through public input included stands in the southwest portion of Section 14, of T19N, R17W. The need for active vegetation management was suggested in this area based on the presence of large diameter mature ponderosa pine. Field reconnaissance identified significant access and logging systems constraints in this area and it was also determined that many of the stands in this area are old growth.

For these reasons, an alternative to treat more extensively and intensively within the project area was not considered in detail.

NO TEMPORARY ROAD CONSTRUCTION

Some input was received from the public that, in the opinion of the commenters, no temporary roads should be built. These commenters felt that building roads, even temporary ones within RHCAs and streams within Section 12 would have significant effects on the watershed. The commenters also felt that the impacts of building temporary roads are the same as building permanent roads and that the temporary roads proposed with this project would increase road densities and decrease habitat security in violation of the Forest Plan and the Swan Valley Grizzly Bear Conservation Agreement. Commenters also expressed concern that building temporary road poses water, soils, other wildlife, fish, and noxious weed concerns also requested if there may be opportunities to avoid road construction by requiring cut to length and forwarding logging practices as opposed to tractor logging and whole tree yarding systems (Project File Exhibit D-1).

In project development, I asked the ID team to design the proposed action to limit temporary road construction. In response to public comment, I further asked the ID team to limit temporary road construction in designing the other action alternatives. These alternatives reduce temporary roads by requiring skidding longer distances that would normally be used under Forest Service guidelines for timber sales. The extra logging cost entailed impairs the economic viability of the alternative with little environmental gain in this situation. Due to the economic infeasibility of the alternative in current and reasonably foreseeable future market conditions, such an alternative was not considered in detail.

We realize that forest vegetation treatments and road building have the potential to produce impacts to water resources. We also believe that effects to water resources can be minimized with appropriate, site specific application of project Design Criteria and Best Management Practices (BMPs). Best Management Practices prevent most management activities from impacting water quality by minimizing sediment-producing disturbance and minimizing the potential for any sediment that is generated to reach a water body. Specific Design Criteria and

Best Management Practices to address your concern are included in this document.

Montana has laws and regulations, included in timber sale contracts whose intent is to protect the environment in and around the potholes and wetlands. Further protection is exercised by project design, both in unit layout and in implementation. INFISH and the Streamside Management Zone Law are two examples of regulations whose focus is to protect water quality and aquatic habitat.

When the project is scheduled for implementation, the appropriate 404 permitting and approval from the US Army Corps of Engineers would be obtained. Montana Streamside Protection Act (SPA) 124 permits would be obtained for any activity that would disturb stream channels.

Temporary roads would be constructed to the minimum standards necessary for log hauling. No public wheeled motorized access would be allowed on them. All temporary roads would be reclaimed following use (See Design Criteria, Appendix 2). The goal of reclaiming the temporary roads would be to discourage motorized use. Temporary roads will not increase the total road density (TRD) in the bear subunit. Open road densities (ORD) would temporarily increase during sale activities. The proposed activities in the Glacier Loon Project are outside of areas that would be expected to provide potential denning habitat for grizzly bear. There is no proposed activity in known or potential grizzly bear denning habitat. There is no proposed activity in known or potential grizzly bear denning habitat

All temporary roads and skid roads would be reclaimed by removing any installed culverts or temporary bridges (or, where they are less impactful, through the use of log crossings to be placed without excavation and removed prior to the wet season), by placing large woody material on the template, and by seeding with the native plant mix as specified by the Forest Botanist. In addition, all newly constructed temporary and skid 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. However, on this gentle terrain, it is anticipated that little top soil would need to be moved, for the most part, during temporary road construction. Resource specific analyses of the effects to temporary roads on Fisheries, Invasive Plants, and Water Resources are disclosed in the EA.

KRAFT CREEK FISH BARRIER

Westslope cutthroat trout have greatly declined in number and distribution throughout the Swan River Valley. In 2008, a collaborative group, called the "Swan Native Fish Committee," reviewed all available data regarding cutthroat trout in the Swan River Valley. Available data indicated that only 17 tributary streams still had genetically pure or nearly pure populations and this represented just 20 percent of the historic distribution. The Kraft Creek population was the largest remaining population in the Swan River Valley. This population consisted of several tributaries (Red Butte, Upper Kraft, Middle Kraft, Hemlock, and Frenchy Creeks) that all co-mingled and formed a stronghold population. Available information for the Kraft Creek population was largely based on Forest Service surveys in 2004. The 2004 surveys found 100 percent genetically pure populations in the Red Butte and Upper Kraft Creeks. Middle Kraft Creek was 95 percent pure with slight introgression from rainbow trout alleles. Several migratory rainbow trout were captured in an upstream weir (fish trap) in the spring of 2004. Brook trout had invaded the area but their numbers were relatively low.

Based on this information, the Swan Native Fish Committee recommended investigating if it would be desirable to install a barrier on Kraft Creek. The concept was to install a barrier that blocks any further invasion of both rainbow trout and brook trout. There were several factors about Kraft Creek that made it appealing to conserve cutthroat trout by isolation. Kraft Creek was the largest remnant population in the Swan River Valley and unlikely to experience a loss of genetic fitness over time ("inbreeding"). The 2004 fish weir determined the cutthroat trout do not migrate and isolating them would be benign. Kraft Creek also has excellent habitat conditions. The watershed is entirely on National Forest System lands. Bull trout do not spawn in this system and installing the barrier would not have significant impacts to them. However, it was also understood that the Kraft Creek population would not be 100 percent pure (some rainbow alleles

had already been detected in Middle Kraft Area) but still at least 95 percent pure. There was also some concern that brook trout had already invaded the system, although they had remained at low numbers and were not depressing cutthroat trout abundance.

The Forest Service identified a possible location for a barrier in Kraft Creek, not far downstream from the Hemlock Creek confluence. The Glacier Loon proposed action included the barrier in public scoping. Comments received were supportive although concern was raised about the impact of a short, temporary road needed to install the barrier. An engineering firm was contracted to prepare a design concept for the barrier to aid environmental analysis. Meanwhile, the Swan Native Fish Committee collected more fisheries data in 2011 and also took advantage of recent advancements in conservation genetics. Unfortunately, the 2011 surveys found Kraft Creek had changed a lot since 2004. The area that previously was considered 95 percent pure was now about 88 percent pure. Most of the fish collected here had non-native alleles, indicating hybridization was rapidly increasing and widespread. Upper Kraft Creek and Hemlock Creek were also slightly hybridized. Only Red Butte Creek was still 100 percent pure. The 2011 Surveys also discovered that brook trout had substantially increased in numbers. Brook trout were now 50 percent of the biomass in Middle Kraft and Lower Hemlock Creeks. Brook trout numbers were also beginning to increase in Upper Kraft Creek. **Only Red Butte Creek was largely un-invaded by brook trout.**

Based on this information, the Swan Native Fish Committee withdrew support for installing a barrier on Kraft Creek as initially proposed. The group recommended investigating Red Butte Creek as a more suitable location for a barrier. Therefore, the Forest Service removed the Kraft Creek barrier from consideration with this project. In a separate decision, the Forest Service approved a barrier on Red Butte Creek instead and this was constructed in 2014. The Red Butte Creek fish barrier is located just outside of the Glacier Loon project boundary.

ALTERNATIVES CONSIDERED IN DETAIL

ALTERNATIVE A – NO ACTION

This alternative represents the existing condition in the Glacier Loon Project Area. Under this alternative, none of the activities proposed for the Glacier Loon Project would occur. No fuels reduction or forest health activities, temporary road and access management, and planting activities to aid in vegetation recovery, or other activities associated with the Proposed Action would occur at this time. Ongoing activities, such as recreation, public firewood gathering, fire suppression, and normal road maintenance would continue. Activities identified in Chapter 3 as current and foreseeable actions would occur.

ALTERNATIVES B, C, AND D (ACTION ALTERNATIVES)

Alternative B is the Proposed Action as described on pages 2-16 through 2-21.

Alternative C responds to the Purpose and Need and addresses comments received on Scenic Values and Water Quality concerns. This alternative focuses on eliminating the impacts to scenic values and reducing sedimentation to streams and water bodies by focusing on dropping proposed treatment units, reducing the amount of new temporary road construction, and increasing opportunities for decommissioning of historic road templates.

Alternative D is an alternative which responds to the Purpose and Need and focuses on wildlife security, retention of hiding cover and habitat connectivity, riparian habitat protection, and retention and recruitment of old growth habitat and lynx forage. Alternative D proposes the treatment of stands that would not continue to provide wildlife habitat in the short-term (5 to 10 years) without management intervention. Forested stands that would likely continue to provide habitat for longer than 5 to 10 years, without management intervention, were deferred from

treatment at this time, in order to maintain hiding cover, connectivity of habitat, and wildlife security.

TREATMENTS USED IN THE ACTION ALTERNATIVES

The section that follows describes silvicultural treatments, fuels treatments, site preparation, reforestation, and road management that are used to varying degrees in the descriptions of the individual action alternatives which follow this section.

VEGETATION MANAGEMENT

Silvicultural treatments are often defined as either regeneration or intermediate treatments. Regeneration methods are those that purposefully establish a new age class. Conversely, intermediate treatments are meant to enhance growth, quality, vigor, and composition of a stand prior to a regeneration treatment. Associated fuel treatments, site preparation and reforestation treatments are also proposed. Descriptions of the proposed treatments follow. Please refer to Appendix C in this document for detailed illustrations of the Silvicultural Treatments.

REGENERATION TREATMENTS

- **Clearcut with Reserves** - This treatment will remove nearly all trees from the site to facilitate regeneration of a new age class and increase species diversity. Although limited, all long lived, fire resistant, shade intolerant species (western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be retained, where feasible and where not acting as an insect or disease vector. Reserve trees would be retained to provide long term structural diversity. These treatment areas consist of primarily even-aged lodgepole pine with little species or structural diversity and are either experiencing mountain pine beetle mortality or are at risk of being affected. Regeneration of trees would result from natural seeding, planted seedlings, or a combination of both. Mechanical treatments and/or prescribed fire could be used to reduce fuels, recycle nutrients and prepare the site for regeneration.

The National Forest Management Act and Forest Service Handbook direction dictate that clearcutting must be justified as the optimum method to meet management objectives when prescribed. Fourteen areas are proposed for clearcutting in this project. Clearcutting was determined to be the optimum regeneration method for meeting management objectives for each of these areas by the Project Silviculturist. Criteria used to make this determination included; species composition relative to management direction and availability of desired species for seed sources, species susceptibility to observed insect agents, presence of disease infections which would be transmitted to the regenerated stand or where non-susceptible species conversion is necessary, and stands subject to windthrow if residual trees were retained. Appendix A of the Silviculture Report (Project File Exhibit I-1) discusses the criteria which applied to specific treatment areas.

All of the action alternatives include one unit - #48 (clearcut with reserves) that would require Regional Forester approval to create an opening that exceeds 40 acres in size. However, during project layout, there is the potential that this unit may be broken into several subunits separated by buffers resulting in no unit being greater than 40 acres in size.

Regional Forester policy (FSM 2471.1) directs the size of harvest openings created by even-aged silvicultural practices would be normally 40 acres or less, to support NFMAs general intent to limit the size of harvest openings. Creation of larger openings requires 60-day public review and Regional Forester approval. The public is being given 60 days notification of the potential for an opening over 40 acres with this EA. More information

about the stand conditions and the proposed treatments are provided in Chapter 3 – Forest Vegetation.

- **Seed Tree with Reserves** - A portion of the existing overstory long-lived, fire-resistant, shade-intolerant species (western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be retained and reserved at a density sufficient to facilitate regeneration of these desired species and create a two-aged stand structure (e.g., 5 to 15 trees per acre). This density is designed to provide seed sources and long-term structural diversity, while not interfering with the successful regeneration of desired species. The majority of these areas are dominated by lodgepole pine infested with mountain pine beetle or at risk. In addition, some proposed areas are affected by dwarf mistletoe and/or root diseases. Regeneration of trees would result from natural seeding, planted seedlings, or a combination of both. Mechanical treatments and/or prescribed fire could be used to reduce fuels, recycle nutrients and prepare the site for regeneration.
- **Shelterwood with Reserves** - A portion of the existing overstory long-lived, fire-resistant, shade-intolerant species (typically; western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be retained and reserved at a density sufficient to facilitate regeneration of these desired species and create a two-aged stand structure (e.g., 10 to 30 trees per acre). This density is designed to provide seed sources, long-term structural diversity, and provide shelter and a moderated micro-climate favorable for regeneration. Although similar to Seed Tree Treatments, the number of trees retained in Shelterwood Treatments would be greater. Again, these areas are currently affected by mountain pine beetle, dwarf mistletoe, and/or root diseases. Regeneration of trees would result from natural seeding, planted seedlings, or a combination of both. Mechanical treatments and/or prescribed fire could be used to reduce fuels, recycle nutrients and prepare the site for regeneration.

INTERMEDIATE TREATMENTS

- **Commercial Thin** - Existing tree density would be reduced from current levels to a target residual density ranging from 60 to 120 square feet of basal area per acre. This equates to approximately 50 to 150 trees per acre depending on tree species and site variables. Long-lived, fire-resistant, shade-intolerant species (typically; western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be favored for retention. The purpose of this treatment is to enlarge the growing space of desirable trees and reduce tree competition for limited site resources allowing for improved tree growth, vigor, resilience, and manipulation of fuel continuity. Mechanical treatments and/or prescribed fire would be used to reduce fuels and recycle nutrients.
- **Modified Commercial Thin** - This treatment is specific to Units 66 and 67 as these units are in the vicinity of the Lindbergh Lake Campground and adjacent to private lands near Cygnet Lake. A modified commercial thin is proposed in those portions of Units 66 and 67 which are adjacent to and which would directly impact the campground and private lands. The commercial thin treatment would be “modified” so that the primary treatment objectives of fuels reduction and hazard tree mitigation are met while ensuring retention/enhancement of the recreational experience and privacy retention/screening for private lands. Modifications could include, but not limited to, items such as varying residual tree densities near private lands and strategically retaining understory trees for visual/noise screening. During implementation, the Project Silviculturist would work closely with the District Recreation Staff and private land owners on treatment specifics.
- **Improvement Cut** - These treatments would be designed to achieve one of two objectives. Where mature ponderosa pine trees exist, the purpose would be to reduce impacts from mountain pine beetle by altering the stand micro-environment and enlarging the growing space of desirable trees. The existing tree density would be reduced from current levels either through thinning (residual densities ranging from 60 to 80 square feet of basal area per acre) or “Daylighting.” Daylighting Treatments are applied on an

individual tree basis and involve clearing vegetation within a specified distance (~30 feet) of a target tree. Ponderosa pine and non-susceptible species (e.g. western larch and Douglas-fir) would be favored for retention in all treatments. In addition to the thinning of live trees, dead trees and pine trees currently infested with mountain pine beetle would be salvaged from these areas if encountered. Alternatively, improvement cutting is also proposed in immature stands with high existing tree densities and designed to manipulate fuel continuity and reduce mountain pine beetle hazard. Here, tree density would be reduced from current levels to a target residual density ranging from 50 to 200 trees per acre. Many of the trees to be removed would be smaller than the minimum Forest Service sawlog specifications of 7 inches DBH; however larger trees are also likely to be removed. Mechanical treatments would be used to reduce fuels and recycle nutrients.

- **Sanitation/Salvage** - In these treatment areas the existing stand structure would generally remain intact following treatment. However, these areas would be modified by removal of dead, dying, or damaged trees. Primarily this includes lodgepole pine trees affected by mountain pine beetle. Where concentrations of affected trees exist, stand structure would be more significantly modified. The purpose of this treatment is to improve stand health, recover economic value, and manipulate fuel loadings and continuity. Mechanical treatments would be used to reduce fuels and recycle nutrients.
- **Post and Pole** - Areas identified as "Post and Pole" would be established as personal use post and pole areas. In these areas permitted individuals would be allowed to harvest live lodgepole pine trees less than 5 inches DBH. Areas would be identified on the ground and all specified permit conditions would apply, including limits on material harvested.
- **Pre-Commercial Thin** - In this treatment the existing immature tree density would be reduced to a target residual density (e.g., 50 to 300 trees per acre). The primary purpose of this treatment is to reduce fuel continuity, adjust species composition, and concentrate growth on the most desirable trees. This treatment would focus on the removal of sapling and pole-sized trees generally not greater than 5 inches DBH. Mechanical treatments and/or pile burning would be used to reduce fuels and recycle nutrients. This treatment is typically accomplished through hand thinning methods or through mechanized chipping/mastication.

FUEL TREATMENTS

A number of prescribed treatments are designed to reduce natural and activity generated fuels within the proposed treatment areas. These treatments include mechanical methods and the use of prescribed fire. Mechanical treatments could include a combination of the following; whole tree yarding (or possibly yarding of tops), lop and scatter, masticating, and/or excavator piling. Fuel accumulations at landings would be addressed through burning, chipping/masticating, and/or removal from National Forest lands. Prescribed fire treatments could include broadcast burning, pile burning and/or jackpot burning.

SITE PREPARATION

Depending on existing vegetation and ground conditions, site preparation may be prescribed to create favorable conditions to help ensure adequate regeneration. These treatments are often prescribed in both artificial and natural regeneration situations and typically address competing vegetation, seed bed preparation, fuel accumulations, and duff reduction. Site preparation can be accomplished through hand, mechanical, or prescribed fire methods. Hand methods usually involve creating favorable conditions at the time of planting using hand tools. Mechanical treatments are often accomplished during harvest operations or shortly afterwards and involve scarification and seed bed preparation through the use of mechanized equipment. Prescribed fire can also be used to recycle nutrients, consume excess fuels, reduce competing vegetation, and create a favorable seedbed.

REFORESTATION

Where regeneration treatments are proposed, a combination of natural and artificial reforestation is planned (specifically, hand planting of desired species). Where planting occurs, species selection would be based on management direction and site characteristics. Emphasis would be placed on establishing long-lived shade intolerant species such as western larch, ponderosa pine, western white pine, and occasionally Douglas-fir. It is expected that some level of natural regeneration would occur in all regeneration units.

ROAD MANAGEMENT

ROAD MAINTENANCE (BEST MANAGEMENT PRACTICES)

The objectives of road maintenance are to reduce the concentration of sub-surface and surface water runoff, minimize road surface erosion, filter ditch water before entering streams, and decrease the risk of culvert failures during peak runoff events. Maintenance work could include culvert installation, replacement of existing culverts with larger culverts, installation of drainage dips and surface water deflectors, placement of rip-rap to armor drainage structures, aggregate surface replacement, aggregate placement to reinforce wet surface areas, ditch construction and cleaning where needed, and surface blading to restore drainage efficiency of the road surface. These actions would bring the roads up to current BMP Standards and provide benefits to the streams in the project area. Best Management Practices are required under Timber Sale Contracts prior to hauling of timber over these roads.

ROAD CONSTRUCTION

The Glacier Loon Transportation Plan identified several areas that would need to be accessed by temporary roads. The proposed road construction would allow temporary access to proposed treatment areas through historic road templates and new temporary roads.

Historic Road Template

An historic template can be defined as a constructed road surface that was once used for a transportation need but is not currently a part of the National Forest Road System. It has an overall template that has not been re-contoured, and is in a state that is impassible to full sized motor vehicles due to waterbars and culvert removals and/or closure by vegetation, earth berm, or other natural features.

Temporary Roads

Temporary roads would be constructed to the minimum standards necessary for log hauling on National Forest System (NFS) roads. Temporary road surface width would be limited to truck bunk width plus 4 feet. Temporary roads would be reclaimed following their use using drain dips, outsloping, scarifying, seeding, and re- contouring.

ROAD DECOMMISSIONING

Road decommissioning is defined as activities that result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR 212.1), (FSM 7703). Decommissioning removes roads from the landscape that are no longer needed for current or future resource management or which pose a threat to water quality or wildlife security. This action would restore the natural drainage patterns interrupted when the roads were constructed. These methods for decommissioning include active and passive restoration. **Active treatment** may include total re-contouring that would restore the road template to the natural hill slope, partial re-contouring to fill ditches or remove unstable road shoulders, removing culverts and other drainage structures, ripping the roadbed to reduce compaction, installing water bars, out-sloping the road prism, seeding and fertilizing disturbed soil, and blocking the road entrance and abandoning the road to allow re-vegetation. **Passive treatment** would not involve any ground disturbing work.

Please refer to Table 2-1 below for a summary by alternative of management activities.

TABLE 2-1. TREATMENT SUMMARY BY ALTERNATIVE			
	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D
COMMERCIAL HARVEST TREATMENT ACRES*			
Clearcut with Reserve Trees	240	229	217
Seed Tree with Reserve Trees	463	405	347
Shelterwood with Reserve Trees	70	51	31
Commercial Thin	851	624	236
Improvement Cut	117	117	84
Sanitation/Salvage	8	11	5
Post and Pole	10	10	10
Pre-Commercial Thin	343	343	95
Modified Commercial Thin	0	119	125
Total Treatment Acres	2,102	1,909	1,150
LOGGING SYSTEM ACRES*			
Tractor	1,697	1,549	1,038
Skyline	44	0	0
Mechanical	356	355	107
Hand	5	5	5
Total Logging System Acres	2102	1909	1150
FUEL TREATMENT ACRES*			
Fuels treatments within the Wildland Urban Interface	1,710	1,526	902
Fuels treatments outside the Wildland Urban Interface	392	383	248
ROAD MANAGEMENT MILES			
Haul Routes (BMPs to be applied to meet Timber Sale Requirements)	37.7	34.7	29.1
Temporary Road Construction	11.5	7.4	5.8
Roads Proposed for Decommissioning	4.1	8.4	8.4
Resource Enhancement Projects	Two Projects to Improve Values (See narrative below)		

* Acres will likely be slightly less due to change in buffer (Management Requirement and Design Criteria) for unoccupied water howellia habitat from 150 feet to 300 feet.

RESOURCE ENHANCEMENT PROJECTS

Resource enhancement projects identified during project design are shown in the Table 2-2 below. These projects were identified to improve other resource values within the project area. Please refer to Maps 2-2 through 2-6 at the end of this chapter for a display of the project locations. These projects, while in the project analysis area, are not needed to mitigate effects of the proposed action or any of the alternatives. These projects represent site specific resource enhancement opportunities that, through this decision, would be authorized to occur. The implementation of these projects could occur as stand-alone projects and or could be associated with the proposed actions through stewardship contracting. Additional detail on the projects and potential funding sources follow.

TABLE 2-2. RESOURCE ENHANCEMENT PROJECTS.

GROUND LOCATION	PROJECT # ON MAP	PROJECT DESCRIPTION
End of Road #9591Y in T20N, R17W, Section 14	#1	A historic road (unmapped, no number) or skid trail was discovered about 0.25 miles from the end of FSR 9591Y. This road was built in the bottom of a small draw and not reclaimed. This draw now collects water into a stream that runs down the middle of the old road. The stream is small and not substantially eroding but it may have slightly altered the groundwater input of the wetland it flows into, which happens to be occupied by <i>Howellia</i> . This project would plant approximately 400 shrubs and seedlings on about 250' length of the stream. As the plants mature, they should be able to restore natural groundwater movement and help the stream fade away.
Road #9552 in T19N, R17W, Sections 33	#2	The existing road is poorly designed where it crosses the unnamed stream that flows between Meadow Lake and Bunyan Lake. The culvert is a seasonal fish migration barrier and the road surface erodes into the creek. Both Bunyan and Meadow Lake have wild (self-sustaining) cutthroat trout and the barrier is not desirable. This project would replace the culvert with either a larger culvert that provides fish passage or a bridge. The road would be reconstructed so that it does not erode into the stream. Minor work would also take place at the trailhead to reduce erosion.

Several sources of funding exist for resource enhancement projects. Many items have the potential to be funded through timber sales, while other items could be funded with Congressionally-approved funds (Collaborative Forest Landscape Restoration Program) or Stewardship dollars. Implementation would be based on annual budgets and program direction. It is anticipated that this project may be offered under a Stewardship Contract. Actual authority to offer under such a contract comes from the Regional Forester on a case-by-case basis. If approved as a Stewardship offering, these items will be included in Stewardship Projects, but inclusion of projects in the final award will depend on the bid value received for the project. Some, none, or all of the projects may be implemented through Stewardship contracting depending on market conditions at the time of offer. Implementation through direct project funding will be based on annual budgets and program direction. If funding were not available, the improvements from these projects would not be accomplished.

DESIGN CRITERIA

Table 2- 16 located at the end of this chapter describes the Design Criteria applied to this project to protect resources.

MONITORING

Monitoring and evaluation compared the results being achieved to those projected in the Forest Plan. Monitoring is conducted on a sample basis to evaluate the overall progress in implementing the Forest Plan, the assumptions on which the Forest Plan is based, and to provide a feedback loop for determining effectiveness of project and mitigation implementation (USDA Forest Service 2001). For this project, monitoring and evaluation would be conducted as described in Appendix A of this document. Those monitoring components not specifically discussed in this appendix tier to the monitoring described in the Forest Plan.

ACTIVITIES SPECIFIC TO THE ACTION ALTERNATIVES

Features unique to each alternative are described below. Maps displaying each alternative (Maps

2-1, 2-2, 2-3, 2-4, 2-5, and 2-6) are found at the end of this chapter.

ALTERNATIVE B – PROPOSED ACTION (MAPS 2-1 AND 2-2)

Intent: Alternative B was developed to respond to the Purpose and Need for the Glacier Loon Project. The Proposed Action focuses on reducing hazardous fuel buildup and improving forest health in the Glacier Loon Project Area by using various vegetative treatments, both commercial and non-commercial. Features associated with this alternative include the following:

- Fuel reduction and forest health treatment of affected stands on approximately **2102 acres** of NFS lands within the Glacier Loon Project Area including:
 - 240 acres of Clearcut with Reserve Trees;
 - 463 acres of Seed Tree with Reserve Trees;
 - 70 acres of Shelterwood with Reserve Trees;
 - 851 acres of Commercial Thin;
 - 117 acres of Improvement Cut;
 - 8 acres of Sanitation/Salvage;
 - 10 acres of Post and Pole; and
 - 343 acres of Pre-Commercial Thin.
- Harvest activities would be implemented using the tractor, skyline, mechanical, and hand treatments in the summer and tractor and forwarder logging systems during the winter.
- Slash would be treated through a combination of the following; whole tree yarding (or possibly yarding of tops), lop and scatter, masticating, and/or excavator piling. Fuel accumulations at landings would be addressed through burning, chipping/masticating, and/or removal from National Forest lands. Prescribed fire treatments could include broadcast burning, pile burning and/or jackpot burning.
- Hand planting would occur on an estimated **400 acres** of desired species within regeneration treatment units. Where adequate site preparation is achieved, natural regeneration would be expected to occur and in some cases supplement planted seedlings. A variety of species would likely become naturally established.
- Fuels Treatment would occur on **1,710 acres** within the Wildland Urban Interface.
- Fuels Treatment would occur on **392 acres** outside the Wildland Urban Interface.
- Best Management Practices would be implemented on an estimated **37.7 miles** of haul routes to meet Timber Sale Requirements.
- Units would be accessed through an estimated **11.5 miles** of temporary road construction as shown in Table 2- 3Table below. System roads would be used for road haul.
- Road decommissioning is proposed on an estimated **4.1 miles**.
- Minimal harvest activity would occur within Riparian Habitat Conservation Areas (RHCAs) in upland areas. Some temporary road locations would occur within RHCAs and cross streams. Site specific Design Criteria would assure that there would not be any adverse effects to streams, fish, or fish habitat. Portions of Units 19, 24, 57, 61, and 205 totaling 4.3 acres and a portion of Unit 64 totaling 2.08 acres would occur within RHCAs.

TABLE 2- 3. TEMPORARY ROAD NEEDS FOR ALTERNATIVE B - PROPOSED ACTION			
UNIT	TEMP ROAD NAME	ACCESS	MILES
2	14A	Access via NFS Road #9591	0.27
3, 4, 5, 6, 7, 8	23A	Access via NFS Road #91306 & #91305	0.76
6	14B	Access via NFS Road #91306	0.09
9	14D	Access via NFS Road #9591	0.35
9, 10	23B	Access via NFS Road #9591 & #91306	0.14
11	23C	Access via NFS Road #91306	0.11
12, 13, 14	24A	Access via NFS Road #9780	0.48
13, 14	24A	Access via NFS Road #9780	0.32
15, 16, 17	26A	Access via NFS Road #561	0.65
18	27A	Access via NFS Road #561	0.17
20, 21, 22, 23	36C	Access via NFS Road #9579C	0.98
24, 25	36A	Access via NFS Road #9579	0.16
26	36B	Access via NFS Road #9579C	0.30
27, 28	01B	Access via NFS Road #9579 & #9579C	0.34
29	01C	Access via NFS Road #9579C	0.19
30	01A	Access via NFS Road #9579C	0.13
41	06A	Access via NFS Road #10567	0.13
47, 48	11A	Access via NFS Road #9578 & #11648B	0.44
48	02D	Access via NFS Road #9578 & #11648B	0.12
51	11B	Access via NFS Road #11648B & #10741	0.47
52, 53, 54, 55, 57, 58	12E	Access via NFS Road #79	0.84
59	12D	Access via Missoula County #79	0.34
60, 61, 62, 63	12A	Access via NFS Road #10566	0.40
60	12C	Access via NFS Road #10566	0.16
61, 63	12B	Access via NFS Road #10566	0.20
66	14B and 11C	Access via NFS Road #79	0.37
67, 68, 69, 70	15C	Access via NFS Road #91240	0.74
71	15D	Access via NFS Road #90243	0.19
76	15A and 15B	Access via NFS Road #90241 & #90242	0.55
79, 80, 81	22A	Access via NFS Road #79A	0.61
84, 85	22B	Access via NFS Road #10734	0.26
90	22C	Access via NFS Road #9575	0.30
Total Temporary Roads			11.5

Alternative B vegetation treatments and associated activities are summarized in the following table.

TABLE 2- 4 SUMMARY OF PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE B.	
HARVEST TREATMENT ACRES *	
Clearcut with Reserve Trees	240
Seed Tree with Reserves	463
Shelterwood with Reserves	70
Commercial Thin	851
Improvement Cut	117
Sanitation/Salvage	8
Post and Pole	10

TABLE 2- 4 SUMMARY OF PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE B.	
HARVEST TREATMENT ACRES *	
Pre-Commercial Thin	343
Total Treatment Acres	2102
LOGGING SYSTEM ACRES *	
Tractor	1,697
Skyline	44
Mechanical	356
Hand	5
Total Logging System Acres	2102
SLASH TREATMENT *	
Chip/Excavator Pile/Burn	13
Chip/Pile Remove	339
Lop & Scatter/Pile/Burn	5
Lop & Scatter/Hand Pile/Burn	10
Whole Tree Yarding	468
WTY/Broadcast Burn	164
WTY, Excavator Pile/Burn Piles	751
WTY/Excavator Pile/Burn/Chip	311
WTY/Hand Pile/Burn/Chip	41
Total Slash Treatment Acres	2102
ROAD MANAGEMENT	
Haul Routes (BMPs) to be applied to meet Timber Sale Requirements	37.7
Temporary Road Construction	11.5
Roads Proposed for Decommissioning	4.1

* Acres will likely be slightly less due to change in buffer (Management Requirement and Design Criteria) for unoccupied water howellia habitat from 150 feet to 300 feet.

TABLE 2- 5 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE B - PROPOSED ACTION.					
UNIT No.	UNIT ACRES	ALTERNATIVE B TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA DIRECTION
1	10	Commercial Thin	Tractor	WTY	15C
2	12	Clearcut with Reserves	Tractor	WTY, Broadcast Burn	15C
3	6	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
4	2	Sanitation/Salvage	Tractor	WTY	15C
5	15	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
6	29	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
7	3	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
8	2	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
9	15	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
10	5	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
11	3	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
12	6	Commercial Thin	Tractor	WTY	15C
13	88	Commercial Thin	Tractor	WTY	15C
14	36	Commercial Thin	Tractor	WTY	15C
15	75	Commercial Thin	Tractor	WTY	15C
16	5	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
17	21	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C

GLACIER LOON FUELS REDUCTION AND FOREST HEALTH PROJECT

CHAPTER 2

ALTERNATIVES CONSIDERED

TABLE 2- 5 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE B - PROPOSED ACTION.

UNIT NO.	UNIT ACRES	ALTERNATIVE B TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA
18	9	Commercial Thin	Tractor	WTY	15C
19	11	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
20	14	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
21	1	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
22	31	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
23	24	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
24	17	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
25	20	Commercial Thin	Tractor	WTY	15C
26	24	Commercial Thin	Tractor	WTY	15C
27	11	Improvement Cut	Tractor	WTY	15C
28	17	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
29	16	Improvement Cut	Tractor	WTY	15C
30	6	Improvement Cut	Tractor	WTY	15C
31	26	Improvement Cut	Tractor	WTY	15C
32	23	Commercial Thin	Tractor	WTY	5
33	24	Commercial Thin	Tractor	WTY	5
34	16	Improvement Cut	Tractor	WTY, Hand Pile/Burn, Chip	5
35	41	Commercial Thin	Tractor	WTY	5
36	4	Improvement Cut	Tractor	WTY, Hand Pile/Burn, Chip	5
37	21	Improvement Cut	Tractor	WTY, Hand Pile/Burn, Chip	5
38	11	Clearcut with Reserve Trees	Tractor	WTY	5
39	14	Improvement Cut	Mechanical	Chip, Excavator Pile, Burn	5
40	3	Improvement Cut	Mechanical	Chip, Excavator Pile, Burn	5
41	22	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
42	23	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	17
43	16	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
44	4	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
45	7	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
46	2	ST Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
47	12	Clearcut with Reserves	Tractor	WTY, Broadcast Burn	15C
48	76	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
49	6	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
50	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
51	20	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
52	34	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
53	3	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
54	11	Commercial Thin	Tractor	WTY	17
55	4	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
56	6	Sanitation/Salvage	Tractor	WTY	15C
57	18	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
58	16	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
59	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
60	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
61	20	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
62	2	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
63	9	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
64	9	Commercial Thin	Tractor	WTY	15C

TABLE 2- 5 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE B - PROPOSED ACTION.					
UNIT NO.	UNIT ACRES	ALTERNATIVE B TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA DIRECTION
65	3	Commercial Thin	Tractor	WTY	17
66	96	Commercial Thin	Tractor	WTY, Excavator Pile, Burn, Chip	5
67	87	Commercial Thin	Tractor	WTY, Excavator Pile, Burn, Chip	5
68	34	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	5
69	5	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
70	18	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
71	10	Commercial Thin	Tractor	WTY	15C
72	9	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
73	17	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15C
74	23	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15C
75	6	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15C
76	128	Commercial Thin	Tractor	WTY, Excavator Pile, Burn, Chip	15C
77	18	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
78	10	Post and Pole	Tractor	L&S, Hand Pile/Burn	15
79	11	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
80	21	Shelterwood with Reserves	Tractor	WTY, Broadcast Burn	15
81	23	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
82	21	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15
83	7	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15
84	6	Shelterwood with Reserves	Tractor	WTY, Broadcast Burn	15
85	12	Shelterwood with Reserves	Skyline	WTY, Broadcast Burn	15
86	32	Seed Tree with Reserves	Skyline	WTY, Broadcast Burn	15
87	3	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15
88	9	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
89	31	Shelterwood with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
90	17	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
92	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
94	25	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
200	8	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
201	133	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
202	44	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
203	4	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
204	53	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
205	6	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
206	3	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
207	5	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
208	5	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
209	2	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	17
210	4	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	17
211	8	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
212	14	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
213	17	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
214	6	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	9
215	7	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
216	5	Pre-Commercial Thin	Hand	Lop & Scatter, Pile/Burn	15C
217	6	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
218	5	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	5

TABLE 2- 5 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE B - PROPOSED ACTION.

UNIT NO.	UNIT ACRES	ALTERNATIVE B TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA
219	8	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15
Total Acres	2102				

ALTERNATIVE C (MAPS 2-3 AND 2-4)

Intent: Alternative C was developed to respond to Issue #1, Scenic Values (primarily views from the property owners on the northwest shore of Lindbergh Lake) and Water Quality (reducing sedimentation to streams and water bodies). To address these concerns, treatment units were modified by shape, reduced in acreage, or dropped. Proposed temporary roads were shortened, re-located, or dropped. In addition, an increased number of roads were proposed for decommissioning. Features associated with this alternative include the following:

- Fuel reduction and forest health treatment of affected stands on approximately **1909 acres** of NFS lands within the Glacier Loon Project Area including:
 - 229 acres of Clearcut with Reserve Trees;
 - 405 acres of Seed Tree with Reserve Trees;
 - 51 acres of Shelterwood with Reserve Trees;
 - 624 acres of Commercial Thin;
 - 117 acres of Improvement Cut;
 - 11 acres of Sanitation/Salvage;
 - 10 acres of Post and Pole; and
 - 343 acres of Pre-Commercial Thin; and
 - 119 acres of Modified Commercial Thin
- Harvest activities would be implemented using the tractor, skyline, mechanical, and hand treatments in the summer and tractor and forwarder logging systems during the winter.
- Slash would be treated through a combination of the following; whole tree yarding (or possibly yarding of tops), lop and scatter, masticating, and/or excavator piling. Fuel accumulations at landings would be addressed through burning, chipping/masticating, and/or removal from National Forest lands. Prescribed fire treatments could include broadcast burning, pile burning and/or jackpot burning.
- Hand planting would occur on an estimated **340 acres** of desired species within regeneration treatment units. Where adequate site preparation is achieved, natural regeneration would be expected to occur and in some cases supplement planted seedlings. A variety of species would likely become naturally established.
- Fuels Treatment would occur on **1,526 acres** within the Wildland Urban Interface.
- Fuels Treatment would occur on **383 acres** outside the Wildland Urban Interface.
- Best Management Practices (BMPs) would be implemented on an estimated **34.7 miles** of haul routes to meet Timber Sale Requirements.
- Units would be accessed through an estimated **7.4 miles** of temporary road construction as shown in Table 2- 6 Temporary Road Needs for Alternative C.below. System roads would be used for road haul.
- Road decommissioning is proposed on an estimated **8.4 miles**.

- No new temporary road construction would occur within riparian areas.
- Minimal harvest activity would occur within Riparian Habitat Conservation Areas (RHCAs) in upland areas. Portions of Units 19, 24, 57, 61, and 205 totaling 4.3 acres and a portion of Unit 64 totaling 2.08 acres would occur within RHCAs. Site specific Design Criteria would assure that there would not be any adverse effects to streams, fish, or fish habitat.
-

TABLE 2- 6 TEMPORARY ROAD NEEDS FOR ALTERNATIVE C.			
2	14A	Access via NFS Road #9591	0.07
3, 4, 5, 6, 7, 8	23A	Access via NFS Road #91306 & #91305	0.76
9	14D	Access via NFS Road #9591	0.35
9, 10	23B	Access via NFS Road #9591 & #91306	0.10
11	23C	Access via NFS Road #91306	0.11
12, 13	24A	Access via NFS Road #9780	0.48
15, 16, 17	26A	Access via NFS Road #561	0.45
18	27A	Access via NFS Road #561	0.17
26	36B	Access via NFS Road #9579C	0.30
27, 28	01B	Access via NFS Road #9579 & #9579C	0.22
29	01C	Access via NFS Road #9579C	0.19
30	01A	Access via NFS Road #9579C	0.06
47, 48	11A	Access via NFS Road #9578 & #11648B	0.37
48	02D	Access via NFS Road #9578 & #11648B	0.12
51	11B	Access via NFS Road #11648B & #10741	0.47
52, 53, 54, 55,	12D	Access via NFS Road #79	0.62
60, 61, 62, 63	12A	Access via NFS Road #10566	0.40
61, 63	12B	Access via NFS Road #10566	0.20
66	14B and 11C	Access via NFS Road #79	0.37
68,70	15C	Access via NFS Road #91240	0.24
71	15D	Access via NFS Road #90243	0.19
76	15B	Access via NFS Road #90241 & #90242	0.35
80	22A	Access via NFS Road #79A	0.05
89	27A	Access via NFS Road #10734	0.09
90	22C	Access via NFS Road #10728	0.30
Total Temporary Roads			7.4

Alternative C vegetation treatments and associated activities are summarized in the following table.

TABLE 2- 7 SUMMARY OF PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE C.	
HARVEST TREATMENT ACRES *	
Clearcut with Reserve Trees	229
Seed Tree with Reserves	405
Shelterwood with Reserves	51
Commercial Thin	624
Improvement Cut	117
Sanitation/Salvage	11

TABLE 2- 7 SUMMARY OF PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE C.	
HARVEST TREATMENT ACRES *	
Post and Pole	10
Pre-Commercial Thin	343
Modified Commercial Thin	119
Total Treatment Acres	1,909
LOGGING SYSTEM ACRES	
Tractor	1,549
Skyline	0
Mechanical	355
Hand	5
Total Logging System Acres	1,909
SLASH TREATMENT *	
Chip/Excavator Pile/Burn	14
Chip/Pile Remove	338
Lop & Scatter/Pile/Burn	5
Lop & Scatter/Hand Pile/Burn	10
Whole Tree Yarding	432
WTY/Broadcast Burn	102
WTY, Excavator Pile/Burn Piles	730
WTY/Excavator Pile/Burn/Chip	237
WTY/Hand Pile/Burn/Chip	41
Total Slash Treatment Acres	1,909
ROAD MANAGEMENT *	
Haul Routes (BMPs) to be applied to meet Timber Sale Requirements	34.7
Temporary Road Construction	7.4
Roads Proposed for Decommissioning	8.4

* Acres will likely be slightly less due to change in buffer (Management Requirement and Design Criteria) for unoccupied water howellia habitat from 150 feet to 300 feet.

TABLE 2- 8 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE C.					
UNIT NO.	UNIT ACRES	ALTERNATIVE C TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA DIRECTION
1	10	Clearcut with Reserves	Tractor	WTY	15C
2	12	Clearcut with Reserves	Tractor	WTY, Broadcast Burn	15C
3	6	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
4	2	Sanitation/Salvage	Tractor	WTY	15C
5	15	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
6	29	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
7	3	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
8	2	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
9	15	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
10	5	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C

TABLE 2- 8 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE C.

UNIT NO.	UNIT ACRES	ALTERNATIVE C TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA DIRECTION
11	3	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
12	6	Commercial Thin	Tractor	WTY	15C
13	88	Commercial Thin	Tractor	WTY	15C
15	75	Commercial Thin	Tractor	WTY	15C
16	5	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
17	21	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
18	9	Commercial Thin	Tractor	WTY	15C
19	11	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
20	14	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
22	31	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
23	24	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
24	17	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
25	20	Commercial Thin	Tractor	WTY	15C
26	24	Commercial Thin	Tractor	WTY	15C
27	11	Improvement Cut	Tractor	WTY	15C
28	17	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
29	16	Improvement Cut	Tractor	WTY	15C
30	6	Improvement Cut	Tractor	WTY	15C
31	26	Improvement Cut	Tractor	WTY	15C
32	23	Commercial Thin	Tractor	WTY	5
33	24	Commercial Thin	Tractor	WTY	5
34	16	Improvement Cut	Tractor	WTY, Hand Pile/Burn, Chip	5
35	41	Commercial Thin	Tractor	WTY	5
36	4	Improvement Cut	Tractor	WTY, Hand Pile/Burn, Chip	5
37	21	Improvement Cut	Tractor	WTY, Hand Pile/Burn, Chip	5
38	11	Commercial Thin	Tractor	WTY	5
39	14	Improvement Cut	Mechanical	Chip, Excavator Pile, Burn	5
40	3	Improvement Cut	Mechanical	Chip, Excavator Pile, Burn	5
41	22	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
42	23	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	17
43	16	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
44	4	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
45	7	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
46	2	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
47	12	Clearcut with Reserves	Tractor	WTY, Broadcast Burn	15C
48	76	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
49	6	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
50	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
51	20	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C

TABLE 2- 8 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE C.

UNIT NO.	UNIT ACRES	ALTERNATIVE C TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA DIRECTION
52	34	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
53	3	Seed Tree with Reserve Trees	Tractor	WTY, Excavator Pile, Burn Piles	17
54	11	Commercial Thin	Tractor	WTY	17
55	4	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
56	6	Sanitation/Salvage	Tractor	WTY	15C
57	18	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
58	2	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
59	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
60	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
61	20	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
62	2	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
63	9	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
64	9	Commercial Thin	Tractor	WTY	15C
65	3	Sanitation/Salvage	Tractor	WTY	17
66	96	Modified Commercial Thin	Tractor	WTY, Excavator Pile, Burn, Chip	5
67	23	Modified Commercial Thin	Tractor	WTY, Excavator Pile, Burn, Chip	5
68	34	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	5
70	18	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
71	10	Commercial Thin	Tractor	WTY	15C
72	9	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
73	17	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15C
74	23	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15C
75	6	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15C
76	118	Commercial Thin	Tractor	WTY, Excavator Pile, Burn, Chip	15C
77	18	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
78	10	Post & Pole	Tractor	Lop and Scatter, Hand Pile/Burn	15
79	11	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
80	20	Shelterwood with Reserves	Tractor	WTY, Broadcast Burn	15
81	23	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
82	19	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15
88	9	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
89	31	Shelterwood with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
90	17	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
92	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
94	25	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
200	8	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C

TABLE 2- 8 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE C.

UNIT NO.	UNIT ACRES	ALTERNATIVE C TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA DIRECTION
201	133	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
202	44	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
203	4	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
204	53	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
205	6	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
206	3	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
207	5	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
208	5	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
209	2	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	17
210	4	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	17
211	8	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
212	14	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
213	17	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
214	6	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	9
215	7	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
216	5	Pre-Commercial Thin	Hand	Lop & Scatter, Pile/Burn	15C
217	6	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
218	5	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	5
219	8	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15
Total Acres	1909				

ALTERNATIVE D (MAPS 2-5 AND 2-6)

Intent: Alternative D was developed to respond to Issue #2, Wildlife Security. Wildlife security, retention of hiding cover and habitat connectivity, riparian habitat protection, and retention of recruitment of old growth habitat and lynx forage were the focal points for the development of this alternative. To address these concerns, some units in Alternative B have been retained, modified, or dropped. Proposed road management in Alternative D is also different; there has been a decrease in the amount of temporary road construction and an increase in the amount of road decommissioning as compared to Alternative B. With the reduction in the amount of temporary road construction, longer skidding distances would occur with this alternative.

Alternative D proposes the treatment of stands that would not continue to provide wildlife habitat in the short-term (5-10 year) without management intervention. Forested stands that would likely continue to provide habitat for longer than 5-10 years, without management intervention, were deferred from treatment at this time, in order to maintain hiding cover, connectivity of habitat, and wildlife security. Features associated with this alternative include the following:

- Fuel reduction and forest health treatment of affected stands on approximately **1150 acres** of NFS lands within the Glacier Loon Project Area including:
 - 217 acres of Clearcut with Reserve Trees;
 - 347 acres of Seed Tree with Reserve Trees;
 - 31 acres of Shelterwood with Reserve Trees;
 - 236 acres of Commercial Thin;
 - 84 acres of Improvement Cut;
 - 5 acres of Sanitation/Salvage;

- 10 acres of Post and Pole; and
 - 95 acres of Pre-Commercial Thin
 - 125 acres of Modified Commercial Thin
- Harvest activities would be implemented using the tractor, skyline, mechanical, and hand treatments in the summer and tractor and forwarder logging systems during the winter.
 - Slash would be treated through a combination of the following; whole tree yarding (or possibly yarding of tops), lop and scatter, masticating, and/or excavator piling. Fuel accumulations at landings would be addressed through burning, chipping/masticating, and/or removal from National Forest lands. Prescribed fire treatments could include broadcast burning, pile burning and/or jackpot burning.
 - Hand planting would occur on an estimated **290 acres** of desired species within regeneration treatment units. Where adequate site preparation is achieved, natural regeneration would be expected to occur and in some cases supplement planted seedlings. A variety of species would likely become naturally established.
 - Fuels Treatment would occur on **902 acres** within the Wildland Urban Interface.
 - Fuels Treatment would occur on **248 acres** outside the Wildland Urban Interface.
 - Best Management Practices (BMPs) would be implemented on an estimated **29.1 miles** of haul routes to meet Timber Sale Requirements.
 - Units would be accessed through an estimated **5.8 miles** of temporary road construction as shown in Table 2- 9 **Error! Reference source not found.** below. System roads would be used for road haul.
 - Road decommissioning is proposed on an estimated **8.4 miles**.
 - Minimal harvest activity would occur within Riparian Habitat Conservation Areas (RHCAs) in upland areas. Some temporary road locations would occur within RHCAs and cross streams. Portions of Units 19, 24, 57, 61, and 205 totaling 4.3 acres would occur within RHCAs. Site specific Design Criteria would assure that there would not be any adverse effects to streams, fish, or fish habitat.

TABLE 2- 9 TEMPORARY ROAD NEEDS FOR ALTERNATIVE D			
UNIT	TEMP ROAD NAME	ACCESS	MILES
2	14A	Access via NFS Road #9591	0.07
3, 4, 5, 6, 7, 8	23A	Access via NFS Road #91306 & #91305	0.76
9	14D	Access via NFS Road #9591	0.35
9, 10	23B	Access via NFS Road #9591 and #91306	0.10
12, 13, 14	24A	Access via NFS Road #9780	0.79
17	26A	Access via NFS Road #561	0.45
22	36C	Access via NFS Road #9579C	0.43
26	36B	Access via NFS Road #9579C	0.30
48	11A	Access via NFS Road #11648B	0.44
48	02D	Access via NFS Road #9578	0.12
59	12D	Access via NFS Road #79	0.34
52, 53	12D	Access via NFS Road #79	0.40
61, 63	12A	Access via NFS Road #10566	0.12
61, 63	12B	Access via NFS Road #10566	0.20
66	14B	Access via NFS Road #90243	0.10
66	11C	Access via NFS Road #90243	0.27

TABLE 2- 9 TEMPORARY ROAD NEEDS FOR ALTERNATIVE D			
UNIT	TEMP ROAD NAME	ACCESS	MILES
68, 70	15C	Access via NFS Road #90241 & #90242	0.24
89	27A	Access via NFS Road #10734	0.08
90	22C	Access via NFS Road #10728	0.30
Total Temporary Roads			5.8

Alternative D vegetation treatments and associated activities are summarized in the following table.

TABLE 2- 10 SUMMARY OF PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE D.	
HARVEST TREATMENT ACRES *	
Clearcut with Reserve Trees	217
Seed Tree with Reserves	347
Shelterwood with Reserves	31
Commercial Thin	236
Improvement Cut	84
Sanitation/Salvage	5
Post and Pole	10
Pre-Commercial Thin	95
Modified Commercial Thin	125
Total Treatment Acres	1150
LOGGING SYSTEM ACRES *	
Tractor	1,038
Skyline	0
Mechanical	107
Hand	5
Total Logging System Acres	1150
SLASH TREATMENT *	
Chip/Excavator Pile/Burn	13
Chip/Pile Remove	90
Lop & Scatter/Pile/Burn	5
Lop & Scatter/Hand Pile/Burn	10
Whole Tree Yarding	228
WTY/Broadcast Burn	82
WTY, Excavator Pile/Burn Piles	556
WTY/Excavator Pile/Burn/Chip	125
WTY/Hand Pile/Burn/Chip	41
Total Slash Treatment Acres	1150
Haul Routes (BMPs) to be applied to meet Timber Sale Requirements	29.1
Temporary Road Construction	5.8
Roads Proposed for Decommissioning	8.4

* Acres will likely be slightly less due to change in buffer (Management Requirement and Design Criteria) for unoccupied water howellia habitat from 150 feet to 300 feet.

TABLE 2- 11 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE D.

UNIT No.	UNIT ACRES	ALTERNATIVE D TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA DIRECTION
2	12	Clearcut with Reserves	Tractor	WTY, Broadcast Burn	15C
3	6	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
4	2	Sanitation/Salvage	Tractor	WTY	15C
5	15	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
6	29	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
7	3	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
8	2	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
9	15	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
10	5	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
12	22	Commercial Thin	Tractor	WTY	15C
13	13	Commercial Thin	Tractor	WTY	15C
14	20	Commercial Thin	Tractor	WTY	15c
17	21	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
19	11	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
20	14	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
22	31	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
24	17	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
25	20	Commercial Thin	Tractor	WTY	15C
26	24	Commercial Thin	Tractor	WTY	15C
31	26	Improvement Cut	Tractor	WTY	15C
32	23	Commercial Thin	Tractor	WTY	5
33	24	Commercial Thin	Tractor	WTY	5
34	16	Improvement Cut	Tractor	WTY, Hand Pile/Burn, Chip	5
35	41	Commercial Thin	Tractor	WTY	5
36	4	Improvement Cut	Tractor	WTY, Hand Pile/Burn, Chip	5
37	21	Improvement Cut	Tractor	WTY, Hand Pile/Burn, Chip	5
38	11	Commercial Thin	Tractor	WTY	5
39	14	Improvement Cut	Mechanical	Chip, Excavator Pile, Burn	5
40	3	Improvement Cut	Mechanical	Chip, Excavator Pile, Burn	5
44	4	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	15C
48	76	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C

TABLE 2- 11 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE D.

UNIT NO.	UNIT ACRES	ALTERNATIVE D TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA DIRECTION
49	6	Clearcut with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
52	34	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
53	3	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
57	18	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
58	2	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	17
59	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
61	20	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
63	9	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
65	3	Sanitation/Salvage	Tractor	WTY	17
66	96	Modified Commercial Thin	Tractor	WTY, Excavator Pile, Burn, Chip	5
67	29	Modified Commercial Thin	Tractor	WTY, Excavator Pile, Burn, Chip	5
68	34	Commercial Thin	Tractor	WTY, Excavator Pile, Burn Piles	5
70	18	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15C
73	17	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15C
74	23	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15C
75	6	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15C
77	18	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
78	10	Post & Pole	Tractor	L&S, Hand Pile/Burn	15
79	11	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
81	23	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
82	21	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15
83	7	Seed Tree with Reserves	Tractor	WTY, Broadcast Burn	15
88	9	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
89	31	Shelterwood with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
90	17	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
92	10	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
94	25	Seed Tree with Reserves	Tractor	WTY, Excavator Pile, Burn Piles	15
205	6	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
206	3	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
207	5	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
208	5	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
209	2	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	17

TABLE 2- 11 PROPOSED TREATMENT ACTIVITIES FOR ALTERNATIVE D.

UNIT No.	UNIT ACRES	ALTERNATIVE D TREATMENT	LOGGING SYSTEM	SLASH TREATMENT	FOREST PLAN MA DIRECTION
210	4	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	17
211	8	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
212	14	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
213	17	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
215	7	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
216	5	Pre-Commercial Thin	Hand	Lop & Scatter, Pile/Burn	15C
217	6	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15C
218	5	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	5
219	8	Pre-Commercial Thin	Mechanical	Chip/Pile/Remove	15
Total Acres	1150				

FOREST PLAN MANAGEMENT DIRECTION

The Flathead Forest Plan sets management direction for this project area. The Forest Plan provides forest-wide goals and objectives (pages II-1 through II-57). The Forest Plan also divides the Flathead National Forest into subunits called Management Areas (MAs). Each of these MAs has resource or activity goals and management standards (Forest Plan, pages III-1 through III-126). In keeping with Forest Service Policy on multiple use, the Forest Plan established goals to strike a balance among different resources (Forest Plan, page II-5).

FOREST PLAN MANAGEMENT AREA CHANGE

Comments were received from the public requesting that the MA designation be changed on the western shore of Lindbergh Lake. The statements below are examples of comments received during scoping, which articulated these concerns (Project File Exhibit D-1).

- I would like the management description for these areas to be reclassified. A classification of MA2 would put this area into a category closely representing "Backcountry" designation, which was proposed during the previous ranger's tenure at Swan Lake. While I am very concerned for the high visual impact of this area, I would not be completely opposed to some thinning due to diseased and dead trees; but would definitely not wish to have it be in what I consider the drastic form of the current proposal (Project File Exhibit C-21).
- We would like the management description for these areas to be reclassified. A classification of MA2 would put this area into a category closely representing "Backcountry" designation, which was proposed during the previous ranger's tenure at Swan Lake (Project File Exhibit C-29).
- It is quite clear that proposed roads and logging units on the slopes above Lindbergh Lake are not acceptable from a visual quality perspective, especially to those who recreate on or have homes on the lake. We ask that the underlying Forest Plan Management Area (MA) designation be changed to MA 5 or MA 2 in order to provide retention of the current visual quality and keep management activities from being noticeable – and to make the MA consistent with those on either side of the proposed activities (Project File Exhibit C-34).

Based on the above public comment, Alternatives C and D include a proposed change to the MA

for a portion of the Glacier Loon Project Area along Lindbergh Lake, including the highly visible portions of the project area from the lakeshore to the slope break totaling approximately 221 acres. The proposal would change 213 acres from MA 15, which consists of timberlands where timber management with roads is economical and feasible as currently assigned, to MA 5, which consists of roaded timberlands in areas of high scenic value. The other 8 acres would be changed from MA 15C, timberlands with emphasis on white-tailed deer summer range, to MA 5.

A brief overview of each of the MAs in this project area follows. More specific Forest Plan direction is discussed in each resource section later in this chapter. Please refer to Maps 2-7 and 2-8 for a display of official Forest Plan MAs and the proposed MA changes for Alternatives C and D. If Alternative C or D is selected, a Forest Plan Amendment would be completed with the Glacier Loon Decision Notice.

TABLE 2- 12 MANAGEMENT AREA DESCRIPTIONS, EMPHASIS, AND MANAGEMENT AREA ACRES FOR THE GLACIER LOON FUELS REDUCTION AND FOREST HEALTH PROJECT.				
MA	DESCRIPTION	MANAGEMENT EMPHASIS	TOTAL ACRES	
			ALT. B.	ALTS. C&D
MA 1	Consists of non-forest lands and timberlands where timber management is uneconomical or currently technologically infeasible due to topographic features.	Maintain the present condition with minimal investment for resource activities, while protecting the basic soils, water, and wildlife resources. Generally, these areas will retain a natural appearance.	245	245
MA 2	Consists of unroaded lands that offer a variety of dispersed recreation opportunities.	Provide a variety of primitive and semi-primitive recreation opportunities.	474	474
MA2A	Consists of unroaded lands suited for dispersed recreation that meet the ROS classification of semi-primitive non-motorized.	Dispersed recreation opportunities will be managed to meet the semi-primitive non-motorized ROS classification.	2,089	2,089
MA 5	Roaded timberlands in areas of high scenic value.	Maintain a pleasing, natural appearing landscape in which management activities are not evident.	1233	1,454
MA 7	Consists of timberlands in areas of high scenic value.	Maintain a pleasing, natural-appearing landscape in which management activities are not dominant.	497	497
MA 9	Consists of timberlands capable of providing white-tailed deer winter habitat.	Provide the size, age, diversity, and distribution of habitat units (both cover and forage areas) suitable for white-tailed deer winter habitat.	48	48
MA11C	Timberlands capable of providing grizzly bear habitat located on the southern portion of the Swan Lake Ranger District.	Manage the Swan/Clearwater Divide as an area that provides a security grizzly bear travel route between the Mission and Swan Mountain Ranges. Desired cover relationship is provided through vegetative manipulation including timber harvest and prescribed burning.	19	19
MA 12	Includes riparian areas consisting of aquatic, riparian, and a portion of terrestrial ecosystems along most perennial streams, lakes, ponds, marshlands, bogs, and some important seasonal flow streams.	Manage riparian areas throughout the Forest to enhance vegetation and wildlife diversity and maintain or enhance water quality and fisheries. Emphasize water and soil protection and old growth habitat. Management of other resources must be compatible with the riparian habitat management standards.	942	942
MA 15	Timberlands where timber management with roads is economical and feasible.	Emphasize cost-efficient production of timber while protecting the productive capacity of the land and timber resource.	4,098	3,885

TABLE 2- 12 MANAGEMENT AREA DESCRIPTIONS, EMPHASIS, AND MANAGEMENT AREA ACRES FOR THE GLACIER LOON FUELS REDUCTION AND FOREST HEALTH PROJECT.				
MA	DESCRIPTION	MANAGEMENT EMPHASIS	TOTAL ACRES	
			ALT. B.	ALTS. C&D
MA15C	Consists of timberlands where timber management with roads is economical and feasible, and is key white-tailed deer summer range.	Special consideration will be given to white-tailed deer summer range within this MA.	7,108	7,100
MA 17	Includes riparian areas consisting of aquatic, riparian, and a portion of terrestrial ecosystems along perennial stream reaches, and some important streams with typically a seasonal flow.	Protect and maintain this riparian zone throughout the Forest, including fish and wildlife habitat, while maintaining a sustained yield of timber.	290	290
MA 22	Mission Mountains Wilderness classified wilderness designated in 1975 by the US Congress.	Manage this area in accordance with the Wilderness Act of 1964 to maintain an enduring system of high quality wilderness representative of all National Forest ecotypes.	12,321	12,321
Non-National Forest			7,556	7,556
Lindbergh Lake			400	400
Total NFS Lands			37,320	37,320

COMPARISON OF ALTERNATIVES

This section provides a comparison of the alternatives in terms of:

- How the alternatives meet the Purpose and Need for the proposal;
- How the alternatives respond to the key issues;
- The potential environmental consequences associated with the implementation of the alternatives.

(Some activities are listed more than once because they meet more than one Purpose and Need.)

TABLE 2- 13 COMPARISON OF ALTERNATIVES - HOW THEY RESPOND TO THE PURPOSE AND NEED.					
PURPOSE AND NEED	INDICATOR	ALT. A	ALT. B	ALT. C	ALT. D
Hazardous Fuels Reduction	Acres of Treatment	0	2102	1909	1150
Improve Forest Health	Acres of Treatment	0	2102	1909	1150
Provide wood products for local economies	Million Board Feet	0	10.5	9.0	6.7

TABLE 2- 14 COMPARISON OF ALTERNATIVES - HOW THEY RESPOND TO THE KEY ISSUES.					
ISSUE	INDICATOR	ALT. A	ALT. B	ALT. C	ALT. D
Meets Forest Plan Visual Quality Objectives	Does or does not meet	Meets	Meets	Meets	Meets
Change in Scenic Integrity	Number of harvest units seen within viewsheds of high concern	0	23	17	16
Magnitude of Visual Impact	Number of regeneration harvest units within viewsheds of high concern	0	10	3	3

TABLE 2- 14 COMPARISON OF ALTERNATIVES - HOW THEY RESPOND TO THE KEY ISSUES.					
ISSUE	INDICATOR	ALT. A	ALT. B	ALT. C	ALT. D
Water Quality	Miles of New Temporary Road	0	9.3	5.4	4.5
	Miles of Temporary Road on Historic Templates	0	2.3	2.0	1.4
	Miles of Road Decommissioned	0	4.1	8.4	8.4
	Miles of Best Management Practices (BMP Work)	0	37.7	34.7	29.1
Wildlife Security	Decrease in hiding cover (Acres)	0	1453	1310	888
	Acres treated adjacent to wetland complexes	0	612	597	320
	Use of restricted (gated/bermed) roads (miles)	0	23.6	21.6	16.0
	Miles of temporary road construction	0	11.5	7.4	5.8
	High contrast edge created adjacent to Old Growth Stands (Feet/Miles)	0	10,400/2.0	8,800/1.7	6,600/1.3
	Acres treated in lynx habitat within WUI	0	1587	1473	755
	Acres treated in lynx habitat outside WUI	0	358	279	238

TABLE 2- 15 COMPARISON OF ENVIRONMENTAL EFFECTS BY ALTERNATIVE.					
ENVIRONMENTAL CONSEQUENCE	INDICATOR	ALT. A	ALT. B	ALT. C	ALT. D
SOIL RESOURCE					
Detrimental soil disturbance resulting from alternative implementation	Units exceeding 15% detrimental soil disturbance	0	0	0	0
Meets Forest Service Regional Soil Quality Standard	Does or does not meet standard	Yes	Yes	Yes	Yes
HYDROLOGY					
Water Quantity (water yield Increase over baseline conditions)	Glacier Creek Watershed	5.9%	6.0%	6.0%	5.9%
	Upper Swan River Watershed	0.9%	1.2%	1.1%	1.1%
	Swan River Valley Bottom Area	19.8%	21.4%	21.0%	20.8%
Water Quality (Sediment Delivery)	Sediment increase compared to baseline conditions	Immeasurable	Immeasurable	Immeasurable	Immeasurable
Beneficial Uses	Does or Does not Meet	Meets	Meets	Meets	Meets
Channel Stability	Channel Stability Maintained	Maintained	Maintained	Maintained	Maintained
FISHERIES – THREATENED, ENDANGERED, AND SENSITIVE SPECIES					
Bull Trout/Bull Trout Critical Habitat	Biological Assessment Determination	---	May affect, but not likely to adversely affect		
Metlwater Lednian Stonefly	Biological Assessment Determination	—	No effect		
Westslope Cutthroat Trout	Biological Evaluation Determination	--	May impact individuals or habitat, but will not likely result in a trend towards federal listing or reduced viability for the population or species.		
Western Pearlshell Mussel	Biological Evaluation Determination	---	No impact		
WILDLIFE – THREATENED AND ENDANGERED, SENSITIVE, OTHER MANAGEMENT INDICATOR (MIS) SPECIES					

TABLE 2- 15 COMPARISON OF ENVIRONMENTAL EFFECTS BY ALTERNATIVE.

TABLE 2- 15 COMPARISON OF ENVIRONMENTAL EFFECTS BY ALTERNATIVE.					
ENVIRONMENTAL CONSEQUENCE	INDICATOR	ALT. A	ALT. B	ALT. C	ALT. D
Decrease in Habitat Security due to displacement from potential habitat	Acres treated adjacent to wetland complexes	0	612	597	320
	Acres treated in lynx habitat outside WUI	0	358	279	238
	Acres treated in lynx habitat within WUI	0	1,587	1,473	755
Habitat loss due to decreases in hiding cover	Decrease in hiding cover (acres)	0	1,453	1,310	888
Decease in Habitat Security due to increased motorized access	Use of Restricted (gated/bermed) roads	0.0	23.6	21.6	16.0
	Miles of temporary road construction	0.0	11.5	7.4	5.8
	Open Road Density (ORD)/Total Road Density (TRD) in Glacier Loon Subunit during implementation (assuming all units active at the same time	22.06/43.28 (Existing)	41.9/47.28	40.73/46.65	38.13/46.08
Decrease in quality of important old growth habitats	High contrast edge created adjacent to Old Growth stands (Feet/Miles)	0/0	10,400/2.0	8,800/1.7	6,600/1.3
Wildlife Habitat Improvement	Miles of proposed road decommissioning	0.0	4.1	8.4	8.4
	Proposed Management Area change on 221 acres of MA15/15C to MA5 (This would be beneficial to most wildlife species).	No	No	Yes	Yes
Potential for disturbance to Common Loon nesting pair on Loon Lake from proposed activities	Based on proposed activity near lake and timing of activity	No potential for disturbance	High potential for disturbance	High potential for disturbance	Low potential for disturbance
Grizzly Bear	Biological Assessment Determination	May affect, Likely to Adversely Affect			
Canada Lynx	Biological Assessment Determination	May Affect, Likely to Adversely Affect			
Lynx Critical Habitat	Biological Assessment Determination	May Affect, Likely to Adversely Affect			
Wolverine	Biological Assessment Determination	Would not Jeopardize			
FOREST VEGETATION					

TABLE 2- 15 COMPARISON OF ENVIRONMENTAL EFFECTS BY ALTERNATIVE.

TABLE 2- 15 COMPARISON OF ENVIRONMENTAL EFFECTS BY ALTERNATIVE.					
ENVIRONMENTAL CONSEQUENCE	INDICATOR	ALT. A	ALT. B	ALT. C	ALT. D
Harvest volume of merchantable timber from suitable lands	Million Board Feet	0	10.5	9.0	6.7
Stand Composition shifted towards greater representation of western larch, western white pine, and/or ponderosa pine.	Acres of commercial and pre-commercial silvicultural treatments	0	2092	1899	1140
Forest Structure modified resulting in: reduced stand densities, increased single storied stand conditions, larger average stand diameters, and increased growing space.	Acres of commercial and pre-commercial silvicultural treatments	0	2092	1899	1140
Change in Seral Stage Distribution	Acres converted to early seral stage	0	783	694	604
Insect and Disease Conditions affected through reduced stand densities and increased representation of resistant species.	Acres of commercial and pre-commercial silvicultural treatments	0	2092	1899	1140
Reduce forest fuels buildup adjacent to public and private lands	Acres of treatment within WUI	0	1710	1526	902
Reduce forest fuels buildup adjacent to public and private lands	Acres of treatment outside of WUI	0	392	383	248
Regional Forester's Sensitive Plants	Biological Evaluation Determination	No Impact	May affect individuals and habitat, but would not result in a trend toward federal listing or cause a loss of viability for sensitive species.		
Threatened Plant Species – Water howellia	BA Determination	--	May affect, but not likely adversely affect		
Threatened Plant Species – Spalding's Catchfly	BA Determination	--	No Effect		
Noxious Weed Establishment and Spread	Risk Level	Low	High risk of introduction, spread, establishment, and persistence		
SCENIC VALUES					
Meets Forest Plan Visual Quality Objectives	Does or does not meet	Meets	Meets	Meets	Meets
Change in Scenic Integrity	Number of units seen within viewsheds of high concern	0	23	17	16
Magnitude of Visual Impact	Number of regeneration unit within viewsheds of high concern	0	10	4	5
RECREATION					

TABLE 2- 15 COMPARISON OF ENVIRONMENTAL EFFECTS BY ALTERNATIVE.					
ENVIRONMENTAL CONSEQUENCE	INDICATOR	ALT. A	ALT. B	ALT. C	ALT. D
Restrictions on existing recreation opportunities	Does or does not restrict	No	No	No	No
HERITAGE RESOURCES					
Effects to Heritage Resources	Number of sites affected	0	0	0	0
SOCIAL & ECONOMIC					
Direct Employment	Number of jobs	0	69	61	44
Indirect and Induced Employment	Number of Jobs	0	58	51	38
Total	Number of Jobs	0	128	112	83
Economic viability of alternative	Predicted High Bid \$/CCF	\$0	\$31.80	\$33.27	\$33.79
Sawtimber Volume Harvested	CCF	0	19,456	16,889	12,644

MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA

The measures identified in the following table serve to further reduce impacts to the specific resources identified. Most are considered Design Criteria and are included in all action alternatives.

Several abbreviations are used in the responsibility section of Table 2- 16. The following explains those abbreviations:

ARCH	Archeologist	LEO	Law Enforcement Officer
BT	Botanist	NWM	Noxious Weed Manager
DR	District Ranger	RA	Range Administrator
DRC	District Road Coordinator	RF	Resource Forester
ENG	Engineer	SA	Sale Administrator
AFMO	Assistant Fire Mgmt Officer	SILV	Silviculturist
FISH	Fisheries Biologist	SP	Sale Prep
FMO	Fire Management Officer	SS	Soils Scientist
HYD	Hydrologist	TMC	Timber Marking Crew
IDT	Interdisciplinary Team	TP	Timber Sale Purchaser
LA	Landscape Architect	WB	Wildlife Biologist

TABLE 2- 16 MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA.

OBJECTIVE	TASK	RESPONSIBILITY	DUE DATE
Grizzly Bear Security and SVGBCA Compliance	The Glacier-Loon Grizzly Bear Subunit was "active" 2012 through 2014 and is currently "inactive." Standards and guidelines for an inactive grizzly bear subunit will be followed, as per the Swan Valley Grizzly Bear Conservation Agreement during the "inactive" period. The subunit is "active" again in 2021 through 2023 under the SVGBCA. The Buck Holland Subunit is "Active from 2018 through 2020, and becomes "Inactive" again in 2021.	WB, SA, SP	Pre & Post Sale
Grizzly Bear Security and SVGBCA Compliance	In order to avoid the potential disturbance of grizzly bear in important Spring Habitat, management activities that are planned in Spring Habitat, which is defined as areas within designated Linkage Zones, below 5,200 feet, will not occur within the spring period (April 1 through June 15). This timing restriction would apply to all units except Units 1-14, 19-26, 30-34, 90, 92, 94, 200, and 205.	SP, SA, TMC, WB	Pre & Post Sale
Grizzly Bear Security and SVGBCA Compliance	Seed Tree Units and Clearcut with Reserve Units will be designed so that no point in the unit is more than 600 feet from cover; in other words, a bear in the unit would be able to find cover anywhere in the unit within 600 feet or less.	SP, WB	Pre & Post Sale
Grizzly Bear Security (SVGBCA Compliance) - General Wildlife Security	Visual screening will be retained adjacent to open roads in proposed cutting units.	SP, SA, TMC, WB	Pre & Post Sale
Wildlife – TES	Provisions will be included in the contract to cease activity or otherwise protect populations and individuals of threatened or endangered species. This allows for modification of the project should an unforeseen issue(s) be identified during operations. Standard contractual requirements used in all contracts provide for modification or termination of the contract to avoid impacts and protect TES.	WB, SA, SILV	Contract Prep & During Harvest Activities
Wildlife – TES	Public motorized access will be restricted on temporary roads and skid trails normally closed to use.	WB, SA, DRC	Pre & Post Sale, During Harvest Activities
Wildlife– TES	Contractors working under contract on NFS lands are prohibited from carrying firearms on roads within the project area that are normally closed to public use (SVGBCA).	SA, LEO, WB	Pre & Post Sale, During Harvest Activities
Wildlife - Security	Vegetation and/or rock barriers will be retained around berms and gates, where needed, to maintain closure effectiveness.	DRC, SA, WB	Pre & Post Sale, During Harvest Activities
Wildlife – Security	If berms are removed for access to treatment units, temporary gates will be installed. Berms will be re-installed when sale activities are complete.	SB, SA, DRC	Pre & Post Sale, During Harvest Activities
Wildlife - Security	Decommissioned roads will be treated so that they are impassable to motorized vehicles and meet the minimum criteria for a "reclaimed road" as defined by Forest Plan Amendment 19 (Amendment 19 Amended EA, Appendix D pg. 2). When the decommissioned roads meet the "reclaimed" definition in Amendment 19, they will no longer be counted in road density or security core calculations. All decommissioned roads will receive the following treatments:	WB, SA, DRC	During harvest activities, Post-Sale

TABLE 2- 16 MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA.

OBJECTIVE	TASK	RESPONSIBILITY	DUE DATE
	- The first portion of the road (typically 200 to 600 feet) will be treated in such a manner to preclude its use as a motorized or non-motorized travelway – this could include one or more of these options: recontouring the road surface, placement of natural debris, placement of rock barriers or berms, or revegetation with shrubs or trees. - Culverts aligned with stream channels will be removed. - The entire road will receive treatment such that maintenance or entries to maintain road drainage is not needed. - Road related sediment sources will be repaired and road reworked to eliminate ditch water flow without the aid of cross drain culverts. Typically this is achieved by cutting waterbars into the ditch line every 200 feet. Waterbars can be placed closer or further apart depending on site specific conditions and are typically installed 50ft above grade or near existing cross drains. - Beyond the first portion of the road (200 to 600 feet), the roadway will be treated to discourage use including sporadic placement of natural debris where available and seeding or planting to encourage revegetation. Recontouring all or a portion of the remaining roadway is also an option.		
Snag Retention for Snag Associated Wildlife Species	In treatment units, where available, a minimum average of 6 snags per acre that are 12-20 inches DBH would be left, and all snags greater than 20 inches would be left. If existing snag densities are below these densities, substitute live trees would be left. All standing dead cull western larch, ponderosa pine, and Douglas-fir trees 16 inches DBH or greater may be retained. Generally, snags to be left would be further than 150 feet from open roads and private land boundaries. Snags that pose a safety hazard to the Contractor's operation would be removed.	SILV, WB, SP, SA, TP	Pre & Post Sale, During Harvest Activities
Retention of Down Woody Material for Down Woody Habitat Associated Wildlife Species	The minimum retention for down woody material will be approximately 10 tons per acre, where available. To achieve the tonnage required, retain (where it exists) down woody material which includes the longest material available (e.g., 16 feet long or longer) and retain the woody debris with the largest diameters available (e.g., 15 inches DBH or greater), sufficient to achieve the tons per acre.	SILV, WB, SP, SA, TP	Pre & Post Sale, During Harvest Activities
Hardwood Retention for Associated Wildlife Species	All hardwood trees will be reserved where feasible.	SILV, SA, TP, SP	Pre & Post Sale, During Harvest Activities
Public Safety	Contracts would require the contractor to clearly post signs warning the public of nearby activities and truck hauling traffic associated with the treatments.	SA, DRM	Pre & Post - Sale, During Harvest Activities
Public Safety	The District Assistant Fire Management Officer (Fuels) or designated liaison would notify nearby landowners prior to fuel reduction activities commencing on NFS lands that are adjacent to their properties.	FAFMO	Pre-Sale, During Harvest Activities
Special Use Permits	All permitted improvements, including power and phone service lines and water transmission lines (authorized by special use permits) would be clearly marked and protected during project implementation.	SA, TMC, IF, FMO, SP, RF	Pre- & Post-Sale
Protect Site and Soil Productivity	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.	SA	During Harvest Activities

TABLE 2- 16 MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA.

TABLE 2- 16 MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA.					
OBJECTIVE	TASK		RESPONSIBILITY	DUE DATE	
Protect Site and Soil Productivity	Skid trail spacing width must average at least 75 feet in all tractor harvest units. The goal is to occupy less than 15 percent of the treatment area including soil disturbance from skid trails, temporary roads and landings associated with past and proposed activities.		SA, SP, SS	Pre & Post Sale, During Harvest Activities	
Protect Site and Soil Productivity	Winter harvest is required to meet the Region 1 soil quality standard and/or protect sensitive soils in the following units by alternative:		SA, SP, SS	During Harvest Activities	
	Alternative	Winter Tractor Unit			Winter CTL/Forwarder Unit
	B	10, 11, 16, 34, 59			2, 5
	C	10, 11, 16, 34			2, 5
	D	10, 17, 20, 22, 34			2, 5
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.					
Protect Site and Soil Productivity	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 and location must be considered when laying out additional skid trails.		SA, SP, SS	Pre & Post Sale, During Harvest Activities	
Protect Site and Soil Productivity	Logging would occur when soils are dry as determined by the hand feel method (Project Record Exhibit 21).		SA	During Harvest Activities	
Protect Site and Soil Productivity	Sale administrators will monitor soil moisture conditions prior to allowing equipment to begin operations in summer. This monitoring must be documented in the Timber Sale Daily Report.		SA	Pre-Sale	
Protect Site and Soil Productivity	All mechanical fuel reduction will be accomplished with excavators. Excavators will, to the extent feasible, remain on skid trails.		SA	During Harvest Activities	
Protect Site and Soil Productivity	Prescribed burning prescriptions would be prepared and implemented to not exceed moderate burn severity conditions.		FMO, AFMO	Post Sale	
Improve soil condition, protect fish and wildlife habitat, and protect water quality	All newly constructed temporary roads and extended log skidding corridors 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 - Where re-contouring is unnecessary, scarify with excavator teeth to a depth equal sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 and 12 inches) - Removing any installed culverts or temporary bridges. - Installing erosion control features where needed.		SA, SS, TP, BT, NWM	Post-Sale	

TABLE 2- 16 MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA.

OBJECTIVE	TASK	RESPONSIBILITY	DUE DATE
	- Revegetation with native shrubs or native seed mix (specified by the Forest Botanist) after soil is replaced as soon as feasible after disturbance to provide for site protection until native species are established. - Placing woody material on the template		
Improve soil condition, protect fish and wildlife habitat, and protect water quality	All temporary roads re-constructed for this project that utilize historic road templates would be reclaimed by any site-appropriate combination of the following: - Removing any installed culverts or temporary bridges. - Installing erosion control features where needed. - Scarification with excavator teeth to a depth equal sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 to 14 inches). - Revegetation with native shrubs or native seed mix (specified by the Forest Botanist) after soil is replaced as soon as feasible after disturbance to provide for site protection until native species are established. - Placing woody material on the template. Roads should be reclaimed as soon as access is no longer required, before the close of the project.	SA, SS, TP, BT, NWM	Post-Sale
Water Quality	Skid Trail crossings of scoured channels will require drainage protection measures as required by State BMPs. BMPs will be followed for harvest, temporary road and system road management.	SA	During Harvest Activities
Protect Fish Habitat	With the exception of Units 19, 24, 57, 61, 64, and 205; no harvest activity will take place in Riparian Habitat Conservation Areas (RHCAs). Lindbergh Lake is a priority watershed. The RHCAs in Lindbergh Lake watershed are: 300' from fish-bearing streams 150' from perennial, non-fish-bearing streams 100' from intermittent streams 150' from lakes or wetlands greater than 1 acre 50' from wetlands less than 1 acre All other watersheds are not priority watersheds. The RHCAs in all other watersheds are: 300' from fish-bearing streams 150' from perennial, non-fish-bearing streams 50' from intermittent streams 150' from lakes or wetlands greater than 1 acre 50' from wetlands less than 1 acre	SA, SP, FISH, AFMO	Pre & Post Sale, During Harvest Activities
Protect Fish Habitat Water Quality Protection	All temporary roads that cross streams will have culverts or temporary bridges installed, <u>there will be no fords</u> . Culverts will be installed when the channel is dry (intermittent streams) or the stream will be diverted during low flow periods (perennial streams). The culvert will be removed during dry or low flow periods with appropriate sediment reduction devices (Straw bales) in place. Stream channels will be reshaped to natural contours after the culvert is removed. All fill material will be removed by equipment from stream channels to restore the natural channel contours after the culvert is removed.	SA, FISH, HYD	Pre & Post Sale, During Harvest Activities
Protect Fish Habitat BMP Compliance, Protect Beneficial Uses	Any culverts replaced for BMPs will be adequately sized for 100 year flood events.	FISH, HYD, ENG, DRC	Pre-Sale

TABLE 2- 16 MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA.

OBJECTIVE	TASK	RESPONSIBILITY	DUE DATE
Protect Fish Habitat	The new culvert on Road #9552 at Meadow Lake outflow will be designed for aquatic fish passage and will be sized for 100 year flood event. During project implementation, the stream will be de-watered at the worksite. Sediment retention devices will be installed immediately below the terminus of the de-watering pipe. This may be either 2 straw bales staked into the streambed or one commercially-manufactured burlap fence called "Sedimat" (provided by the Forest Service). After stream flow is resumed, a hand crew shall shovel out trapped sediments and dispose the straw bales on adjacent ground. If a "Sedimat" is used, the excavator shall remove and dispose the soiled mat.	FISH, HYD, ENG, DRC	Post Sale
Protect Fish Habitat	The old culvert on temporary Road #12A would be removed (when the stream is dry) even though no haul is anticipated on this portion of the road. This design criteria is unique to Alternative D.	FISH, HYD, ENG, DRC	Post Sale
Protect Fish Habitat	Mechanical equipment would not utilize Road #79Y if there is any water on the road. The culverts on this road were removed years ago. When the road is dry, equipment may use the road. If not, equipment will need to find alternative access across private ground or defer work out of away from any wet area.	FISH, HYD, ENG, DRC	During Harvest Activities
Forest Vegetation	Prepare detailed site specific silvicultural prescription for all treatment areas requiring vegetation manipulation	SILV	Prior to presale activities
Forest Vegetation	Consult with Project Silviculturist where treatment deviations are required during contract execution, as a result of changed or unidentified conditions that materially affect the intended treatment as described in the detailed site specific silvicultural prescription. As needed, the silvicultural prescription will be modified and re-approved by a certified silviculturist.	SILV, TSA, SP, FMO	Pre, During, and Post Harvest Activities
Forest Vegetation (Leave Tree Protection)	Contractor will take all reasonable care to avoid damage to the roots, bole, and crown of trees to be reserved from cutting. No more than 5 percent of the trees designated to be reserved should be damaged beyond recovery by the Contractor's operations. Any tree damaged beyond recovery, (will die within one year due to damage), can be removed or otherwise treated by the Contractor as instructed by the Forest Service.	TP, TSA, SILV	Pre, During, and Post Harvest Activities
Forest Vegetation (Down Woody Material)	The minimum retention for down woody material will be approximately 10 tons per acre, where available. To achieve the tonnage required, retain (where it exists) down woody material which includes the longest material available (e.g., 16 feet long or longer) and retain the woody debris with the largest diameters available (e.g., 15 inches DBH or greater), sufficient to achieve the tons per acre.	SILV, SA, TP, SP	Pre, During, and Post Harvest Activities
Forest Vegetation (Snag Retention)	In treatment units, where available, a minimum average of 6 snags per acre that are 12-20 inches DBH would be left, and all snags greater than 20 inches would be left. If existing snag densities are below these densities, substitute live trees would be left. All standing dead cull western larch, ponderosa pine, and Douglas-fir trees 16 inches DBH or greater may be retained. Generally, snags to be left would be further than 150 feet from open roads and private land boundaries. Snags that pose a safety hazard to the Contractor's operation would be removed.	SILV, SA, TP, SP	Pre, During, and Post Harvest Activities
Forest Vegetation (Implementation in Units 66 and 67)	In those areas of Units 66 and 67 which would directly impact the adjacent recreation site or private land, the Project Silviculturist and Presale Forester will coordinate layout and prescriptive parameters with the recreation staff, fuels specialist, and private land owners (if they are interested).	SILV, SP, RS,FS	Pre Harvest Activities
Preserve TES Plant Populations and Their Habitats	Protect occupied howellia ponds located near haul routes and in treatment units. No vegetation management activities may be conducted within 300 feet of occupied howellia ponds. If ground disturbing BMP-related activities occur within 300 feet to the north and south of these ponds, natural filtration zones, sediment retention structures, or straw bales would be applied to ensure limited sediment deposition into these ponds. See attached table for occupied pond label and location, and see Project File Exhibit J-84 for specific locations of ponds.	SILV, SA, TP, SP	Pre & Post Sale & During Harvest Activities

TABLE 2- 16 MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA.

OBJECTIVE	TASK	RESPONSIBILITY	DUE DATE
Preserve TES Plant Populations and Their Habitats	Protect unoccupied howellia ponds located near haul routes and in treatment units. No vegetation management activities may be conducted within 300 feet of unoccupied howellia ponds. If ground-disturbing BMP activities occur in the vicinity of these ponds, natural filtration zones, sediment retention structures, or straw bales would be applied to ensure limited sediment deposition into these ponds. See attached table for occupied pond label and location, and see Project File Exhibit J-86 for specific locations of ponds.	SP, SA, BT, ENG	Pre & Post Sale & During Harvest Activities
Preserve TES Plant Populations and Their Habitats	Howell's gumweed occurs in Units 34-37 along Highway 83. Common camas occurs in Units 2, 14, 61, 57, 219 . Adder's tongue occurs adjacent to Units 51 and 215. Sites will be flagged by the Forest Botanist or certified botany technicians ahead of pre-sale prior to implementation to be avoided by equipment and other disturbance.	SP, SA, BT,	Pre & Post Sale & During Harvest Activities
Preserve TES Plant Populations and Their Habitats	Several wetlands and ponds support sensitive species in the project area. See Project Exhibit J-8 for species information. Avoid all wetlands with all ground-disturbing activities, including lakes, ponds, marshes, fens, and streams. Establish buffers around wetlands – 150 feet for areas greater than 1 acre and 50 feet for areas less than 1 acre. Buffers should begin where riparian vegetation ends.	SP, SA, BT,	Pre & Post Sale & During Harvest Activities
Preserve TES Plant Populations and Their Habitats	If unknown populations of sensitive plants are found during project implementation, they will be evaluated and protected as necessary to retain population viability. A contract clause would incorporate this into any timber sale contract and would specify that the contract would be modified to protect these plants if located.	SILV, SP, TP, SP	Pre & Post Sale & During Harvest Activities
Control Spread and Reduce Potential spread of Noxious Weeds	Re-establish vegetation on bare ground created by road decommissioning or timber harvest activity. Seed landings, decommissioned roads, and roadsides with soil disturbance with a Montana-Certified grass ground cover (seed mix of native plants will be specified by the Forest Botanist), as soon as feasible after disturbance to provide for site protection until native species are established.	SA, BT, DRC	Post-Sale
Control Spread and Reduce Potential spread of Noxious Weeds	Equipment use associated with timber harvest and road maintenance (excluding pickups and trucks used to remove forest products) would be power scrubbed or steam cleaned on the undercarriage and chassis before transport to the project area. This cleaning shall remove all soil, plant parts, seeds, vegetative matter, or other debris that could contain or hold seeds. All subsequent entries of equipment to the project area shall be treated in the same manner as the initial entry. "Off-road equipment" includes all logging and construction machinery, except for log trucks, chip vans, service vehicles, water trucks, pickup trucks, cars, and similar vehicles. Contractors will be required to adhere to C6.351#- Washing Equipment, or similar contract provision which specifies the above washing criteria.	SA, TP	Pre-Harvest
Control Spread and Reduce Potential spread of Noxious Weeds	Spray weeds along designated Forest Road haul routes (prism) and disturbed areas. Existing roads within the project boundary would be identified for noxious weed treatment. Specific roads and mileage to be treated would be prepared in consultation with the Forest Weeds Coordinator. Road prism is the road and associated toe of the fill to the top of the cut slope, including the running surface and turnouts. However, when a contiguous patch of weeds extends beyond the road prism, it shall be treated via force account or other means. Spraying of appropriate herbicides would occur pre- and post-haul, during the periods from June 1 to July 15 or September 1 to September 30. Pre- and post-haul treatment shall be the responsibility of the contractor and specified in contract clause C6.27#- Noxious Weed Treatment. Roads would be monitored after initial treatment, and future treatments would be the responsibility of the Forest. Treatment of invasive plants would be consistent with the strategy outlined in the Noxious and Invasive Weed Control Environmental Assessment (March 2001).	NWM	Post-Sale
Control Spread and Reduce Potential spread of Noxious Weeds	When the use of a temporary road is no longer needed for the project, the first 100 feet where the temporary road or skid trail meets a traveled road should be more heavily brushed and blocked with large woody debris to discourage unauthorized entry and any resulting spread of weeds.	SA, TP	Post-Sale

TABLE 2- 16 MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA.

OBJECTIVE	TASK	RESPONSIBILITY	DUE DATE
Control Spread and Reduce Potential spread of Noxious Weeds	The Noxious Weeds Manager or Forest Botanist will, if necessary, provide noxious weed material to sale administrators and contractors identifying the Forest's target species and recommended control measures.	NWM, BT	Post-Sale
Protect Heritage Resources	Modify contractual requirements to provide for protection of heritage resources and modify the contract to avoid impacts to heritage resource if cultural resources are discovered during ground disturbing activities.	SA, ARCH, SP	Pre & Post Sale, During Harvest Activities
Reduce Immediate Foreground View Effects to Scenery Resources	Units 32, 33, 34, 36, 37, 43, 44, 57, 58, 61, 64, 65, 66, 67, 212, 218 - No more than 12 ton per acre of slash (favoring coarse material) would remain within 150' of road (Highway 83, Lindberg Lake Road and Lindbergh Lake Campground campsites). Slash, root wads, and other debris will be removed, buried, burned, chipped or lopped to a height of 2 feet or less. - Maintain 8" or less stumps (flush cut if feasible) within 150' of road (Highway 83, Lindberg Lake Road and Lindbergh Lake Campground campsites). - Mask any boundary or leave tree marking that is clearly visible from sensitive viewing locations (Highway 83, Lindberg Lake Road and Lindbergh Lake Campground campsites). It would generally not be necessary to extend this treatment further than about 150 feet from the viewpoints. Other options to mitigate for this visual impact include using Cut Tree Marking or other methods of designating leave trees - for example using spacing clauses in a stewardship contract, or using removable "tags" to designate leave or boundary trees. - Site landing offset from road to reduce visual impact if feasible. Do not locate landings immediately adjacent to the road unless limited by terrain. Extend short "jump up" road spurs into unit to landings, with vegetative screening between road and landing location left where possible. - Landing clean up should be more thorough than may ordinarily occur, specifically the burning of the debris in landing piles should be nearly complete, with repiling/reburning occurring if it burned poorly the first time and left unsightly "bones". Slash piles visible from roadside shall be removed or burned upon unit completion. Where new access roads and skid trails meet a primary travel route or trail, they should intersect at a right angle and, given the physical limitations of expected truck traffic, should curve to the extent feasible after the junction to minimize the length of route seen from the primary travel route or trail.	SP, SA, LA	Pre-Sale
	Units 66 and 67 All slash shall be removed within 50' of campsites.	SP, SA, LA	Pre-Sale
	Units 67, 68, 73, 74 All slash shall be removed from trails (Lindbergh Lake Campground and Glacier Slough Trail #481).	SP, SA, LA	Pre-Sale
	Units 73 and 74 Maintain 8" or less stumps (flush cut if feasible) within 50' of trail (Glacier Slough Trail #481). Where new access roads and skid trails meet a primary travel route or trail, they should intersect at a right angle and, given the physical limitations of expected truck traffic, should curve to the extent feasible after the junction to minimize the length of route seen from the primary travel route or trail.	SP, SA, LA	Pre-Sale
	Units 32, 33, 34, 36, and 37 As seen from Highway 83, along edge of unit apply transition zones that would be left along north and south edge of unit where tree retention would be modified to create a more gradual visual transition of the treated stand to the adjacent stand and soften unit edges. This may mean progressively decreasing the leave tree density in this zone	SP, SA, LA	Pre-Sale

TABLE 2- 16 MANAGEMENT REQUIREMENTS AND DESIGN CRITERIA.

OBJECTIVE	TASK	RESPONSIBILITY	DUE DATE
	(such as if next to an existing opening) or progressively increasing the leave tree density in this zone (such as if next to a dense uncut forest).		
*Reduce Middle ground and Foreground Views Effects to Scenery Resources	Units 83, 84, 85, 86, and 87 To reduce the visual contrast of skyline corridors align corridors so they are less visible, where feasible designate skyline corridors after felling trees (avoiding regular spaced widths between corridors) and/or, and/or avoid skyline corridors on alignment perpendicular to sensitive view, and/or use lateral yarding capabilities. Transition zones would be left along edge of unit openings where tree retention would be modified to create a more gradual visual transition of the treated stand to the adjacent stand and soften unit edges. Progressively increasing the leave tree density in this zone for 50' to 100' along the boundary edge.	SP, SA, LA	Pre-Sale

* A Forest Service Staff Member trained in Visual Resource Management will review visual Design Criteria with Presale Forester and Sale Administrator before implementation of the project. A portion of the Design Criteria was selected from the Northern Region Scenic Resource Mitigation Menu & Design Considerations for Vegetation Treatments, March 1, 2011.

CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes general information, location, management direction, and existing conditions for the project area or analysis area. It also describes the environmental impacts of the alternatives described in Chapter 2. Information in this chapter is based on reports written by various Resource Specialists (Appendix E – List of Preparers). These more detailed reports are kept in the project file located at the Swan Lake Ranger District. Analysis in the chapter is the basis for the summary of alternative comparisons given in Chapter 2.

The affected environment and environmental consequences are combined into one chapter for continuity and ease of reading. After providing the location and the Forest Plan management direction, this chapter discusses specific resources and issues.

PROJECT AREA

The Glacier Loon Fuels Reduction and Forest Health Project Area lies within the boundaries of the Glacier Loon and Buck Holland Grizzly Bear Subunits. It extends south and west of Condon on the west side of MT Highway 83 to the south end of Lindbergh Lake. The project area is located in Missoula County in Sections 2-6 of T18N, R17W; Sections 1-3, 5-9, and 16-17 of T18N, R18W; Sections 1-4, 7-23, 26-35 of T19N, R17W; Sections 2-4, 9-15, 22-27, and 33-36 of T19N, R18W; Sections 18-19 and 29-32 of T20N, R16W; and Sections 1-2, 11-15, 22-27, and 33-36 of T20N, R17W; Swan Lake Ranger District, Flathead National Forest (See Vicinity Map 1-1).

DEFINITIONS

The following definitions should help the reader understand terms describing the analysis areas used to disclose the environmental consequences of implementing the alternatives.

PROJECT AREA

As shown on the Vicinity Map, the project area includes approximately 37,320 acres. The project area lies in mixed ownership (NFS and private lands).

ANALYSIS AREA

The analysis area is the area used for determining direct, indirect, and cumulative effects for the natural resources considered in this analysis. Note, the spatial and temporal bounds of the

analysis (affected) area used for the effects analysis have been identified and described for each natural resource area included in this analysis and may vary from resource area to resource area.

GRIZZLY BEAR SUBUNITS

The Glacier Loon Project is located in the Northern Continental Divide Grizzly Bear Ecosystem (NCDE). The NCDE has been divided into Bear Management Units (BMUs), Areas (BMAs), and Subunits. The BMU Subunits approximate the size of a female grizzly bear's home range. The Glacier Loon Project lies within several subunits. Most of the proposed treatments are in the Glacier Loon BMU Subunit. Nine proposed treatment units are on the east side of the Swan River and MT Highway 83, in the Buck Holland Grizzly Bear Subunit. These subunits were used to analyze direct, indirect, and cumulative effects to the grizzly bear. Conservation measures for the grizzly bear, including standards and guidelines, have been addressed at the subunit scale (e.g., Interagency Grizzly Bear Guidelines, Forest Plan Amendment 19, and the SVGBCA).

AFFECTED ENVIRONMENTAL ANALYSIS

The resource information provided in the Affected Environment narratives includes the effects of past actions, assessing them as part of the existing condition of the landscape. For instance, consider a hypothetical example of a past timber sale in 1979 harvesting 150 acres of forest and constructing 2 miles of new road within the Glacier Loon Project Area. The effects of the harvest and road construction, as well as the vegetation re-growth and roadbed stabilization, occurring over the past 33 years would be accounted for in several assessments of the affected environment based on the specific resource being analyzed. Using this scenario, the following are examples that consider how past actions influence the existing affected environment.

The change in forest structure from this past regeneration harvest would be displayed in the existing successional stage distribution disclosure in the Vegetation Section. Field examinations indicate this 150-acre harvest area supports a fully-stocked stand of 20-foot trees and has progressed into a mid-seral successional stage over the past 32 years. This information would be included in the acreage of mid-seral successional classification and used in disclosure of existing vegetation and wildlife habitat conditions.

The existing level of past regeneration harvest in the project area would include the 150 acres from this activity.

Stream channel surveys assessing stream conditions in the project area would reflect any remaining physical and biological effects of the past timber sale and road construction. These field classifications of existing conditions of specific streams would be disclosed in the Affected Environment Section.

The present contribution of sediment and increased stream flow from the 2 miles of road construction would also be accounted for in the calculation of existing watershed conditions as specific road segments and their construction dates are entered into the Watershed Resource Models. Likewise, any residual effects of the 150-acre harvest unit would be reflected in the existing condition model outputs based on vegetative recovery validated through field and aerial photo reconnaissance.

Field examinations of road conditions would provide additional data on residual contributions of sediment from the 2 miles of road. These effects would be incorporated into existing road condition disclosures and provide a basis for proposed BMP projects for improved drainage, if needed.

Specific past actions considered in the Glacier Loon Project are summarized in Table 3- 1 below. Project File Section U provides detailed information for these actions. A 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 1969. 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

The Environmental Consequences Section details the environmental effects that would occur for each alternative. It forms the scientific and analytical basis for the alternative comparisons presented at the end of Chapter 2. Information used to assess effects is based on the consideration of the best available science. The effects of Alternative A - No Action Alternative form a baseline against which action alternatives are evaluated. Each narrative begins with a brief explanation of how effects were analyzed and the models used for each resource. When the effects or impacts are associated with an issue, as described in Chapter 2, their relevance and connectedness with the issue are discussed and play an important role in the evaluation of alternatives.

Environmental effects can be direct, indirect, or cumulative. They can be long or short duration. Effects can be quantitative or qualitative, adverse or beneficial, actual or potential. It is important to consider timing and location of effects. Direct effects are those caused by the action and occur at the same time and place. Indirect effects are those caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). In most cases, direct and indirect effects are discussed together. Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). Therefore, the discussion of effects first considers the direct and indirect effects of each alternative and does not consider cumulative effects unless direct and indirect effects exist.

As the effects on a resource for each alternative are read, the supplemental maps should be referred to for the location of activities and area of analysis.

Discussions at the end of each resource section include a description of the Regulatory Framework associated with that resource. Environmental laws such as the NFMA, Endangered Species Act (ESA), Wilderness Act, Clean Water Act, and Clean Air Act provide the direction to the Forest Service for management of forest resources. These laws are interpreted and defined through the Code of Federal Regulations (CFR), Administrative Rules of Montana (ARM), Forest Plan) direction, FSM direction, and Forest Service policy. The Regulatory Framework associated with each resource is helpful in relating National and Forest direction to resource analysis procedures.

The cumulative effects analysis includes the additive effect of the action being considered when added to the effects of past, present, and reasonably foreseeable future actions. As past actions are already included in the affected environment, cumulative effects analysis builds upon this existing condition assessment by considering the incremental addition of direct and indirect effects of proposed, as well as present and reasonably foreseeable actions. While impacts can be differentiated by direct, indirect, and cumulative, the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time.

Detailed descriptions of foreseeable actions and Cumulative Effects Worksheets by natural resource are filed in the Glacier Loon Project File. The cumulative effects analysis for each resource area considered only those actions that would have measurable effects. Reasons as to why other actions had no effects are documented in the project file and are not elaborated on further in this chapter.

Table 3- 1 provides a summary of the actions that occurred in the Glacier Loon project area and were considered in the cumulative effects analysis for the Glacier Loon Project. Each resource

has a defined analysis area for their resource, which may be different than the project area. For these resources, additional actions outside the project area have been considered, as appropriate for each resource. Additional information such as maps and specific details such as the timing, type, location, and scale of these past, present, and future actions is also included in the project file. The effects of these activities are discussed by resource in Chapter 3 - Affected Environment and Environmental Consequences.

PAST ACTIONS

Past actions are management activities (timber harvest and prescribed burning) and events (wildfire) that occurred in the analysis area. The effects of these activities and events provide baseline conditions for the affected environment resources existing in the analysis area, which are described in Chapter 3 of this EA. Additional information, is contained in the project file for each of the resources. Records of past activities and events for the analysis area were examined from years 1910 to 2010. Activities recorded during this time are listed in Table 3- 1.

TABLE 3- 1. PAST ACTIONS CONSIDERED IN THE CUMULATIVE EFFECTS ANALYSIS.			
ACTION	DESCRIPTION	UNIT OF MEASURE	
NFS LANDS			
Fuels Management, Wildfire Suppression, and Vegetation Management Activities within the Glacier Loon Project Area	Vegetation Management (1950-2010)	Regeneration Harvest 4,538 acres	Intermediate Harvest 1,094 acres
		Uneven-Aged Harvest 187 acres	
		TSI Treatments 897 acres	
		Reforestation 2,808 acres	
		Site Preparation 3,194 acres	
		Insect Control 134 acres	
	Fuels Treatments (1950-2010)	5,154 acres	
	Wildfire Suppression 1910-2010	7,314 acres (Includes: 1953 – Herrick Run – 640 acres; 2003 – Crazy Horse – 2354 acres; & 2008 – Lindbergh Lake Fire – 44 Acres)	
Road Management/Maintenance within the Glacier Loon Project Area	Road Management/Maintenance	State Highway 3.0 miles Nature Conservancy (acquired by FS in 2013) 4.6 miles Missoula County 13.0 miles Private 17.1 miles Forest Service Special Use Permit 1.2 miles Forest Service System Roads 101.4 miles (22.3 miles open-Maintenance Level (ML) 3, 3.3 miles closed-ML 2, 75.8 miles closed-ML 1)	
Special Use Permits within the Glacier Loon Project Area	T19N R17W Sec. 4 – 423 (Weather Station) – USN RC T19N R17W Sec. 4 – 814 (Communications Use) – USN RC T19N R17W Sec. 12 – 823 (Telephone Line) – Blackfoot Telephone Coop T19N R17W Sec. 12 – 822 (Telephone Line - REA) – Blackfoot Telephone Coop T19N R17W Sec. 12 – 641(Powerline – REA) – Missoula Electric Coop T19N R17W Sec. 13 – 753 (FLPMA Permit) – Eres Una Barbara, LLC T20N R16W Sec. 29 – 822 (Telephone Line) – Blackfoot Telephone Coop T20N R16W Sec. 29 – 751 (FRTA Easement) – BN&SF RR T20N R16W Sec. 29 – 751 (FRTA Easement) – Missoula County T20N R16W Sec. 30 – 751 (FRTA Easement) – Missoula County		

TABLE 3- 1. PAST ACTIONS CONSIDERED IN THE CUMULATIVE EFFECTS ANALYSIS.

TABLE 3- 1. PAST ACTIONS CONSIDERED IN THE CUMULATIVE EFFECTS ANALYSIS.			
ACTION	DESCRIPTION	UNIT OF MEASURE	
	T19N R16W Sec. 30 – 753 FLPMA Permit – Missoula County T20N R16W Sec. 32 – 753 (FLPMA Permit) – Missoula County T20N R16W Sec. 32 – 822 (Telephone Line - REA) – Blackfoot Telephone Coop T20N R16W Sec. 32 – 823 (Telephone Line) – Blackfoot Telephone Coop T20N R16W Sec. 32 – 333 (Sign) – Virgil & Barbara Burns T20N R16W Sec. 32 – 753 (FLPMA Permit) – Robert & Ruth Korn T20N R16W Sec. 32 – 641 (Powerline – REA) – Missoula Electric Coop T20N R16W Sec. 32 – 751 (FRTA Easement) – Missoula County T29N R16W Sec. 32 – 522 (Stockpile Site) – Missoula County Public Works T20N R16W Sec. 32 – 573 (FLPMA Permit) – Debra & Tony Moors T20N R16W Sec. 32 – 741 (DOT Easement) – MT Dept. of Transportation T20N R16W Sec. 32 – 753 (FLPMA Permit) – Mark & Jodi Rittenhouse T20N R16W Sec. 32 – 753 (FLPMA Permit) – Mike Williams T20N R17W Sec. 32 – 333 (Sign) – Mike Williams T20N R16W Sec. 32 – 753 (FLPMA Permit) – Shana Lincoln T20N R16W Sec. 32 – 753 (FLPMA Permit) – Kenneth Anderson T2oN R16W Sec. 32 – 753 (FLPMA Permit) – James and Wendy Drasdo T20N R17W Sec. 25 – 751 (FRTA Easement) – Missoula County T20N R17W Sec. 26 – 751 (FRTA Easement) – Missoula County T20N R17W Sec. 23 – 822 (Telephone Line) - Blackfoot Telephone Coop. T20N R17W Sec. 23 – 823 (Fiber Optic Cable) – Blackfoot Telephone Coop T20N R17W Sec. 24 – 822 (Telephone Line) Blackfoot Telephone Coop. T20N R27W Sec. 24 – 823 (Fiber Optic Cable) – Blackfoot Telephone Coop.		
NFS Trail Management/Maintenance within the Glacier Loon Project Area	NFS Trail #351 (Crystal Lake Trail) – 0.1 miles NFS Trail #690/708 (Glacier Creek Trail) - 7.1 miles NFS Trail #742 (Glacier Creek Feeder Trail) – 0.4 mile NFS Trail #481 (Glacier Slough Trail) – 1.5 miles		
Noxious Weed Management within the Glacier Loon Project Area	Noxious Weed Spraying		
Range Permits	The Holland Creek and Barber Creek Range Allotments overlaps a small portion of the southeast corner of the project area.		
FS Land Acquisition	FS Acquisition of PCTC Lands within the Glacier Loon Project Area (LWCF Lands 1998 – 2006) (Legacy Lands 2010 - 2016)	1,729 acres 5,101 acres	
PRIVATE AND INDUSTRIAL LANDS			
Legacy (PCTC and TNC) Fuels Management, Wildfire Suppression, and Vegetation Management Activities within the Glacier Loon Project Area	Vegetation Management (1960-2016) Includes: Fredswood (TNC 2012, 154 acres) Krafty 13 (TNC non-FS land 2011/12, 173 acres)	Regeneration Harvest 3,052 acres	Intermediate Harvest 269 acres
	Fuels Treatments	26 acres	
	Wildfire Suppression (1910-2010)	2,661 acres (Includes: 1953 – Herrick Run – 140 acres & 2003 – Crazy Horse – 918 acres)	
Private Land Fuels Management, Wildfire Suppression, and Vegetation Management Activities within the Glacier Loon Project Area	Vegetation Management	Regeneration Harvest 3,040 acres	Intermediate Harvest 1,698 acres
		Uneven-Aged Harvest 479 acres	
Road Management, Maintenance, and Closures within the Glacier Loon Project Area	PCTC Roads	4.6 miles	
	Private Roads	17.1 miles	
	Private Historic Roads	0.4 miles	
Private Land Development within the Glacier Loon Project Area	Corey Villa Sites (1959) (T21N R17W Sec 36) Cougar Run (2007) (T20N R17W Sec. 25) Diamond L Bar Lakeshore No. 4 (1965) (T19N R17W Sec. 13)		

TABLE 3- 1. PAST ACTIONS CONSIDERED IN THE CUMULATIVE EFFECTS ANALYSIS.		
ACTION	DESCRIPTION	UNIT OF MEASURE
	Elk Creek Preserve (2006) (T20N R17W Sec. 25) Glacier Ridge (2007) (T20N R17W Sec. 25) Guest Ranch Road Subdivision (1998) (T20N R17W Sec. 12) HacMoore (1978) (T19N R17W Sec. 13) Remicks Swan River Tracts (1966) (T20N R17W Sec. 25) Scenic Drive Addition (T20N R16W Sec. 18)	
Conservation Easements	Conservation easements exist on the following lands within the Glacier Loon Project Area: T20N R17W Sec. 15 – Garlick T20N R16W Sec. 18, 19– Rowlands T20N R16W Sec. 31 – Holland Peak Reserve, LLC T19N R16W Sec. 5 – Holland Peak Reserve, LLC T19N R16W Sec. 5, 8, 9 – Gordon Ranch T19N R16W Sec. 6, 7 – Roth (Chugwater) R20N R17W Sec. 2 – Haasch Homestead Trust	
MONTANA STATE AND MISSOULA COUNTY		
State of Montana Timber Harvest	Vegetation Management within the Glacier Loon Project Area	No State of Montana lands lie within the Glacier Loon Project Area.
Road Management, Maintenance, and Closures within the Glacier Loon Project Area	State of Montana	3.0 miles – MT State Highway 83
	Missoula County Roads	13.0 miles
ALL FOREST LANDS (NFS, PUBLIC & TIMBER INDUSTRY) ACTIONS		
Dispersed Recreation	The area offers a variety of motorized and non-motorized year-round recreation opportunities including, hiking, cross-country skiing, mountain biking, hunting, fishing, gathering forest products, driving for pleasure, and snowmobiling. Crystal Lake (# 351), Glacier Creek (#690), Glacier Lake Feeder (#742), and Glacier Slough (#481) Trails lie within the project area.	X

PRESENT AND REASONABLY FORESEEABLE ACTIONS

Present and Reasonably Foreseeable Actions are management activities or projects planned by the Forest Service, other government agencies, or private landowners in or near the analysis area, which could occur regardless of which alternative is selected for implementation. Present and Reasonably Foreseeable Actions are activities or projects that are ongoing or will be implemented within the next 10 years, including those that would recur annually.

Present and Reasonably Foreseeable Actions are displayed in Table 3- 2.

TABLE 3- 2. PRESENT AND REASONABLY FORESEEABLE ACTIONS CONSIDERED IN THE CUMULATIVE EFFECTS ANALYSIS.			
Action	Description	Present	Reasonably Foreseeable
NATIONAL FOREST SYSTEM LANDS			
Fuels Management, Wildfire Suppression, and Vegetation	Fire Suppression Activities will occur as needed. Control of wildfires will follow Forest Plan standards for the affected Management Areas.	X	X

TABLE 3- 2. PRESENT AND REASONABLY FORESEEABLE ACTIONS CONSIDERED IN THE CUMULATIVE EFFECTS ANALYSIS.

Action	Description	Present	Reasonably Foreseeable
Management Activities within the Glacier Loon Project Area	Forest-Wide Pre-Commercial Thinning Project	No stands are proposed within the Glacier Loon Project Boundary.	
Routine Road Management	Routine road maintenance will occur as needed on roads in the Project Area; separate from any road maintenance identified in this EA. Maintenance includes road grading, gate repair/replacement, cleaning ditches and culverts, brushing, and debris removal. Additional culverts are likely to be installed as needed.	X	X
	BMP Activities		X
Special Use Permits within the Glacier Loon Project Area	T19N R17W Sec. 12 – 641 (Powerline REA) Missoula Electric Coop T19N R17W Sec. 12 – 822 (Telephone Line) – Blackfoot Telephone Coop T19N R17W Sec. 12 – 823 (Fiber Optic Cable) – Blackfoot Telephone Coop. T19N R17W Sec. 13 – 753 (FLPMA Permit) – Eres Una Barbara, LLC T19N R17W Sec. 4 – 423 (Weather Station) – USDA NRCS T19N R17W Sec. 4 – 814 (Resource Monitoring Site) USDA NRCS T20 N R16W Sec. 32 – 753 (FLPMA Road Permit) – Mike Williams T20N 16W Sec. 32 – 741 (DOT Road Easement) – MT Department of Transportation T20N R 16W Sec. 32 – 641 (Powerline, REA) – Missoula Electric Coop T20N R16W Sec. 29 – 751 (FRTA Easement) – BN&SF RR T20N R16W Sec. 29 – 751 (FRTA Easement) – Missoula County T20N R16W Sec. 29 – 822 (Telephone Line) – Blackfoot Telephone Coop T20N R16W Sec. 29 – 823 (Fiber Optic Cable) Blackfoot Telephone Coop. T20N R16W Sec. 30 – 751 (FRTA Easement) – Missoula County T20N R16W Sec. 32 – 522 (Stockpile Site) – Missoula County Public Works T20N R16W Sec. 32 – 741 (DOT Easement) – MT Dept. of Transportation T20N R16W Sec. 32 – 751 (FRTA Easement) – Missoula County T20N R16W Sec. 32 – 753 (FLPMA Permit) – James and Wendy Drasdo T20N R16W Sec. 32 – 753 (FLPMA Permit) – Kenneth Anderson T20N R16W Sec. 32 – 753 (FLPMA Permit) – Mark & Jodi Rittenhouse T20N R16W Sec. 32 – 753 (FLPMA Permit) – Mike Williams T20N R16W Sec. 32 – 753 (FLPMA Permit) – Robert & Ruth Korn T20N R16W Sec. 32 – 753 (FLPMA Permit) – Shana Lincoln T20N R16W Sec. 32 – 822 (Telephone Line - REA) – Blackfoot Telephone Coop T20N R16W Sec. 32 – 823 (Telephone Line) – Blackfoot Telephone Coop T20N R17W Sec. 23 – 822 (Telephone Line) - Blackfoot Telephone Coop. T20N R17W Sec. 23 – 823 (Fiber Optic Cable) – Blackfoot Telephone Coop T20N R17W Sec. 24 – 822 (Telephone Line) Blackfoot Telephone Coop. T20N R17W Sec. 24 – 823 (Fiber Optic Cable) – Blackfoot Telephone Coop. T20N R17W Sec. 25 – 751 (FRTA Easement) – Missoula County T20N R17W Sec. 26 – 751 (FRTA Easement) – Missoula County T20N R17W Sec. 32 – 333 (Sign) – Mike Williams T20N R17W, Sec. 36 – 751 (FRTA Road Easement) – BN&SF RR		
Noxious Weed Management within the Glacier Loon Project Area	Efforts to control infestations of noxious weeds and reduce new infestations are ongoing and would continue through the foreseeable future. Control actions may include hand spraying herbicides, hand pulling, and biological control. All activities would comply with the 2001 Flathead National Forest Noxious and Invasive Weed Control EA and DN.		
Wetland Restoration	A 2.6 acre wetland adjacent to Lindbergh Lake was historically ditched and drained to convert to a hay field. A reasonably foreseeable project involves converting the ditch back to the natural meandering stream channel and thereby restoring the wetland.		
Range Permits	The Holland Creek and Barber Creek Range Allotments overlap a small portion of the southeast corner of the project area.		
PRIVATE AND INDUSTRIAL LANDS			
Noxious Weed Management within the Glacier Loon Project Area	Efforts to Control Noxious Weeds	No herbicide use planned.	

TABLE 3- 2. PRESENT AND REASONABLY FORESEEABLE ACTIONS CONSIDERED IN THE CUMULATIVE EFFECTS ANALYSIS.			
Action	Description	Present	Reasonably Foreseeable
Private Land Development	Missoula County	Glacier Creek Meadows Subdivision (T20N R17W Sec. 1) – 18 lots on 98.36 acres ¹ Triple C Ranch LLC Subdivision (T19N, R16W, Section 6 T20N, R16W, Section 31) – 19 lots on 211 acres.	
MONTANA STATE AND MISSOULA COUNTY			
State of Montana Timber Harvest	Vegetation Management within the Glacier Loon Project Area	No Montana State lands lie within the Project Area.	
Road Management, Maintenance, and Closures within the Glacier Loon Project Area	State of Montana	3.0 miles – MT State Highway 83	
	Missoula County Roads	13.0 miles	
ALL FOREST LANDS (NFS, PUBLIC & TIMBER INDUSTRY) ACTIONS			
Dispersed Recreation within the Glacier Loon Project Area	The area offers a variety of motorized and non-motorized year-round recreation opportunities including, hiking, cross-country skiing, mountain biking, hunting, fishing, gathering forest products, driving for pleasure, and snowmobiling. Crystal Lake (# 351), Glacier Creek (#690), Glacier Lake Feeder (#742), and Glacier Slough (#481) Trails lie within the project area.	X	X

As was discussed earlier, there are additional USFS activities that have or will be occurring outside the Glacier Loon Project Area, but are located within the appropriate analysis area for individual resources. The potential effects of these activities are discussed by resource in Chapter 3 - Affected Environment and Environmental Consequences. These activities include, but are not limited to the following:

- **Beaver Creek Landscape Restoration Project:** This project lies to the south of the Glacier Loon Project Area (Sections 5, 6, 7, 8, and 18, T18N, R16W; Sections 1-23, and 27-32, T18N, R17W; Sections 1-3, 10-16, 21-27, and 35-36, T18N, R18W; Sections 7-9, 16-22, and 28-31, T19N, R16W; Sections 12-14, 23-26, 31, and 34-36, T19N, R17W; and Sections 34 and 36, T19N, R18W) and authorizes vegetation restoration activities on approximately 4,530 acres. Also authorized are 5.5 miles of temporary road, 4.5 miles of road decommissioning, 12.6 miles of roads placed in intermittent stored service, 0.15 miles of realigned road, and application of about 49.7 miles of BMPs.
- **Cold Jim Fuels Reduction and Forest Health Project.** This project lies to the north of the Glacier Loon Project Area (T22N R17W, Sections 21, 28, 29, 31-34; T21N R17W, Sections 3-10, 15-22, 27-33; T21N R18W, Sections 1-4, 8-17, 20-29, 32-36; T20N R18W, sections 1-5, 8-12, 14-15; T20N R17W, Sections 3-6). This project authorized fuels reduction and forest health restoration activities on approximately 1,155 acres of NFS lands using a combination of harvest treatments. In addition, three resource enhancement projects would be implemented to improve water quality, restore wetlands, and restore wildlife habitat. Approximately 3.1 miles of temporary road will be used to access treatment units would be constructed, Best Management Practices

¹ Subdivision Request approved at the April 27, 2011 Missoula County Commissioners Meeting.

would be applied on 21.5 miles of existing specified road and 1.9 miles of roads will be decommissioned. This project has not yet been implemented.

- Chilly James Restoration Project: This project area lies to the north of the Glacier Loon Project Area (Sections 1-3, 10-12, Protraction Block 37-40 T20N, R18W and Sections 4-9, 17 T20N, R17W and Sections 9-36, T21N, R17W and Sections 11-14, 24-25 and 36 of T21N, R18W. In Lake County, the project area includes Sections 1-4, Protraction Block 37-38 T21N, R18W and Sections 3-10, 15-22, 27-34 T21N, R17W and Sections 28-34, T22N, R17W and Sections 1-4, 35-36, T22N, R18W). This project will implement BMPs on 20.9 miles of system roads, place 4.8 miles of system roads into storage, passively decommission 14.9 miles of system roads; activity decommission 9.8 miles of system roads, decommission and recontour an estimated 2.4 miles of system road, and realign about 0.2 miles of road to mitigate inefficiencies. This project will likely be completed in 2017.
- In 2014, the Red Butte Fish Barrier project installed a fish migration barrier just upstream of the mouth of Red Butte Creek in Section 4 of T19N R17W. The barrier consists of a concrete dam approximately 6-feet high and 64-feet wide and seeks to protect a native Westslope cutthroat trout population in Red Butte Creek from non-native fish species.
- Several culverts and a portion of NFS Road #9590 are authorized for removal as watershed restoration under the Hemlock Elk DN. This project is located in upper Windfall Creek, which is outside of the Glacier Loon project area, but it is a tributary stream to Glacier Creek. This work is reasonably foreseeable but no specific date has been proposed.

THE MONTANA LEGACY PROJECT

On June 30, 2008, The Nature Conservancy (TNC) and The Trust for Public Land (TPL) announced they reached agreement to purchase approximately 310,000 acres of PCTC lands in three phases over two years culminating in December 2010. The lands in the agreement include more than 65,630 acres in the Swan Valley. By 2014, TNC had conveyed approximately 47,000 acres in the Swan Valley to the Forest Service. The Legacy Lands Acquisition included a fiber supply agreement to provide timber to PCTC for 10 years through a timber reservation that TNC and TPL placed on deeds to honor the original purchase agreement with PCTC. TNC had logged in various portions across this 65,630 acres to provide fiber to honor this agreement between 2010 and 2015. On January 5, 2016, the U.S. Forest Service received a letter announcing that the fiber supply agreement between TNC and Plum Creek had been terminated and that there were no plans for future harvest on Legacy Lands (Project File Section AA).

To meet commitments described in the fiber agreement TNC conducted a number of harvest plans in the Swan Valley. Some of these harvest plans occur in the Glacier Loon project area and some occur outside of the project area but within resource analysis areas used to describe the effects of the Glacier Loon project. Several harvest plans occurred on TNC lands before they were acquired by the Forest Service (Krafty 13 and Elk Meadow 1-6). The remaining harvest plans occurred between 2010 and 2013. Table 3- 3 provides a list of harvest plans and where they are located by resource analysis area.

TABLE 3- 3 TNC HARVEST PLAN LOCATION BY RESOURCE ANALYSIS AREA				
Harvest Plan Name	Harvest Plan Wholly or Partly Located In:			
	Glacier Loon	Grizzly Bear Units	Lynx Analysis Units	Watershed

TABLE 3- 3 TNC HARVEST PLAN LOCATION BY RESOURCE ANALYSIS AREA												
	Project Area	Glacier Grizzly Subunit	Buck Holland Subunit	Buck	Elk	Glacier	Lower Beaver	Upper Beaver	Holland	Herrick Run	Glacier Creek	Lindberg Lake
Fredswood	In	In				In	In				In	
Krafty 13	In	In			In						In	
Mac N Cheese					In	In					In	
Pickpocket					In						In	
Barber Chair			In	In								
Last Gasp				In								
Elk Meadow 1-6					In							
Elk Point				In								
Elk Meadows Revisited				In								
Beaver Highway			In			In						
Two Bears						In						

SOIL RESOURCE

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA. The effects to the soils resource is confined to the units proposed for treatment, and because these have not changed, the effects to soils has not changed. The analysis considered potential cumulative effects of updated or adjacent activities, but because these activities do not occur within the analysis area, they do not contribute to cumulative effects to the soils resource.

INTRODUCTION

The following section describes the existing condition and discusses the potential effects of the proposed Glacier Loon Fuels Reduction and Forest Health Project on the Soils Resource. Effects to the watershed resource as a whole are discussed in the Hydrology Section.

ANALYSIS AREA

SPATIAL BOUNDS

The analysis area forms the boundary for the direct, indirect, and the cumulative effects soils analysis. It consists of the proposed treatment units and temporary roads. This analysis area was selected because it is where the effects of implementing the proposed activities would occur. The effects on soils would not extend beyond the units proposed for treatment.

TEMPORAL BOUNDS

The temporal bounds for the soil resource analysis are considered to be within 10 years for short-term impacts and 50 years for long-term impacts.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Forest Service Manual Section 2550 and the Region 1 Supplement 2500-99-1 (Project File Exhibit L-3) provide direction for maintaining soil quality. Numerous bulk density samples have been taken from the Flathead National Forest in areas that were managed for timber production. Statistical analyses of bulk density measurements establish their validity in determining the effects of management on the ground (Project File Exhibits L-4 and L-5).

A study of soil moisture trends on the Flathead National Forest (Project File Exhibit L-6) demonstrates the average annual period when soils are sufficiently dry (soil moisture less than field capacity) to reduce detrimental soil disturbance, a practice recommended in literature cited in this document. Literature has been cited that documents the effectiveness of Design Criteria proposed to reduce anticipated disturbance from the activities proposed in Glacier Loon Project. In addition, monitoring reports for activities on soils similar to those in the Glacier Loon Project

Area (Project File Exhibits L-6 through L-18) were used to estimate the effects of the proposed activities. Information gathered in field investigations was used to determine cumulative effects (Project File Exhibit L-19).

The soils in the project area are described in the updated landtype report for the Flathead National Forest (Martinson et al. 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 information was assembled from the Forest Service Activity Tracking System (FACTS).

Predicted detrimental soil disturbance from proposed temporary roads was calculated based on average clearing width. 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 assigned to the related harvest units.

MEASUREMENT INDICATORS

This section discusses the soil measurement indicators that could be affected by the proposed activities. They are:

- Soil productivity,
- Soil erosion,
- Mass failure.

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, porosity, and bulk density. Changes in these occur most often when ground-based equipment makes repeated passes over the soil (Lull 1959). These activities compact soils and, if soils are moist enough, cause rutting and puddling. All of these changes to the physical soil characteristics reduce the pore space volume and water holding capacity. These physical changes reduce infiltration rates, slow soil drainage, impede root growth and reduce plant-available water and nutrients. Physical soil disturbances also decrease gas exchange, affecting both plants and soil biota.

ORGANIC MATTER

Organic matter in its various forms contributes to soil productivity. Organic matter is particularly important for water retention, cat ion exchange, nutrient cycling, and erosion control (Page-Dumroese et al. 1991). Humus is decomposed organic matter. Duff and litter are partially decomposed leaves, needles and twigs less than 3 inches in diameter on the soil surface. Eighty-five to 90 percent of the total nutrients in most coniferous trees are contained in branches, twigs and foliage (Garrison et al. 1998). Coarse woody debris consists of woody stems greater than 3 inches in diameter (Harvey et al. 1994). This material has no effect on soil nitrogen or other

nutrients regardless of decay stage, and it can compete with vegetation for limited nutrients through immobilization (Busse 1994; Prescott et al. 2002).

SOIL BIOLOGICAL ACTIVITY

Soil organisms, including fungi and bacteria, drive the nutrient cycling process by decomposing organic matter and mineralizing nutrients for use by plants. Soil organisms depend on organic matter for the nutrients they need to carry out their life processes. Decomposed large woody debris provides 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:

Abundant organic matter provides a protective layer on the soil surface that reduces the impacts of raindrops and allows water to infiltrate; and

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 the movement of water into the soil and tend to channel and concentrate water. As a result run off (overland flow) is increased and carries soil particles with it. Natural occurrences, such as 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 wildfire 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. All mass failures triggered by human causes are classified as detrimental soil disturbance (DSD). These disturbances cause long-term changes in soil productivity that can last centuries.

AFFECTED ENVIRONMENT

In order to determine the existing condition of soils within the proposed activity areas, field investigations were conducted to determine 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 Flathead National Forest, including those within the project area, have a surface that formed in or is strongly influenced volcanic ash loess and thus are similarly classified. Since most soil quality monitoring on the Flathead National Forest has occurred on soils that have a

volcanic ash-influenced 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; first, we can estimate the amount of detrimental soil disturbance that exists from past management activities by doing transects and observing the amount of visible detrimental disturbance present and second, we can estimate the amount of detrimental soil disturbance 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 conditions for proposed treatment units followed the approach outlined in the Region 1 Soil/NEPA Technical Guide (USDA Forest Service 2011b) (Project File Exhibit L-20). When initial observations showed potential for existing detrimental disturbance to be in excess of 2 percent of the activity area, the Forest Soil Disturbance Monitoring Protocol (SDMP) (Page-Dumroese et al. 2009) was utilized. This protocol provides a method for systematically quantifying soil conditions based on visual indicators.

All SDMP surveys were conducted using an 80 percent confidence interval. The margin of error around each estimate is ± 5 percent. Sample size is determined automatically on the electronic SDMP Field Form. Soil Disturbance Monitoring Protocol field data collection spreadsheets and activity area documentation forms are located in Project File Exhibit L-19. Information gathered during field investigations is also used to determine cumulative effects.

Table 3- 4 summarizes SDMP results for mechanical treatment proposed action units with existing detrimental soil disturbance. In units with multiple past activities, these activities did not spatially overlap with one another.

TABLE 3- 4 PROPOSED MECHANICAL TREATMENT EXISTING CONDITION INFORMATION.			
UNIT	FACTS PAST ACTIVITY	FACTS PAST ENTRY YEAR	DSD %
1	No Record	No Record	2.8
2	Stand Clearcut	1970	6.0
4	No Record	No Record	2.0
5	No Record	No Record	6.7
6	No Record	No Record	1.0
12	No Record	No Record	1.9
13	No Record	No Record	1.9
14	No Record	No Record	1.9
15	Stand Clearcut	1965	5.6
	Shelterwood Establishment Cut	1966	
16	Shelterwood Establishment Cut	1966	3.3
17	Shelterwood Establishment Cut	1966	2.8
	Stand Clearcut	1967	
18	No Record	No Record	4.0
25	Stand Clearcut	1965	5.6
26	Stand Clearcut	1965	5.0
31	Stand Clearcut	1965	4.6
38	Stand Clearcut	1969	5.8
39	Stand Clearcut	1969	5.8
40	Stand Clearcut	1969	5.8
44	Sanitation (Salvage)	1985	1.0
64	No Record	No Record	5.6
72	No Record	No Record	2.8
78	No Record	No Record	1.0
79	No Record	No Record	1.0
92	No Record	No Record	1.0
200	Seed Tree Seed-Cut	1983	10.0
205	Stand Clearcut	1987	2.9

TABLE 3- 4 PROPOSED MECHANICAL TREATMENT EXISTING CONDITION INFORMATION.			
UNIT	FACTS PAST ACTIVITY	FACTS PAST ENTRY YEAR	DSD %
206	Stand Clearcut	1984	9.3
207	Liberation Cut	1984	9.3
208	Liberation Cut	1985	9.3
209	Stand Clearcut	1985	4.7
211	Seed-tree Seed Cut	1984	6.3
212	Seed-tree Seed Cut	1984	3.3
213	Stand Clearcut	1985	2.8
219	No Record	No Record	5.9

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 disturbance information. Units that had database records of past activities, but had no measured detrimental disturbance, might have recovered or were logged in a manner that minimized disturbance.

SOIL PRODUCTIVITY TRENDS

Soil quality in the Glacier Loon Area is stable to trending upward. Past activities were minimal. 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). The target downed wood for these forest types is 5 to 20 tons/acre for moderating soil productivity, while minimizing fuels hazard (Brown et al. 2003b; Graham et al. 1994).

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- 5 lists landtype map units for the proposed units (USDA NRCS 1998). The dominant soils in the project area are typified by rocky subsoil horizons, moderate erosion hazard, high infiltration rates and moderate to high relative productivity.

TABLE 3- 5 LANDTYPES OF PROPOSED TREATMENT UNITS.					
Landtype	Relative Productivity	Sensitive	Surface Erosion Hazard	Acres	Features
26D-7	Moderate	No	Moderate	1312.3	Gravelly loam surface texture
26D-8	Moderate	No	Moderate	248.2	Gravelly loam surface texture
26C-7	High	No	Moderate	110.0	Silt loam surface texture
27-7	Moderate	No	Moderate	105.5	Very gravelly silt loam surface texture
73	Moderate	No	Moderate	74.4	Gravelly silt loam surface texture
27-8	Moderate	No	Moderate	71.7	Very gravelly silt loam surface texture
28-7	Moderate	No	Moderate	46.0	Gravelly silt loam surface texture
57-8	Moderate	No	Moderate	40.08	Gravelly silt loam surface texture

TABLE 3- 5 LANDTYPES OF PROPOSED TREATMENT UNITS.

Landtype	Relative Productivity	Sensitive	Surface Erosion Hazard	Acres	Features
14-3	Moderate	Yes	Moderate	37.8	Silt loam surface texture
57-9	Moderate	No	Moderate	32.7	Gravelly silt loam surface texture
14-2	High	No	Moderate	20.7	Silt loam surface texture
10-3	Moderate	Yes	Not Rated	14.1	Loam surface texture
10-2	High	No	Not Rated	0.4	Loamy sand surface texture Moist soils

PRODUCTIVITY

Productivity of the landtypes in the Glacier Loon Area is dominantly moderate. All soils within the proposed units, with the exception of small, shallow, rocky inclusions, support forest vegetation.

SURFACE EROSION HAZARD

The dominant erosion risk for the landtypes in the Glacier Loon Area is moderate. A majority of these landtypes are characterized by 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

Sensitive soils contain an excess of soil moisture either yearlong or on a seasonal basis. Disturbance on sensitive soils can lead to loss of soil productivity. All confirmed areas of sensitive soils will require Design Criteria for protection.

- Landtype 10-3 consists of moist, poorly-drained soils formed in alluvium. Due to close proximity to streams, this landtype has high sediment delivery efficiency. Tractor operation should be carefully managed and confined to periods when soil is frozen or snow covered. Where ground-based treatments are proposed on this landtype, winter logging would be required.
- Landtypes 14-3 consists of moist, somewhat poorly drained soils formed in lacustrine deposits. This landtype 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. Where ground based-treatments are proposed on this landtype, winter logging would be required.
- Adequate and well-maintained surface drainage is necessary on all roads and skidtrails that cross landtype 14-3. Temporary roads would exhibit low strength and be subject to rutting when wet, increasing the potential for sediment.

MASS FAILURE

The dominant mass failure hazard rating for the Glacier Loon Area is low (Table 3- 6). None of the landtypes have increased potential for mass failure.

TABLE 3- 6 GLACIER LOON PROJECT MASS FAILURE HAZARD RATINGS.	
Rating	Acres
Low	2040.1

TABLE 3- 6 GLACIER LOON PROJECT MASS FAILURE HAZARD RATINGS.

Rating	Acres
Moderate	74.4

ENVIRONMENTAL CONSEQUENCES

The analysis of effects for soils assumes that all Design Criteria outlined in Chapter 2 (Table 2-16) would be effectively implemented. The analysis will show the expected amount of detrimental soil disturbance resulting from the implementation of the action alternatives. The proposed harvest systems and Design Criteria have been implemented in previous projects and monitored for effectiveness. These monitoring reports are located in the Project File (Exhibits L-7-15).

The soil analysis process is described in the soil analysis guideline document (Project File Exhibit L-22). Cumulative effects are discussed in terms of the activity areas. The FSM R-1 Supplement No. 2500-99-1 (Project File Exhibit L-3) 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.

The soil 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. At least 85 percent of an activity area must have soil that is in satisfactory condition.

It is important to consider that not all soil disturbances are detrimental. Our past monitoring of projects on the Flathead National Forest suggests that some soil disturbances create bulk density below the levels that inhibit root growth (Project File Exhibit L-4). Research has shown that increased bulk density on coarse textured soils results in increased production capacity because of associated increases in soil water holding capacity (Powers et al. 2005). 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.

ALTERNATIVE A – NO ACTION DIRECT AND INDIRECT EFFECTS

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 failure.

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

Standing dead trees would eventually fall over and contribute coarse woody debris. Fine woody debris would remain on site. Soil organisms would decompose the organic materials adding humus to the soil. Nutrients associated with this material would slowly become available for plant growth. As the tree canopies close 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 BIOLOGICAL ACTIVITY

Microorganism populations would fluctuate with the changes in microclimate and supply of organic matter on the soil surface. These changes would be in response to the changing vegetation as a result of natural events such as fire, wind throw 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. 2007b).

SOIL EROSION

Alternative A would allow any current soil erosion to decrease as vegetation returns to soils that lack plant cover. Wildfires could cause short-term increases in soil erosion. Soil erosion rates would fluctuate with natural changes in vegetation.

MASS FAILURE

Alternative A would not change the risk of mass failures within the project area. All slopes are considered stable. Mass failures would be very unlikely.

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

SOIL PRODUCTIVITY

The following paragraphs are based on our intent to maintain soil productivity by designing skid trails and landings so they occupy less than 15 percent of each activity area and to use site preparation methods that minimize soil detrimental disturbance. In addition, implementation of Design Criteria (Chapter 2, Table 2- 16) has the potential to further reduce soil impacts.

PHYSICAL SOIL CHARACTERISTICS

Tractor Harvest

These operations would result in direct and indirect effects on soil physical characteristics within the boundaries of proposed activity areas. Most detrimental effects would be concentrated on the proposed skid trails, temporary roads, and landings within or associated with timber harvest units. Minimizing the area occupied by landings and skid trails to reduce the detrimental effects on soil productivity from changes in physical soil properties is recommended in several papers (Garland 1983; Page-Dumroese 1993; Williamson et al. 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 (Project File Exhibit L-21). Designated skid trails spaced 100 feet impact 11 percent of the harvest area (Garland 1983). Post-harvest monitoring on the Flathead National Forest consistently shows less than 15 percent detrimental soil disturbance from ground-based operations that use designated skid trails (Project File Exhibits L-9 thru L-18).

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 soils are drier than field capacity (McNabb et al. 2001; Startsev et al. 2001). Rutting and puddling are most often associated with logging on wet soils (Williamson et al. 2000). Soil moisture monitoring on

the Flathead National Forest showed that soils are drier than field capacity during the summer dry period which begins in early summer and often lasts through October (Project File Exhibit L-6). Most summer logging would occur when soils are drier than field capacity. By operating on low soil moisture conditions we have the potential to reduce the amount of detrimental disturbance from skidding operations.

Skyline Harvest

These operations would result in direct and indirect effects on soil physical characteristics within the boundaries of the proposed activity areas. Effects would be less than those from ground-based operations. Skyline yarding disturbs 2 to 8 percent of the soil in a unit (McIver et al. 2000). Monitoring results on the Flathead National Forest show skyline yarding had consistent levels of detrimental disturbance less than 15 percent of an activity area.

Excavator Piling

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 Flathead National Forest 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 (Project File Exhibit L-5). In addition, when they are used on slopes less than 45 percent, displacement of the topsoil is rare.

Pre-Commercial Thinning (Mechanical Treatment)

Use of ground-based mastication equipment would have direct and indirect effects on soil physical characteristics within the boundaries of proposed activity areas. There would be potential to greatly reduce these effects by limiting equipment operation to dry soils. Soil compaction would be reduced when soils are drier than field capacity (McNabb et al. 2001; Startsev et al. 2001). Rutting and puddling are most often associated with ground-based mechanical equipment operation on wet soils (Williamson et al. 2000). Flathead National Forest soils are typically drier than field capacity between July and mid- to late-October (Project File Exhibit L-4). Mechanical mastication would occur only when soils are drier than field capacity.

Mastication treatments substantially increase woody debris (Harrod et al. 2009). This heavy slash would be effective for buffering the effect of ground-based mechanical equipment operation on mineral soil (Han 2006). A significant relationship exists between the presence of bare ground and the potential for increased compaction (Hatchett et al. 2006). Further soil protection would be expected though retention of forest floor due to absence of displacement normally associated with ground-based skidding of logs.

Monitoring on two recent mechanical mastication units on the Flathead National Forest met the Regional Soil Quality Standard from the cumulative effects of original regeneration harvest and mastication (Project File Exhibit L-18). Measured detrimental impacts in these two units were well below the regional standard. In addition, all observed detrimental impacts are attributable to the original harvest activities. Bare soil occurrence in these units ranged from 2 to 6 percent.

Pre-Commercial Thinning (Hand Treatment)

Treatment in these units would typically reduce tree densities to within a target range. Reductions would be accomplished by cutting with chainsaws. In lop and scatter treatments, cut saplings would be left on site. No detrimental soil disturbance would result from the hand cutting of saplings or the hand piling of cut saplings.

Hand pile burning could result in some minor changes to soil structure where temperatures between 220 to 460°C are generated (DeBano et al. 1998). No significant effects to soil bulk density, infiltration capacity or soil moisture content would be expected (Seymour et al. 2004).

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 tractor logging only when soils are dry, snow covered, or frozen. 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 harvest would impact less soil than tractor harvest when used on the appropriate slopes. Excavators used to treat slash minimize detrimental disturbance levels. Excavator piling was monitored on the Flathead National Forest and was determined to have caused few detrimental impacts (Project File Exhibit L-5). When excavator piling was used in combination with tractor logging systems, Region 1 Soil Quality Standards were met. Pre-commercial thinning activities would not be expected to result in any additional detrimental impacts.

ORGANIC MATTER

All proposed treatments would leave varying amounts of organic matter on the site. Woody debris would be retained at 5 to 21 tons per acre as per Forest Plan Amendment 21.

The total amount of nutrients on a site would likely be reduced where organic matter 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 organic matter 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, potentially conferring greater growth, vigor and disease resistance (Powers et al. 2005).

One must also consider that nutrients in soil and organic matter are not the only nutrients available to the forest vegetation. In logging followed by low severity broadcast burning, 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 (Jurgensen et al. 1981).

Regeneration Harvest

These treatments would remove the most live vegetation and have the potential to remove more amounts of organic matter than intermediate harvests. Whole tree yarding would remove tops and branches of harvested trees from the stand to the landing for disposal by chipping and removal. Units proposed for excavator pile burning or broadcast burning would leave nutrients associated with the slash on the site to be used by the remaining forest vegetation.

All harvest prescriptions would leave a portion of the existing stand on the site. Remaining living trees in stands would serve as potential nutrient sources on the site.

Commercial Thinning and Mechanical Pre-commercial Thinning

These treatments would leave a large portion of the existing stand on site, which would retain more organic matter on the site than regeneration harvests. Whole tree yarding would remove tops and branches of harvested trees from the stand to the landing for disposal by chipping and removal rather than piling and burning.

Pre-commercial Thinning (Mechanical Treatment)

Mastication treatments would increase woody debris and result in a net increase of forest floor carbon. These types of increases do not appear to decrease nitrogen and phosphorus availability (Ryan et al. 2009). Physical forest floor impacts would be limited to track deformation and minor amounts of displacement (less than 100 square feet).

Pre-Commercial Thinning (Hand Treatment)

Limiting hand pile size to less than 50 square feet could reduce surface organic horizon loss and limit soil heating. Pile burning, when duff moisture is 80 to 100 percent, could also reduce organic matter loss and soil heating.

The amount of nutrients lost as particulate matter would be minor. Ash from burned hand piles would contain nutrients available to emergent vegetation, but no significant increases in nitrogen and phosphorus are anticipated (Seymour et al. 2005).

Lop and scatter treatment units would be treated by hand and slash would be dispersed throughout the unit. Organic matter would not be removed, and there would be no measureable effects to the forest floor.

Excavator Piling and Burning

This post-harvest treatment would be used for mechanical site preparation work. The proposed site preparation activities would reduce organic material on sites while reducing hazardous fuel loads. A variety of organic material would remain on the site after project implementation.

Broadcast Burning

The effect of fire on soil is described as burn severity, which depends on the duration of burning and the intensity (Certini 2005). Long-duration burns tend to reach higher temperatures and penetrate deeper into soil, resulting in more soil microbial kill and consumption of soil organic matter (Certini 2005). These burns would result from burning of heavy ground fuel, such as with downed logs and large slash piles. Short duration burning could be associated with fast moving wildfire that blackens all the trees, but leaves some of the forest floor intact. This usually results in low to moderate burn severities on the ground with heat only penetrating a few centimeters (Hartford et al. 1992).

Prescribed fire activities resulting in dominantly low to moderate burn severities would best preserve soil productivity. The amount of nutrients available to plants would increase as a result of the burning. Proposed burn conditions would allow many plants to quickly return to the burned sites from unburned roots and seeds in the soil. Post-fire vegetation response would use available nutrients, reducing nutrient leaching. Native forest vegetation would remain on the site, including some of the existing trees.

The ultimate goal of this effort is to maximize the intended vegetative response while minimizing resource effects. Fire intensity represents the magnitude of produced heat. It is distinct from burn severity. Fire management personnel would design burn plans and implement burning activities to minimize the occurrence of high burn severity, while achieving burn intensities adequate to attain objectives.

Summary

All proposed units would leave live vegetation. Most 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 regeneration harvest units. The material that remains in all of the units would provide an active, microorganism-rich organic layer on the soil surface.

SOIL BIOLOGICAL ACTIVITY

Post-fire recovery of soil microorganisms occurs rapidly, frequently resulting in population levels greater than before the fire (Jurgenson et al. 1977). Less disturbed areas of soil play an important role in inoculating soil lacking or having reduced populations of soil microorganisms (Borchers et al. 1990). 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; these propagules could be freely dispersed by wind, animals and other agents (Borchers et al. 1990).

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 undisturbed 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, rutting and displacement reduce gas exchange and can potentially affect 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 Standards.

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 re-colonize 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

Where there is a risk of soil erosion, it would be minimized by implementing the following management practices:

- Reducing the area where equipment operates,
- Locating landings on relatively flat ground that can be properly drained,
- Locating skid trails on slopes less than 35 percent that have soils with a low or moderate erosion hazard,
- Using erosion control features, such as water bars, replanting, and placing slash on disturbed soils.

Sediment from the permanent transportation system could have direct effects on water quality, but is not a component of the soil quality assessment process. These effects are evaluated in the Water Resources Section.

Regeneration Harvest and Commercial Thinning

Management activities that leave organic matter on the soil surface could reduce soil erosion. The WEPP Model results estimate the potential soil erosion rate from commercial treatment units at a maximum of 0.03 tons/acre (See Table 3- 7 below) (Project File Exhibit L- 24). By way of comparison, the average annual erosion on Montana cropland in 2007 was 6.4 tons/acre/year. A ton of soil spread across an acre would be as thick as a dime.

TABLE 3- 7 POTENTIAL SOIL EROSION - COMMERCIAL TREATMENTS.		
ALTERNATIVE	POTENTIAL EROSION RATE (TONS/ACRE)	POTENTIAL TOTAL EROSION (TONS)
A	0	0
B	0.03	59.3
C	0.03	52.8
D	0.03	35.7

Pre-Commercial Thinning (Mechanical Treatments)

Any increase in overland flow from existing areas of compacted soil would likely be buffered by

existing forest floor and/or new accumulations of woody debris. Mastication treatments would not be anticipated to result in any increase of soil erosion in the proposed units. Existing areas of bare soil could benefit from additions of masticated material as effective ground cover.

Pre-Commercial Thinning (Hand Treatments)

Maintenance of infiltration rates and effective ground cover of soils is necessary to prevent erosion. The lack of compactive forces and small pile burning would not result in a significant reduction in infiltration rates over undisturbed soil. Although reductions in effective ground cover would be expected at burn pile locations, the lack of accompanying increase in overland flow and the rapid establishment of live plant cover would reduce short-term soil erosion. No long-term soil erosion is anticipated from this treatment.

Soil erosion would be unlikely to occur as a result of the pre-commercial thinning treatments. Masticated material and hand thinning slash would add cover to the soil surface, reducing the risk of erosion. Hand piling would not increase risk of soil erosion.

Broadcast Burning

The WEPP Model results indicate that the amount of soil erosion would likely be 0 tons per acre from the prescribed fire treatments. With return period analysis based on 30-year climate average, there would be a 3 percent probability there would be erosion following implementation of broadcast burns. Model results put the amount of burned area erosion in this scenario at 0 tons per acre. There is a 3 percent probability that the burned area erosion rate could be as high as 0.01 tons per acre in that same year (Project File Exhibit L-24).

Post-fire vegetative response would be rapid, regardless of burn severity, and areas that burn intensely would have sufficient organic material and vegetative response to reduce risks to soil erosion (Lentile et al. 2007). Soil erosion rates would decrease as vegetation and effective ground cover are reestablished.

MASS FAILURE

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 majority of proposed tractor harvest treatments are planned for areas with slopes less than 40 percent, which greatly reduces the risk of mass failure. The occurrence of any mass failure activity as a result of implementation of any of the proposed actions would be unlikely.

TEMPORARY ROAD CONSTRUCTION AND EXTENDED LOG SKIDDING CORRIDORS

All temporary roads and extended log skidding corridors constructed for this project would be reclaimed by any site-appropriate combination of the following:

- Removing any installed culverts or temporary bridges;
- Re-contouring the entire template to natural ground contour;
- Where re-contouring is unnecessary, scarify with excavator teeth to a depth sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 and 12 inches);
- Seeding with the native plant mix as specified by the Forest Botanist;
- Placing woody material on the template;
- Planting native shrubs/trees to augment natural vegetation.

These restoration activities would not ameliorate the soil damage immediately, but they would improve soil conditions compared to the disturbance. The establishment of vegetation and associated additions of organic matter would encourage recovery. Re-contouring would provide a suitable seed bed for native forest vegetation. These conditions would likely accelerate the recovery of the soil productivity.

Erosion would be expected from temporary road and extended log skidding corridor construction where native surfaces are exposed to rainfall impact and overland flow. Some areas would likely have short-term increases of soil erosion above 2 tons/acre/year. Erosion rates would decrease as roads are reclaimed immediately following use.

The WEPP Model results estimate the potential amount of soil erosion from these uses (Table 3-8) at 1.9 tons/acre/year over the 3-year sale contract period. These figures represent total erosion from all segments for the anticipated duration of use in all action alternatives (Project File Exhibit L-24).

TABLE 3- 8 POTENTIAL SOIL EROSION - TEMPORARY ROADS AND EXTENDED SKID CORRIDORS.			
ALTERNATIVE	POTENTIAL EROSION RATE (TONS/ACRE/YEAR)	DISTURBANCE ACRES	POTENTIAL TOTAL EROSION (TONS)
A	0	0	0
B	0.08	22.8	56.2
C	0.08	21.3	51.0
D	0.07	14.4	28.2

SYSTEM ROAD DECOMMISSIONING

The project proposes to decommission up to 8.4 miles of road, comprised of up to 3.9 miles of full recontouring, and up to 4.5 miles of lower-level closures ranging from blockage and abandonment to removal of culverts and installation of water bars. On recontoured roads, signs of hydrologic recovery would be expected within 10 to 30 years, while soil biological function would steadily return with accelerated recovery after a forest floor forms in 30 to 70 years. Passive restoration efforts would not result in any measureable improvements in the current level of soil productivity (Alternatives A and B). The lack of any significant efforts to address physical soil impairment on these segments would result in persistence of physical soil impacts in excess of 70 years.

The WEPP Model results estimate the most significant potential for soil erosion from the proposed full recontouring would occur during the first 2 years following implementation (Table 3-9). Predicted amounts drop to 0.01 to 0.02 tons/acre 2 years post-treatment and to 0 tons/acre 5 years post-treatment (Project File Exhibit L-24).

TABLE 3- 9 POTENTIAL SOIL EROSION - RECONTOURED ROAD SEGMENTS FIRST 2 YEARS.			
ALTERNATIVE	POTENTIAL EROSION RATE (TONS/ACRE/YEAR)	DISTURBANCE ACRES	POTENTIAL TOTAL EROSION (TONS)
A	0	0	0
B	0	0	0
C	0.12-0.16	11.6	3.5
D	0.12-0.16	11.6	3.5

ALTERNATIVES A, B, C, AND D CUMULATIVE EFFECTS

The risks of cumulative effects were assessed within each proposed activity area. Cumulative effects consist of the impacts from all past, present, future, and proposed activities overlapping in time and space with the Glacier Loon Project Area. Units proposed for mechanical treatment were reviewed on the ground to quantify the effects from past activities and determine if existing levels of detrimental disturbance exceed the Region 1 Soil Quality Standards.

The estimated cumulative effects for each activity area from implementation of an action alternative are displayed in Table 3- 10. These predicted cumulative detrimental soil disturbance values are based on implementation of all required Design Criteria, most notably and the required use of winter harvest in several units due to existing disturbance, temporary road construction, or sensitive soils. See associated Design Criteria for the Soil Resource in Chapter 2 (Table 2- 16).

TABLE 3- 10 CUMULATIVE EFFECTS SUMMARY.										
ACTIVITY AREA	EXISTING CONDITION DSD %	POTENTIAL DSD % INCREASE						CUMULATIVE DSD %		
		MANAGEMENT ACTIVITIES			TEMPORARY ROADS					
	ALT B	ALT C	ALT D	ALT B	ALT C	ALT D	ALT B	ALT C	ALT D	
1	2.8	6.0	6.0	-	0.0	0.0	-	8.8	8.8	-
2	6.0	2.0	2.0	2.0	4.6	4.6	4.6	12.6	12.6	12.6
3	0.0	10.0	10.0	10.0	2.8	2.8	2.8	12.8	12.8	12.8
4	2.0	6.0	6.0	6.0	2.8	2.8	2.8	10.8	10.8	10.8
5	6.7	4.0	4.0	4.0	2.8	2.8	2.8	13.5	13.5	13.5
6	1.0	10.0	10.0	10.0	3.4	3.4	3.4	14.4	14.4	14.4
7	0.0	10.0	10.0	10.0	2.8	2.8	2.8	12.8	12.8	12.8
8	0.0	10.0	10.0	10.0	2.8	2.8	2.8	12.8	12.8	12.8
9	0.0	10.0	10.0	10.0	3.5	3.5	3.5	13.5	13.5	13.5
10	0.0	6.0	6.0	6.0	5.8	5.8	5.8	11.8	11.8	11.8
11	0.0	6.0	6.0	-	7.4	7.4	-	13.4	13.4	-
12	1.9	6.0	6.0	6.0	0.0	0.0	2.5	7.9	7.9	10.4
13	1.9	6.0	6.0	6.0	1.1	0.8	2.5	9.0	8.7	10.4
14	1.9	6.0	-	6.0	0.8	-	3.1	8.7	-	11.0
15	5.6	6.0	6.0	-	1.3	1.3	-	12.9	12.9	-
16	3.3	8.0	8.0	-	1.3	1.3	-	12.6	12.6	-
17	2.8	10.0	10.0	6.0	1.3	1.3	4.4	14.1	14.1	13.2
18	4.0	6.0	6.0	-	2.8	2.8	-	12.8	12.8	-
19	0.0	10.0	10.0	10.0	0.0	0.0	0.0	10.0	10.0	10.0
20	0.0	10.0	10.0	6.0	2.9	2.9	4.5	12.9	12.9	10.5
21	0.0	10.0	-	-	2.9	-	-	12.9	-	-
22	0.0	10.0	10.0	6.0	2.9	2.9	4.5	12.9	12.9	10.5
23	0.0	8.0	8.0	-	2.9	2.9	-	10.9	10.9	-
24	0.0	10.0	10.0	10.0	0.9	0.9	0.9	10.9	10.9	10.9
25	5.6	6.0	6.0	6.0	0.9	0.9	0.9	12.5	12.5	12.5
26	5.0	6.0	6.0	6.0	2.6	2.6	2.6	13.6	13.6	13.6
27	0.0	6.0	6.0	-	2.5	2.5	-	8.5	8.5	-
28	0.0	8.0	8.0	-	2.5	2.5	-	10.5	10.5	-
29	0.0	6.0	6.0	-	2.5	2.5	-	8.5	8.5	-
30	0.0	6.0	6.0	-	4.3	0.0	-	10.3	6.0	-
31	4.6	6.0	6.0	6.0	0.0	0.0	0.0	10.6	10.6	-
32	0.0	6.0	6.0	6.0	0.0	0.0	0.0	6.0	6.0	6.0
33	0.0	6.0	6.0	6.0	0.0	0.0	0.0	6.0	6.0	6.0
34	0.0	4.0	4.0	4.0	0.0	0.0	0.0	4.0	4.0	4.0
35	0.0	6.0	6.0	6.0	0.0	0.0	0.0	6.0	6.0	6.0
36	0.0	8.0	8.0	8.0	0.0	0.0	0.0	8.0	8.0	8.0
37	0.0	8.0	8.0	8.0	0.0	0.0	0.0	8.0	8.0	8.0
38	5.8	6.0	6.0	6.0	0.0	0.0	0.0	11.8	11.8	11.8
39	5.8	8.0	8.0	8.0	0.0	0.0	0.0	13.8	13.8	13.8
40	5.8	8.0	8.0	8.0	0.0	0.0	0.0	13.8	13.8	13.8
41	0.0	8.0	8.0	-	1.2	1.2	-	9.2	9.2	-
42	0.0	8.0	8.0	-	0.0	0.0	-	8.0	8.0	-
43	0.0	8.0	8.0	-	0.0	0.0	-	8.0	8.0	-
44	1.0	8.0	8.0	8.0	0.0	0.0	0.0	9.0	9.0	9.0
45	0.0	10.0	10.0	-	0.0	0.0	-	10.0	10.0	-
46	0.0	10.0	10.0	-	0.0	0.0	-	10.0	10.0	-
47	0.0	8.0	8.0	-	1.0	1.0	-	9.0	9.0	-
48	0.0	10.0	10.0	10.0	1.3	1.3	1.5	11.3	11.3	11.5
49	0.0	10.0	10.0	10.0	0.0	0.0	0.0	10.0	10.0	10.0
50	0.0	10.0	10.0	-	0.0	0.0	-	10.0	10.0	-

TABLE 3- 10 CUMULATIVE EFFECTS SUMMARY.

TABLE 3- 10 CUMULATIVE EFFECTS SUMMARY.										
ACTIVITY AREA	EXISTING CONDITION DSD %	POTENTIAL DSD % INCREASE						CUMULATIVE DSD %		
		MANAGEMENT ACTIVITIES			TEMPORARY ROADS					
		ALT B	ALT C	ALT D	ALT B	ALT C	ALT D	ALT B	ALT C	ALT D
51	0.0	10.0	10.0	-	4.3	4.3	-	14.3	14.3	-
52	0.0	10.0	10.0	10.0	2.4	3.0	2.9	12.4	13.0	12.9
53	0.0	10.0	10.0	10.0	2.4	3.0	2.9	12.4	13.0	12.9
54	0.0	6.0	6.0	-	2.4	3.0	-	8.4	9.0	-
55	0.0	10.0	10.0	-	2.4	3.0	-	12.4	13.0	-
56	0.0	6.0	6.0	-	0.0	0.0	-	6.0	6.0	-
57	0.0	10.0	10.0	10.0	0.0	0.0	0.0	10.0	10.0	10.0
58	0.0	10.0	10.0	10.0	2.4	0.0	0.0	12.4	10.0	10.0
59	0.0	6.0	10.0	10.0	5.5	3.0	2.9	11.5	13.0	12.9
60	0.0	10.0	10.0	-	2.6	2.6	-	12.6	12.6	-
61	0.0	10.0	10.0	10.0	2.6	2.6	1.6	12.6	12.6	11.6
62	0.0	10.0	10.0	-	2.6	2.6	-	12.6	12.6	-
63	0.0	10.0	10.0	10.0	3.3	3.3	1.6	13.3	13.3	11.6
64	5.6	6.0	6.0	-	0.0	0.0	-	11.6	11.6	-
65	0.0	6.0	6.0	6.0	0.0	0.0	0.0	6.0	6.0	6.0
66	0.0	8.0	8.0	8.0	0.8	0.8	0.8	8.8	8.8	8.8
67	0.0	8.0	8.0	8.0	1.1	0.0	3.2	9.1	8.0	11.2
68	0.0	8.0	8.0	8.0	1.1	0.9	0.9	9.1	8.9	8.9
69	0.0	10.0	10.0	10.0	1.1	0.9	0.9	11.1	10.9	10.9
70	0.0	10.0	10.0	-	1.1	0.9	-	11.1	10.9	-
71	0.0	6.0	6.0	-	3.9	3.9	-	9.9	9.9	-
72	2.8	10.0	10.0	-	0.0	0.0	-	12.8	12.8	-
73	0.0	8.0	8.0	8.0	0.0	0.0	0.0	8.0	8.0	8.0
74	0.0	8.0	8.0	8.0	0.0	0.0	0.0	8.0	8.0	8.0
75	0.0	8.0	8.0	8.0	0.0	0.0	0.0	8.0	8.0	8.0
76	0.0	8.0	8.0	-	0.9	0.6	-	8.9	8.6	-
77	0.0	10.0	10.0	10.0	0.0	0.0	0.0	10.0	10.0	10.0
78	1.0	6.0	6.0	6.0	0.0	0.0	0.0	7.0	7.0	7.0
79	1.0	10.0	10.0	10.0	0.0	0.0	0.0	11.0	11.0	11.0
80	0.0	8.0	8.0	-	2.9	3.0	-	10.9	11.0	-
81	0.0	10.0	10.0	10.0	2.9	2.9	0.0	12.9	12.9	10.0
82	0.0	8.0	8.0	8.0	0.0	0.0	0.0	8.0	8.0	8.0
83	0.0	8.0	-	8.0	0.0	-	0.0	8.0	-	8.0
84	0.0	8.0	-	-	3.0	-	-	11.0	-	-
85	0.0	8.0	-	-	3.0	-	-	11.0	-	-
86	0.0	8.0	-	-	0.0	-	-	8.0	-	-
87	0.0	8.0	-	-	0.0	-	-	8.0	-	-
88	0.0	10.0	10.0	10.0	0.0	0.0	0.0	10.0	10.0	10.0
89	0.0	10.0	10.0	10.0	0.0	0.5	0.5	10.0	10.5	10.5
90	0.0	10.0	10.0	10.0	2.9	2.9	2.9	12.9	12.9	12.9
92	1.0	10.0	10.0	10.0	0.0	0.0	0.0	11.0	11.0	11.0
94	0.0	10.0	10.0	10.0	0.0	0.0	0.0	10.0	10.0	10.0
200	10.0	0-1	0-1	-	0.0	0.0	-	10-11	10 - 11	-
201	0.0	0-1	0-1	-	0.0	0.0	-	0-1	0-1	-
202	0.0	0-1	0-1	-	0.0	0.0	-	0-1	0-1	-
203	0.0	0-1	0-1	-	0.0	0.0	-	0-1	0-1	-
204	0.0	0-1	0-1	-	0.0	0.0	-	0-1	0-1	-
205	2.9	0-1	0-1	0-1	0.0	0.0	0.0	2.9- 3.9	2.9- 3.9	2.9-3.9
206	9.3	0-1	0-1	0-1	0.0	0.0	0.0	9.3-10.3	9.3-10.3	9.3-10.3

TABLE 3- 10 CUMULATIVE EFFECTS SUMMARY.										
ACTIVITY AREA	EXISTING CONDITION DSD %	POTENTIAL DSD % INCREASE						CUMULATIVE DSD %		
		MANAGEMENT ACTIVITIES			TEMPORARY ROADS					
		ALT B	ALT C	ALT D	ALT B	ALT C	ALT D	ALT B	ALT C	ALT D
207	9.3	0-1	0-1	0-1	0.0	0.0	0.0	9.3-10.3	9.3-10.3	9.3-10.3
208	9.3	0-1	0-1	0-1	0.0	0.0	0.0	9.3-10.3	9.3-10.3	9.3-10.3
209	4.7	0-1	0-1	0-1	0.0	0.0	0.0	4.7-5.7	4.7-5.7	4.7-5.7
210	0.0	0-1	0-1	0-1	0.0	0.0	0.0	0-1	0 - 1	0-1
211	6.3	0-1	0-1	0-1	0.0	0.0	0.0	6.3-7.3	6.3-7.3	6.3-7.3
212	3.3	0-1	0-1	0-1	0.0	0.0	0.0	3.3-4.3	3.3-4.3	3.3-4.3
213	2.8	0-1	0-1	0-1	0.0	0.0	0.0	2.8-3.8	2.8-3.8	2.8-3.8
214	0.0	0-1	0-1	-	0.0	0.0	-	0-1	0 - 1	-
215	0.0	0-1	0-1	0-1	0.0	0.0	0.0	0-1	0 - 1	0-1
216	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
217	0.0	0-1	0-1	0-1	0.0	0.0	0.0	0-1	0 - 1	0-1
218	0.0	0-1	0-1	0-1	0.0	0.0	0.0	0-1	0 - 1	0-1
219	5.9	0-1	0-1	0-1	0.0	0.0	0.0	5.9-6.9	5.9-6.9	5.9-6.9

Table 3- 11 displays the total acres of detrimental soil disturbance 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- 11 DETRIMENTAL SOIL DISTURBANCE BY ALTERNATIVE.			
DESCRIPTION	ALTERNATIVE		
	B	C	D
Acres Detrimental Disturbance From Past Activities	20.3	19.6	12.3
Acres Detrimental Disturbance From Proposed Activities	163.2	147.5	100.0
Acres Cumulative Detrimental Disturbance	183.5	167.1	112.3

CONTRASTING EFFECTS OF PROPOSED ACTION WITH PAST ACTIONS

The estimated level of detrimental disturbance from The Glacier Loon Project is less than that associated with harvest activities that occurred earlier than 1990. During the past two decades, the level of concern for maintaining soil productivity has greatly increased. This increase has been accompanied with 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;
- Log forwarder systems;
- 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 better results.

DURATION OF EFFECTS

Displacement and erosion, the loss of topsoil, is a long-term and perhaps a permanent loss of soil productivity. However, management practices outlined in the Design Criteria would reduce the

occurrence of displacement and erosion to within the Region 1 Standards.

Compaction could last from 10 to 70 years (Gonsior 1983). Monitoring of 40 year old activities within this project area averaged between 3 and 6 percent DSD, indicating significant recovery of compacted soils has occurred.

Reductions in organic matter content would reverse quickly as vegetation is established. Organic debris accumulates on the surface and roots grow and are decomposed in the soil. These organic materials would break down and release nutrients and improve the quality of the soil by improving its structure and reducing compaction and other DSDs. 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 would have minor effects, well within the natural range of variability for wildfire. 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 et al. 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 re-vegetated 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 alternatives 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- 11. 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.

Post-implementation monitoring would be performed to determine if selected units are 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 operating conditions are adequate to minimize effects to the soil resource.

Restoration efforts would be undertaken on units where post-implementation monitoring indicates that detrimental soil disturbance for these units exceeds 15 percent. Restoration activities to improve soil conditions would include 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 et al. (1983) showed up to 39 percent improved seedling survival and growth after tilling compacted soils.

Sub-soiling would restore biological processes that are reduced by soil compaction (Dick et al. 1988). 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 would 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.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change in MA designation on approximately 221 acres. Specifically, 213 acres would change from MA 15 to MA 5 and 8 acres would change from MA 15C to MA 5 along Lindbergh Lake. The direct effects of this change are reflected in the previous action alternative effects discussions due to deferral of proposed treatments in this area.

This change would generally result in less silvicultural activities occurring as scheduling of timber harvest within MA 5 would be primarily limited to those treatments that maintain or enhance the scenic quality of the area. Timber harvest designed as such would typically be less frequent and at a lower intensity. Any future activities proposed in MA 5 would meet the Region 1 Soil Quality Standards.

REGULATORY FRAMEWORK AND CONSISTENCY

The Flathead Forest Plan Soil Resource Standards 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);
- Design or modify all management practices as necessary to protect land productivity.

The Soil and Water Conservation Practices (SWCP) Handbook (USDA Forest Service 1988) is incorporated by reference in the Forest Plan. The Handbook describes BMPs to be used in the planning and implementation of timber sales and associated activities.

The NFMA requires that Forest Service regulations implementing NFMA specify guidelines to insure that timber will be harvested from NFS lands only where "soil, slope, or other watershed conditions will not be irreversibly damaged". Region 1 Regional Soil Quality Standards identified as FSM R-1 Supplement 2500-99-01 (See Project File Exhibit L-3) were set forth to meet the direction of NFMA to manage NFS lands without permanent impairment of land productivity and to maintain or improve soil quality.

Regional guidance is available from the Region 1 FSM 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."

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VEGETATION

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA. This section has been updated to reflect that the harvest activities that have occurred on Legacy Lands have been completed. Other activities occurring adjacent to the analysis area were considered for potential cumulative effects to the forest vegetation resource, such as the Beaver Creek Project, but were determined not to have measurable cumulative effects to forest vegetation.

INTRODUCTION

This report documents the analysis and silvicultural review of forest vegetation associated with the Glacier Loon Project. The report describes the analysis area(s), the methodologies used, the affected environment, and the environmental consequences of implementing the alternatives to forest vegetation. Detailed information relative to forest vegetation which is not included in this report is located in the project file and/or individual stand files located at the Swan Lake Ranger District.

During project development, internal and external discussions revealed several issues and concerns relating to forest vegetation. These issues helped frame this forest vegetation analysis and include:

- Effects of the alternatives on present and future forest structure (particularly large trees) and composition [particularly western larch (*Larix occidentalis*) and ponderosa pine (*Pinus ponderosa*)]. Forest structure and composition also relate to forest restoration and resiliency.
- Effects of the alternatives on old growth and age class distribution.
- Effects of the alternatives on forest insects, diseases and other disturbance agents.

The effects of the alternatives on other vegetation components, such as invasive species, threatened, endangered, or sensitive plant and animal habitats, and fire and fuels, are analyzed in respective sections of the Glacier Loon EA.

ANALYSIS AREA

The scale of the analysis area was chosen to allow sufficient size and time to illustrate the potential effects of the alternatives, without those effects diminishing to unnoticeable levels. The following descriptions identify the analysis area for this project.

SPATIAL BOUNDS

The spatial boundary for this analysis is the Glacier Loon Project Area, which is largely coincident with the Glacier Loon Grizzly Bear Subunit, henceforth referred to as the analysis area. This 37,320-acre area is large enough to capture trends and patterns of forest vegetation, but not too large to have the potential effects of the 2,102 acres of proposed actions associated with this

project so small as to be negligible.

TEMPORAL BOUNDS

The temporal bounds of this analysis are designed to capture the direct, indirect, and cumulative effects of the alternatives to forest vegetation within the analysis area. Activities are planned to begin in 2017 and would likely extend through 2020. There is the possibility that operations would continue into the winter of 2020/2021. The effects of the proposed activities would likely last between 15 and 100+ years. Where intermediate silvicultural treatments are proposed, an effects time frame of 15 to 20 years is estimated. This length of time was determined by review of site index curves and forest succession data for Western Montana (Arno et al. 1985; Milner 1992), which describe height growth and stand development. After this length of time, it is believed that, in the absence of additional disturbance or treatments, natural forest succession processes would result in residual stand conditions similar to pre-treatment conditions. This is due to accumulation of surface fuels, height growth of advanced regeneration, ingrowth of shade tolerant species, expansion of residual tree crowns, and individual tree mortality. The effects of regeneration treatments would last at least as long as it takes the stands to progress through successional stages from stand initiation to a mature stand condition (estimated 100 years) (Arno et al. 1985). Some effects, such as changes in species composition and large down woody material, could last even longer. The temporal bounds of past activities for the cumulative effects analysis is limited to the 1950s by the availability of accurate data relating to forest vegetation conditions.

METHODS, DATA SOURCES, AND ASSUMPTIONS USED

This section discusses the methodologies, data sources, and assumptions used to compile this report.

METHODOLOGIES

SILVICULTURAL PRESCRIPTION AND DIAGNOSIS PROCESS

The silvicultural prescription and diagnosis process provides information with which to move the forest vegetation toward a desired condition and meet management objectives. It is a systematic process that integrates interdisciplinary resources goals and objectives and identifies silviculturally sound treatments to achieve those objectives. The process can be done at both the landscape and stand level. The FSH (2409.17) provides national and regional direction for the prescription and diagnosis process.

LANDSCAPE-LEVEL PROCESS

The landscape-level diagnosis process normally precedes the stand-level process. This helps to place stand-level analysis into context with the surrounding ecological conditions. The Flathead National Forest Guide for Watershed Analysis provides direction related to this process. The following steps are typically included in the landscape-level diagnosis process:

Step 1: Characterize the current existing condition of the landscape.

Step 2: Develop desired landscape conditions based on overall landscape characteristics, capabilities, resource objectives, and land management direction.

Step 3: Identify treatment options and alternatives that could move the landscape towards the desired condition. This is accomplished by comparing the existing condition to the desired condition.

Step 4: Develop a silvicultural prescription for the landscape that includes the generalized activities that could achieve the desired condition.

STAND-LEVEL PROCESS

As mentioned above, this process commonly follows and closely parallels the landscape-level analysis, but at a more site-specific scale. The following steps are used in the stand-level process to systematically achieve desired stand and ultimately desired landscape conditions.

Step 1: Examine and identify existing stand conditions.

Step 2: Develop desired stand conditions based on site capabilities, site characteristics, resource objectives, and land management direction.

Step 3: Compare the existing stand conditions to the desired stand conditions and consider options that will achieve the desired conditions. The following options should be considered:

- (1) No Action if the current stand conditions acceptably meet the desired condition.
- (2) Modify the existing stand through intermediate treatments (thinning, prescribed fire, or other activities which do not replace the current stand) to meet or move closer to the desired stand condition.
- (3) Replace the current stand if it cannot be reasonably modified to meet the desired stand conditions. All regeneration options should be considered including: uneven-aged, two-aged, and even-aged methods.
- (4) Stabilize or improve the existing stand if it cannot be modified or replaced (due to external conditions) to meet the desired conditions at this time. This will essentially hold the stand until replacement can be considered. Treatment options may include sanitation, salvage, or other actions.
- (5) Defer treatment because conditions external to the stand do not permit any treatment at this time, even though the stand does not currently meet the desired condition.

Step 4: Develop a detailed silvicultural prescription for each treatment area that identifies the area to be treated and the specific activities to be implemented. This step is done following the issuance of a decision by the Deciding Official.

SPATIAL ANALYSIS

Spatial analysis of the forest vegetation resource for this project was done using the ArcMap 9.3 software. Data from the Flathead National Forest Geographical Information System (GIS) library was used as the basis for the analysis. A number of project-specific GIS layers were created by Ranger District Resource Specialists.

REMOTE SENSING

The 2006 R1 VMAP product, developed by the Forest Service Region One Geospatial Services Group, was used to estimate stand conditions where existing inventory data was lacking or determined to no longer reflect current stand conditions. VMAP classifies vegetation into spatially distinct polygons with attributes related to life form, dominance type, size class, and canopy cover. VMAP data was used to summarize forest vegetation attributes within the project area.

FOREST STAND DYNAMICS MODELING

The Forest Vegetation Simulator (FVS) was used to model the forest stand dynamics associated with alternative silvicultural treatments. Specifically, Version 2.02 of the Suppose interface and the Inland Empire variant were used. Due to limitations in data, only a sample of the stands was modeled and results were extrapolated to stands with similar conditions and proposed treatments.

DATA SOURCES

LANDSCAPE-LEVEL ANALYSIS

A landscape analysis was completed in February 2004 for the Upper Swan Valley. The Upper Swan Valley Landscape Assessment (Project File Exhibit T-4) was completed by the Swan Ecosystem Center in cooperation with the US Forest Service and provides a broad view of existing and historic vegetation conditions. The Glacier Loon Project falls within the area this assessment analyzed. This assessment and its conclusions were incorporated here by reference.

Additional data was used at a finer scale to characterize the landscape associated with this project. Forest Inventory and Analysis (FIA) plot data was summarized and used to describe existing forest vegetation conditions. Across the country, FIA plots are installed at random locations on all land ownerships. These plots are monumented and re-measured over time. This provides the ability to make estimates of forest conditions over broad areas and at variable times.

Data related to historical forest vegetation conditions was derived from a variety of publications and will be referenced later in this report.

Insect and Disease Aerial Detection Surveys are conducted annually using fixed-wing aircraft. Data associated with these surveys was incorporated.

During the summer of 2003, the Crazy Horse Fire burned approximately 3,200 acres within the analysis area. In September 2004, the Swan Lake Ranger District completed the Crazy Horse III Fire Salvage Project EA (Project File Exhibit T-2). In addition, the Ranger District also completed the Hemlock Elk Fuels Reduction and Forest Health Project EA (Project File Exhibit T-3) in August 2008. The Hemlock Elk Project Area abuts the Glacier Loon Project Area to the north. These documents provide data relating to forest vegetation and have been incorporated here.

In 2010, observations of increasing mountain pine beetle activity in ponderosa pine, including large diameter trees, prompted a broad assessment of mountain pine beetle and ponderosa pine interactions within the Upper Swan Valley. General information relating to the distribution of ponderosa pine and the location of active mountain pine beetle populations helped inform this Glacier Loon forest vegetation analysis. Some areas of ponderosa pine with values at risk identified during the assessment have been incorporated into the Glacier Loon proposed action and alternatives.

STAND-LEVEL ANALYSIS

Individual stand inventory data was used in the stand-level silvicultural diagnosis process to develop alternative treatments and in the analysis of the affected environment. Stand-level data has been collected over time using Forest Service stand exam protocols. Stand exam data used in this project was collected between the years 1981 and 2011. This stand data was formerly stored in the Timber Stand Management Records System (TSMRS) and now in the Field Sampled Vegetation (FSVeg) databases. As indicated above, the VMAP product was also used to characterize forest attributes within the analysis area.

In addition to the stand exam data previously mentioned, each stand within the analysis area that provided an opportunity for management actions to meet the project objectives as described by the Forest Plan had a silvicultural walkthrough conducted in 2010 and/or 2011 by the District's Silvicultural staff and/or a contracted Silviculturist. During these walkthroughs, observations of forest vegetation conditions and the stand-level diagnosis process were documented. This information is summarized in Appendix A of the Silviculturist's Report (Project File Exhibit I-1) and hard copies of this information are on file at the Swan Lake Ranger District Office.

Stand-level data from these sources was compiled into GIS layers and analyzed spatially using the methods described above.

ASSUMPTIONS

When completing an analysis of a dynamic resource, such as forest vegetation, at this scale, some assumptions are necessary from an efficiency stand point. Assumptions were also made due to variation and interpretation of terminology and standards associated with silviculture and forest vegetation conditions. The following are some assumptions used in this analysis:

- Vegetation data used in this analysis is assumed to represent current on-the-ground conditions. Efforts were made to ensure that this assumption is true including; field verification, new stand exam data collection, aerial photo interpretation, and incorporation of remote sensing technology. At the time this report was written, no large-scale or catastrophic events were known to have occurred since the data for this project was compiled.
- GIS data used in this analysis is assumed to be accurate to within acceptable standards. This includes ownership boundaries, stand delineations, project and analysis area boundaries, etc.
- Modeling of forest stand dynamics using the methods described above gives a reasonable estimate of how stands would respond to treatment as to be able to compare alternative treatment options. Also, outputs from growth and yield modeling can be applied to “un-modeled” stands with similar conditions, existing on similar sites, and within close proximity to the modeled stands.
- Definitions of terminology related to silviculture and forest vegetation for this analysis came from The Dictionary of Forestry (Helms 1998) and/or the Forest Plan and associated amendments.
- Areas identified as “Old Growth” in this report are only those areas that meet the specifications and descriptions in Old-Growth Forest Types of the Northern Region [Green et al. 1992 (errata corrected 2011)] for the Western Montana Zone.

BEST AVAILABLE SCIENCE

An internal review of literature was conducted prior to this analysis in order to compile relevant information. Sources included recent and historic peer-reviewed publications, past Forest Service EAs, relevant MS and PhD thesis works, and contractor and Forest Service specialist reports. If contradictory information is presented through the public involvement process for this project, it will be addressed in the responses to comments section.

INCONSISTENCY BETWEEN RESOURCE EFFECTS ANALYZES

The effects of the alternatives may vary (either positively or negatively) depending on the resource area being analyzed. It is possible that this could occur even for a particular measurement indicator. It is also possible that inconsistency could arise between resource areas based on inconsistent use of terminology.

MEASUREMENT INDICATORS

Four measurement indicators were identified to evaluate the effects to forest vegetation. These were chosen because they are measurable (both qualitatively and quantitatively), are affected by silvicultural activities, are related to the project purpose and need and Forest Plan direction, and speak to the vegetation issues previously identified.

1. **Forest Structure** - This indicator will discuss the horizontal (i.e., stand density) and vertical arrangement of forest vegetative attributes. Forest structure is relevant to tree

vigor, fuel arrangement, disturbance processes, and general forest resiliency.

2. **Forest Seral Stage** - This indicator includes age class and size class distribution and has implications related to management objectives, landscape insect population dynamics, and vegetative fuel continuity.
3. **Forest Composition** - This indicator will discuss species composition within the analysis area. This is important given management direction and observed landscape trends. Species composition affects forest health and resilience and susceptibility to disturbance.
4. **Forest Insect and Disease Conditions** - This indicator will measure how the alternatives affect the extent of known insect and disease agents in the analysis area. It will also report the risk of stands within the analysis area to potential insect and disease damage (including tree damage).

AFFECTED ENVIRONMENT

This section explores and discusses the historic, existing, and desired conditions of general forest vegetation within the analysis area. This information is useful in placing the proposed actions into context.

HISTORICAL CONDITIONS

Much work has been done related to the historical forest vegetation conditions of the Swan Valley and western Montana. While this work covered broad areas, they often included portions of, and can be applied to, the analysis area. The Upper Swan Valley Landscape Assessment (Project File Exhibit T-4) includes a detailed historical analysis that is also applicable to the analysis area. Historical forest vegetation conditions provide us with an idea of what the area looked like at various points in time. However, it is important to remember they are limited by the availability and accuracy of historical information and do not necessarily identify desired current/future conditions.

HISTORIC DISTURBANCES

Disturbance relative to forest vegetation can be defined as a relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resource availability or the physical environment (Helms 1998). Observations and recent studies (Arno, Harrington, et al. 1995; Ayres 1899; Barrett 1998, 2002; Freedman et al. 1985b) indicate that fire has been the most influential natural disturbance factor following the retreat of the most recent glacial events in the Upper Swan Valley. Fire also provides us a record of its effects to forest vegetation, through fire scars and forest conditions, making it one of the most easily analyzed historical disturbances. Many other natural and human-induced disturbance factors have influenced the forest vegetation in and around the analysis area including: insects, disease, wind, floods, invasive species, residential and commercial development, transportation systems, and timber harvest. Data were available from recent studies and historical accounts to determine some of the historic disturbances related to fire and insects and diseases. Most of the anthropogenic disturbances will be discussed later in the Ownership and Management Section.

Fire

Studies have looked closely at the fire history and fire regimes in and around the analysis area. These studies combined with fire history data from historical accounts provide a picture of how fire has been a dynamic agent of change in the region's forest vegetation.

Fires were frequent in the Upper Swan Valley until the early 1900s, with the earliest fire evidence dating from about 1241 AD. Barrett (1998) reported that 1768, 1814, 1850, 1889, 1919, 1929 were important fire years in the area. A GIS dataset from the Flathead National Forest GIS library

spatially displays the approximate locations of some of the major fires in those years within the analysis area (Figure 3- 1). One study included two sampling locations within the analysis area, both in the vicinity of Lindbergh Lake. In this area, fire occurred about every 20 years (range of 6 to 50 years) between 1687 and 1919, with the last major fire occurring in 1919. The 1919 fire(s) burned approximately 25,000 acres near Lindbergh Lake and to the north. This was largely a severe fire that occurred during a significant regional drought (Barrett 2002).

Fires were the result of natural causes, such as lightning, and traditional burning by Indians (Arno et al. 1997; Ayres 1899; Barrett 1998, 2002; Barrett et al. 1982). Most Indian fires occurred in the valley grasslands and lower-elevation forests dominated by ponderosa pine, Douglas-fir (*Pseudotsuga menziesii*), and western larch. These fires were likely ignited to improve big game browse, berry production, food gathering and hunting, improved travel, communication and horse grazing (Barrett 1981).

Areas of similar fire severity, frequency, size, and pattern have a similar fire regime (Brown 2000; Long 1998). The Upper Swan Landscape Assessment defines three identified regimes in the area:

1. Frequent, low intensity non-lethal severity fire regime with 1 to 25 year intervals.
2. Less frequent and more severe mixed-severity fire regime with 25 to 75 year intervals resulting in scattered mortality.
3. Infrequent stand-replacing lethal severity fire regime with intervals greater than 75 years (SEC 2004).

Barrett (2002) identified similar fire regimes, yet further classified the mixed-severity (MS) fire regime into three distinct classes;

- MS1 with fire intervals ranging from 15 to 25 years,
- MS2 (dominant fire regime) with fire intervals ranging from 40 to 100 years, and
- MS3 high elevation sites with highly variable fire and fire intervals.

Most fires burned with low to moderate severity with the occasional severe fire creating a diverse mosaic across the landscape of mature stands that burned repeatedly interspersed with younger fire regenerated age classes. During the pre-settlement era in the Upper Swan Valley, valley bottom forests were dominated by mixed-severity fire regimes (~50 percent); low-severity fires were restricted to the driest terrain (~5 percent), and high-severity fires were largely found on steep slopes at higher elevations and moist canyon bottoms (~45 percent) (Barrett 2002). Barrett (1998) looked closely at the areas unique riparian "pothole" stands from a fire history stand point. He found that even in these areas frequent non-lethal and mixed severity fires burned within a few feet of the shoreline at intervals similar to adjacent drier sites.

Within the analysis area, several fires have burned in the relatively recent past. In 1953, the Herrick Run Fire burned approximately 780 acres on the western shore of Lindbergh Lake. This fire started near the shore and burned upslope and was primarily a high-severity fire. In the summer of 2003, the Crazy Horse Fire burned approximately 11,000 acres total with approximately 3,200 acres occurring within the analysis area. The Holland Peak Fire burned roughly 1,600 acres on the east side of the Swan Valley, four miles from the Glacier Loon Project Area in the summer of 2005. These fires are the most recent large fires in the Upper Swan Valley. In 2008, the smaller Lindbergh Lake Fire burned upslope on the west side of the lake, with 45 acres occurring at the south end of the analysis area. These most recent fires burned mosaically yet had considerable areas of high severity.

Insects and Diseases

Numerous forest insects and diseases exist within the analysis area and larger Swan Valley at endemic levels. They have been interacting with and shaping the forest vegetation in the analysis area for some time. Those that are currently present and affecting forest vegetation are discussed in the Existing Conditions Section of this report.

Historical accounts indicate that epidemic insect outbreaks have occurred in the area in the past, primarily bark beetle related. The most well-documented epidemic was an outbreak of spruce bark beetles in the Swan Valley following a large-scale wind event in 1949 (SEC 2004).

It should be noted that two major diseases currently affecting forest trees are non-native and were not historically present within the analysis area. Larch casebearer was introduced from Europe and arrived in the Swan Valley in 1968. This defoliator's population peaked in the 1970s and is declining. White pine blister rust was introduced in 1910 and has since had a dramatic effect on the forest composition within the Swan Valley. Western white pine in the mid to lower elevations and whitebark pine in the upper elevations have been significantly affected by this disease.

Other Disturbances:

Undoubtedly, other natural disturbances have occurred throughout history in the area. Most are not well documented except for the major wind event in 1949 mentioned above.

HISTORIC FOREST VEGETATION CONDITIONS

The forest vegetation conditions within the Swan Valley have been documented at various times throughout history starting at about the turn of the 20th Century. These accounts have been at varying intensities and for diverse purposes. Most accounts were to inventory the areas timber resources. More recent efforts were conducted to explore the ecology and reconstruct the historical conditions associated with the areas forests.

Composition and Structure

H.B. Ayers recorded observations of the Swan Valley in 1899 during his mission to survey the timber of the then Lewis and Clark Forest Reserve. His journals describe large expanses of the Swan Valley dominated by large trees of ponderosa pine, Douglas-fir, and western larch grown in an open canopy on the valley, benches and foothills, and denser stands of shade tolerant species on the stream bottoms and high elevations.

"The lands of the upper valley, where the rather scant covering of larch and lodgepole pine at first gives the impression of very poor soil, but upon close examination it is found that the sparseness of tree growth is largely due to frequently occurring fires which have thinned the forest." (Ayers 1899)

Figure 3- 1 illustrates the forest conditions Ayers reported within the analysis area in 1898.

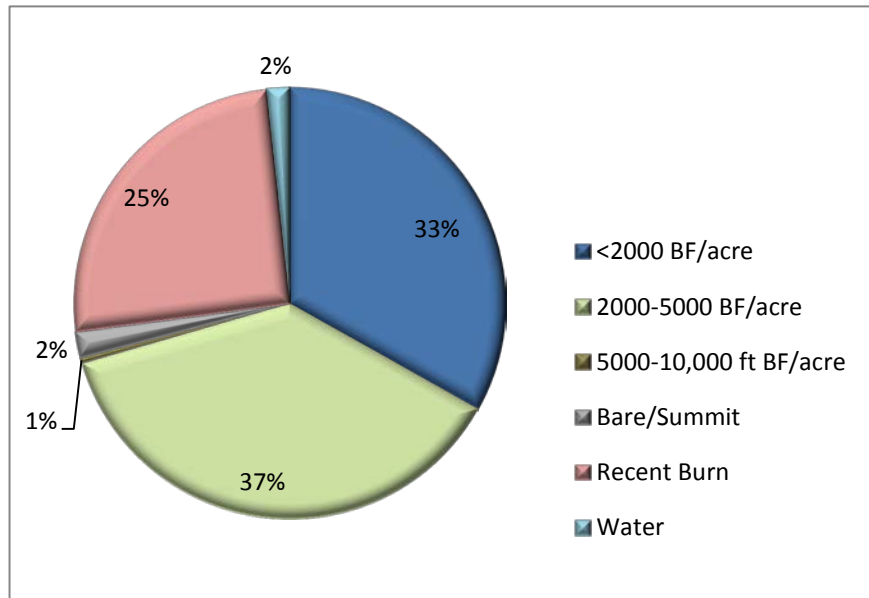


Figure 3- 1 Glacier Loon Forest Condition (Ayer 1898)

The Project Silviculturist for the Meadow Smith Project, Swan Lake Ranger District, developed a table (Vigil 2002) to equate some of Ayer's descriptions into approximate tree densities by tree size. This helps to illustrate that density varied by tree size where larger diameter stands would have fewer trees per acre (Table 3- 12).

TABLE 3- 12 PONDEROSA PINE DIAMETER, VOLUME AND DENSITY COMPARISON OF 2,000 AND 5,000 BOARD FEET PER ACRE (SCRIBNER BOARD FOOT VOLUME).

DIAMETER AND HEIGHT OF A TREE	VOLUME PER TREE (BOARD FEET)	VOLUME PER ACRE	TREES PER ACRE	BASAL AREA PER ACRE
		(BOARD FEET)	(ACRE)	(SQUARE FEET)
10 inches diameter and 50 feet tall	10	2,000	200	109
		5,000	500	273
16 inches diameter and 90 feet tall	226	2,000	9	13
		5,000	22	31
20 inches diameter and 110 feet tall	478	2,000	4	9
		5,000	10	22
30 inches diameter and 130 feet tall	1,567	2,000	1	5
		5,000	3	15

During the 1930s, a broad-scale timber inventory was conducted, which identified cover, stocking, and estimated age. These data were collected over a large area and the resolution is not as fine as today's inventories. However, these data were confirmed to be reasonable and valuable by Hart in 1989 and 1994. This inventory was digitized into a GIS shapefile, which is available in the Flathead National Forest's GIS Library. Figure 3- 2 displays a summarization of what the composition of the analysis area was as a result of the 1930s Timber Inventory.

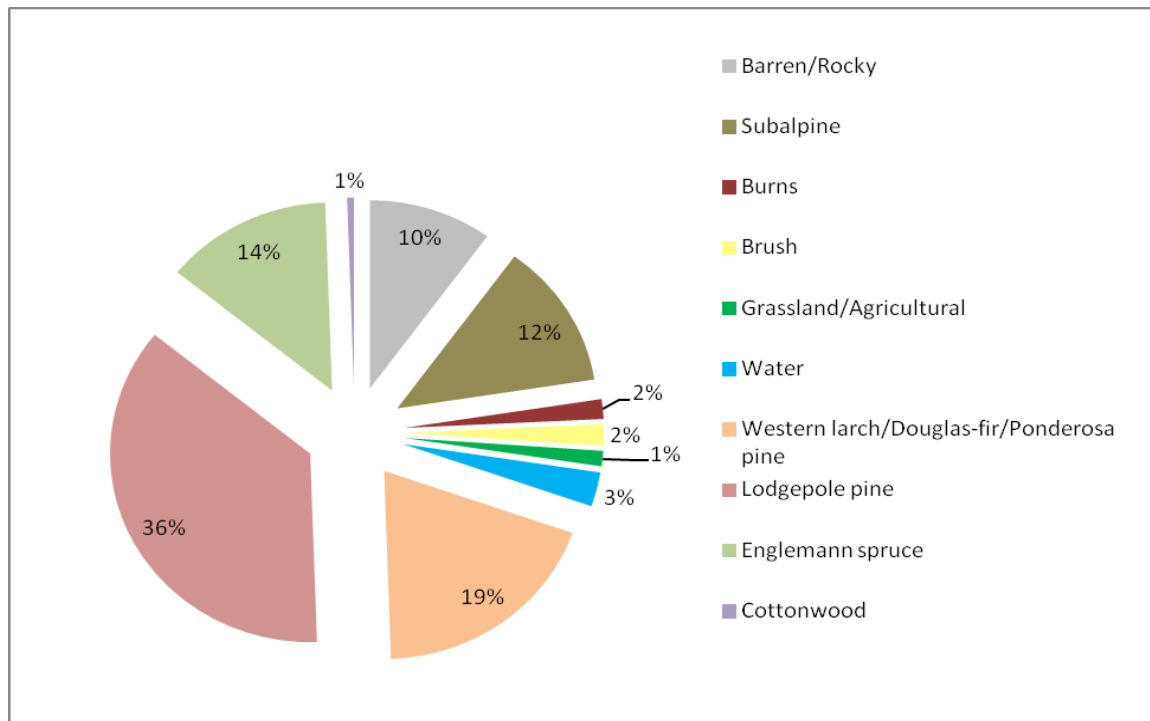


Figure 3- 2 Glacier Loon Analysis Area 1930s Timber Inventory Composition.

In 1998, the EIS for Amendment 21 of the Forest Plan analyzed the historical distribution of seral stages by forested terrestrial community for the Swan Subbasin (USDA Forest Service 1998). In addition to the timber inventories mentioned above, this analysis used data from aerial photo interpretations, computer modeling, fire history studies, and pollen and charcoal records. Again, this analysis was broad and looked at the entire Swan River Watershed. However, it can provide us with some insight into the historic distribution of terrestrial communities and the distribution of

seral stages within the Glacier Loon Analysis Area. The Amendment 21 analysis reported a historic range and 75 percent median of that range for each of three (Early, Mid, and Late) seral stages in each of three terrestrial community groups (Subalpine, Montane, and Lower Montane) within the Swan Subbasin. Table 3- 13 displays the results of that analysis and is presented to provide a possible range of historic conditions, see the Final EIS for Amendment 21 on file at the Swan Lake Ranger Station for more details.

TABLE 3- 13 HISTORICAL SERAL STAGES WITHIN THE SWAN SUBBASIN.			
SERAL STAGE	TERRESTRIAL COMMUNITY GROUPS		
	SUBALPINE	MONTANE	LOWER MONTANE
	APPROX. HISTORIC RANGE	APPROX. HISTORIC RANGE	APPROX. HISTORIC RANGE
Late Seral	8 - 10%	20 - 22%	2 - 6%
Mid Seral	7 - 10%	31 - 37%	2 - 5%
Early Seral	2 - 3%	7 - 18%	0 - 1%

In addition to the results in Table 3- 13, the Final Forest Plan EIS reported that the area historically had a relatively large representation of the Lower Montane group and a small representation non-forest area. At the time of the analysis, the Lower Montana group had been substantially decreased. This is likely due to timber harvest (targeting of fire resistant species) and fire suppression allowing fire-intolerant species typical of the Montane group to invade. One possible explanation for the increase in non-forested area is agricultural and residential development.

Again, it is important to note that the Amendment 21 analysis of an historical range of seral stages was done for the entire Swan Subbasin. Given that the Glacier Loon Analysis Area is a subset of that Subbasin and given the disturbance regime within the Glacier Loon Analysis Area, the actual distribution of seral stages could be significantly different than the Amendment 21 analysis results at any given point in time.

Ownership and Management

The Swan Valley has diverse and interesting land ownership patterns. Though some similarities exist, most of the various owners have managed their lands with different objectives.

Most of the private lands were derived from the 1862 Homestead Act. Settlement of the area was relatively slow due to primitive and difficult access. Filing of homestead claims was most active between 1916 and 1920; and by 1919, 70 homesteads had been established in the Swan Valley (SEC 2004). Private non-industrial lands are residences, pastures, or small wood lots that are primarily located in close proximity to the Swan River and MT State Highway 83.

In 1864, Congress granted lands to the Northern Pacific Railway Company as an incentive for building a transcontinental railroad. Sections of land in the Swan Valley were granted in lieu of sections already withdrawn along the planned railroad route. This action and later land exchanges have resulted in the checkerboard ownership pattern that characterized the Swan Valley (SEC 2004). These granted lands were later managed by industrial timber companies, most recently the PCTC, which accounted for approximately 64 percent of the private land in the Swan Valley in 2008 (Savage 2008). Forest management on PCTC lands focused on productive, profitable, and sustainable forestry, which has evolved with the science of forestry over time. Harvest levels on PCTC lands have fluctuated over time.

Federal land in the Swan Valley was originally part of the Lewis and Clark Forest Reserve. In 1907, the name was changed and the forest was divided into the Flathead National Forest and the Lewis and Clark National Forest. Surveys of the area were completed in the early 1900s. Early forest management consisted of small timber sales, which were purchased primarily for fuel wood, house logs, and other homestead improvements.

Fire suppression started in the early 1930s and was effective. Current increased tree densities, changed forest composition, and longer fire intervals are evidence of the effectiveness of fire

suppression (Barrett 1998).

Timber harvest on NFS lands in the Swan Valley has changed throughout time based on policy, objectives, and social values. In general, harvest activity peaked between the 1960s and 1980s (see Past Harvest Activity). Following World War II, there was improved access and increased demand for timber to fuel an expanding nation. Regeneration cutting was the preferred silvicultural system of the era.

The NFMA looked closely at forest management practices across the country and set new direction. This direction led to smaller areas of regeneration harvest, increased artificial planting, and increased intermediate harvest treatments. By the 1990s, salvage logging of wind-damaged and insect or disease-related mortality was the dominant or only harvest activity on NFS lands.

A summarization of past harvest activities across all ownerships within the analysis area will be discussed in the Existing Conditions Section of this report, as existing forest conditions are largely influenced by past activities.

EXISTING CONDITIONS

Using the methods described earlier, the existing condition of the forest vegetation within the analysis area was investigated at all scales from the landscape to individual trees. This section discusses the existing site conditions, disturbance agents, and various attributes of the forest vegetation.

SITE CONDITIONS

A site can be defined as the environment where a tree or forest stand grows (Helms 1998). As far as tree growth is concerned, the site is controlled by the total physiologically available supply of solar energy, water, carbon dioxide, and various chemical nutrients (Smith et al. 1997). Individual sites are comprised of unique combinations of the physical environment including; landform (elevation, aspect, topography), climate, and geology. Generalizations of sites can be made to characterize the landscape. The following discussion describes some of the general site conditions found in the analysis area.

Landform

The elevation, topography, and aspects within the analysis are widely varied. Elevation ranges from approximately 3,800 up to 9,000 feet in the Mission Mountains. The lower elevations are typified by undulating topography with small southwest-northeast ridges with slopes generally less than 25 percent. Higher on the slopes of the Mission Mountains, slopes generally range from 10 to 45 percent with some sheer cliffs. All directional aspects and slope shapes (concave and convex) are present (SEC 2004). In general, the highest elevations are steep east-facing slopes that transition into a broad expanse of relatively flat terrain dissected by numerous stream channels and small ridges.

Climate

The analysis area is at the eastern extent of the Pacific maritime climatic influence. Mean winter temperatures range from 15 to 25° Fahrenheit and summer temperatures average in the 80s with extreme temperatures reaching 100°+. Higher elevations average 10 to 20° cooler. Precipitation in the form of rain varies between averages 30 inches on the valley floor to over 100 inches at the highest elevations. The bulk of the precipitation usually comes from October to mid-February and again from mid-May to early July (Project File Exhibit T-4).

Geology

Overtime the geology of the analysis area has been shaped by faulting and uplift followed by numerous glacial events. Geological processes have resulted in depositional, erosional, and breakland landforms. Soils are generally acidic and include fine silts, organic soils, lakebed deposits, and glacial tills derived from mostly shale and quartzite. Valley bottom soils are most

productive, partially due to a 6 to 12-inch layer of ash deposited from the eruption of Mount Mazama (Project File Exhibit T-4) The Soils Section of this document contains detailed information related to soils.

The Flathead National Forest GIS library contains a land type coverage which spatially defines areas based on soils, geology, slope, and potential vegetation, as described in the Swan Valley Country Land Type Report (Coyner 1980).

Site Classifications

From a silvicultural perspective, it is useful to classify sites. Classification can provide information about a particular site related to susceptibility and vulnerability of trees to damaging agents, problems with competing vegetation, and responses to various silvicultural treatments (Smith et al. 1997). In forestry, sites are typically classified qualitatively by environment or vegetation or qualitatively by their potential for tree growth.

On the Flathead National Forest, the most common way of classifying sites is by habitat type. All land areas potentially capable of producing similar plant communities at climax may be described as the same habitat type. By focusing on climax plant communities, habitat types account for successional change overtime and thus provide a permanent and ecologically based system of land stratification (Pfister et al. 1977). Pfister's Forest Habitat Types of Montana is the document used to systematically classify sites into habitat types, which are named for the climax vegetation community (dominant tree species followed by dominant undergrowth species, e.g., *Abies lasiocarpa/Clintonia uniflora*)

Appendix I of Forest Plan Amendment 21 (Project File Exhibit T-11) has grouped similar habitat types into coarser potential vegetation groups. Table 3- 14 provides a generalized description of the habitat types used to define the potential vegetation groups. Amendment 21's Appendix I includes the detailed list of habitat types by potential vegetation group. Appendix A of the Silviculturist's Report (Project File Exhibit I-1) also contains detailed information related to individual stands associated with this project, including information related to habitat type.

TABLE 3- 14 HABITAT TYPES USED TO DEFINE POTENTIAL VEGETATION GROUPS.	
AMENDMENT 21 POTENTIAL VEGETATION GROUPS	GENERAL DESCRIPTION OF HABITAT TYPES
Warm Dry	Ponderosa Pine and Douglas-fir/grass types
	Most Douglas-fir types and dry grand fir types
	Douglas-fir/twinflower and most grand fir types
Warm Moist	Grand fir/queencup beadleily types
	Western redcedar and western hemlock/queencup beadleily types
Cool Moist	Subalpine fir/queencup beadleily and Menziesia types
Cold Moist	Subalpine fir/beargrass and dwarf huckleberry types
Riparian	Western redcedar/devil's club types
	Subalpine fir/bluejoint types
Cold	Subalpine fir/ grouse whortleberry and woodrush types
	Whitebark pine and alpine larch types

EXISTING FOREST VEGETATION CONDITIONS

As previously mentioned analysis of forest vegetation can be done at the landscape and stand level. Here, we will discuss various aspects of the existing condition of forest vegetation within the analysis area at multiple scales.

Landscape

The Upper Swan Valley Landscape Assessment (Project File Exhibit T-4) described the general forest conditions at a landscape scale by grouping the analysis area into what was termed "Ecosystems." The assessment identified five "Ecosystems" in the Upper Swan Valley. Three of

those forested “Ecosystems” are represented in the Glacier Loon Project Area. The following are summary descriptions of those “Ecosystems” and are described as they would be encountered traveling from east to west or upslope.

“The warm/cool-moist valley bottoms include the undulating flat lands of the valley floor with its many wetlands. This area is forested with a large diversity of conifer and deciduous tree species. Openings in the forest are numerous, largely due to human settlement. These areas contain a mix of western larch, western white pine, lodgepole pine, Douglas-fir, ponderosa pine, Engelmann spruce, grand fir and subalpine fir on the more well drained sites. The neighboring riparian zones are bordered with cottonwood, birch and aspen. Disturbances in this area included primarily low and mixed severity fire, and occasionally high severity fire. High intensity winds have also occurred at intervals and caused extensive blowdown.

“The cool-moist midslopes include a transition between the warm-moist valley bottoms to the east and the cold-steep forested uplands to the west. Tree species in this area include Douglas-fir, lodgepole pine, western larch, western white pine, Engelmann spruce, grand fir, western red cedar and subalpine fir. Disturbances in this area included a combination of low, mixed, and high severity fires. High severity winds causing blowdown have also occurred in the area.

“The cold-steep uplands form a narrow band between the barren rocky ridges and peaks on the Mission Mountains and the more heavily forested areas on the lower slopes. Vegetation is scattered and clumped across the landscape. Trees and shrubs develop in areas where there is soil. Tree species include whitebark pine, Engelmann spruce, lodgepole pine, mountain hemlock, and subalpine fir. Disturbances in this area include a combination of mixed and high severity fires. Fires tended to be less frequent, and usually occurred during dry periods.

As referenced earlier, the 1998 EIS for Forest Plan Amendment 21 analyzed historical and current distribution of seral stages by forested terrestrial community for the Swan Subbasin. Again, this analysis was done at a broad scale, but can provide us with some idea of the forested conditions in 1998. This also allows us to compare historical and 1998 conditions for the Swan Subbasin. Table 3- 15 displays the 1998 distribution of seral stages by terrestrial community group.

TABLE 3- 15 1998 DISTRIBUTION OF SERAL STAGES WITHIN THE SWAN SUBBASIN.			
SERAL STAGE	TERRESTRIAL COMMUNITY GROUPS WITHIN SWAN SUBBASIN		
	SUBALPINE	MONTANE	LOWER MONTANE
	APPROX. 1998 PERCENT	APPROX. 1998 PERCENT	APPROX. 1998 PERCENT
Late Seral	2	10	1
Mid Seral	11	52	1
Early Seral	2	11	1

Stand

Analysis of stand-level existing forest vegetation conditions was accomplished by assessing individual stand conditions using the methods described earlier, and then compiling these data and summarizing them for the analysis area. Appendix A of the Silviculturist’s Report (Project File Exhibit I-1) has detailed information for individual stands within the analysis area. The stand-level analysis and diagnosis process that was discussed in the Methods Section primarily occurred on lands identified in the Forest Plan as suitable for timber harvest. Areas outside this land base (such as wilderness) have limited stand-level information.

Summary information related to composition, seral stage distribution, and forest structure are reported below.

Composition

Composition refers to the proportion of various species with a stand or area. A variety of species

exist within the analysis area. The spatial distribution and proportions of each species is directly related to site condition and inter-species competition. As previously mentioned habitat types are commonly used to classify sites and also provide an indication of the potential and existing vegetation, both overstory and understory. A GIS layer exists for potential vegetation groups across the Flathead National Forest. Figure 3- 3 below displays the distribution of those groups as a percent of the analysis area.

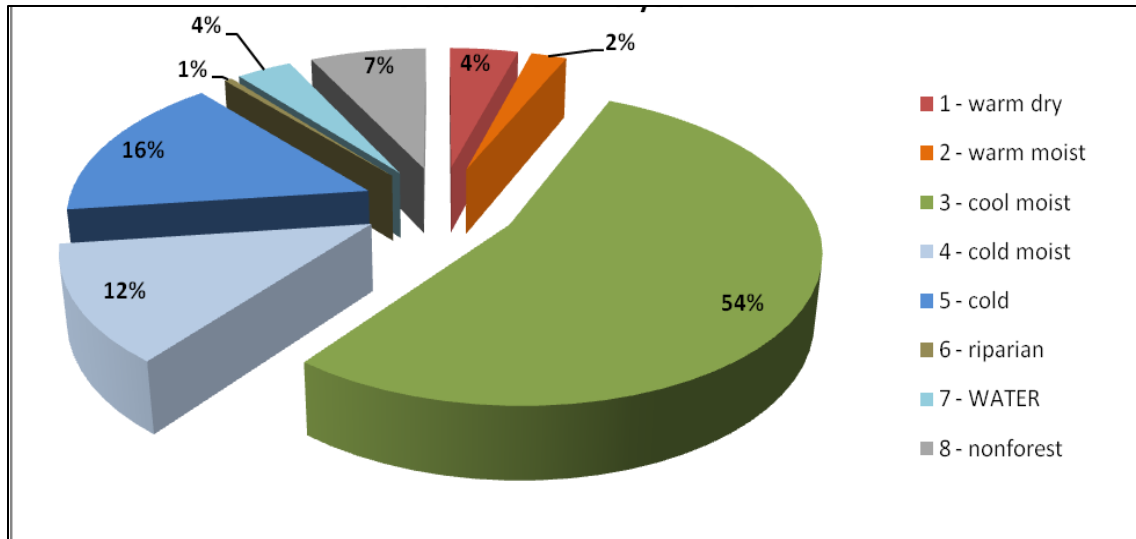


Figure 3- 3 Distribution of Potential Vegetation Groups - Glacier Loon Analysis Area.

Cover Types are used to express the dominant species within an area based on plurality (also commonly referred to as Forest Type, Dominance Type or Existing Vegetation). That is, the specie or species presently most abundant in a given area. Again, the current composition of the analysis area is the result of past disturbances, site conditions, and the competitive advantages of individual species. Cover type information for the analysis area was summarized using 2006 VMAP data. This provides a consistent data set, in terms of classification and data acquisition, for all lands within the analysis area. Characterization of the analysis area is an appropriate mid-scale application of this remote sensing derived data. Field-sampled data has been used for finer/stand-level analysis. VMAP uses the Region 1 Existing Vegetation Classification System (Barber et al. 2011) and Table 3- 16 summarizes the cover types within the analysis area using the Dominance 40 classes found in this system. The non-forested class in Table 3- 16 is an aggregate of multiple VMAP Dominance 40 classes. In addition, it should be noted that non-forested areas could include forested areas where the canopy cover of tree species is less than 10 percent, for example recently burned or regenerated areas.

TABLE 3- 16 COVER TYPES WITHIN THE GLACIER LOON ANALYSIS AREA USING THE DOMINANCE 40 CLASSES.			
VMAP DOMINANCE 40 CLASSES	GENERAL DESCRIPTION	ACRES	PERCENT OF ANALYSIS AREA
NON-FORESTED			
(HERB, SHRUB, SPVEG, WATER)	Aggregation of areas classified as dominated by herbs, shrubs, sparse vegetation and water	8,828	24
Hardwood Mix (HMIX)	Hardwood tree abundance is >40% no single species abundance is > 60%	8	0.02
Intolerant Mix (IMIX)	Shade intolerant tree species (e.g. lodgepole pine, ponderosa pine, western larch, Douglas-fir, western white pine) abundance is >50% and no single species abundance is >=40%	69	0.2
PONDEROSA PINE MIX			

TABLE 3- 16 COVER TYPES WITHIN THE GLACIER LOON ANALYSIS AREA USING THE DOMINANCE 40 CLASSES.			
VMAP DOMINANCE 40 CLASSES	GENERAL DESCRIPTION	ACRES	PERCENT OF ANALYSIS AREA
(MX-PIPO)	Ponderosa pine is the most abundance single species with at least 40% of the total tree abundance	7	0.02
WESTERN LARCH MIX			
(MX-LOAC)	Western larch is the most abundance single species with at least 40% of the total tree abundance	2,784	7
DOUGLAS-FIR MIX			
(MX-PSME)	Douglas-fir is the most abundance single species with at least 40% of the total tree abundance	3,021	8
LODGEPOLE PINE MIX			
(MX-PICO)	Lodgepole pine is the most abundance single species with at least 40% of the total tree abundance	13,009	35
ENGELMANN SPRUCE MIX			
(MX-PIEN)	Engelmann Spruce is the most abundance single species with at least 40% of the total tree abundance	3,565	9
SUBALPINE FIR MIX			
(MX-ABLA)	Subalpine fir is the most abundance single species with at least 40% of the total tree abundance	6,029	16
TOTAL		37,320	100

Seral Stage Distribution

Often forests are seen through our eyes as static entities. An example is a stand of trees we have visited many times but continues to appear unaltered. This concept could be no farther from the truth. Change is constant in forest communities. Change occurs at all scales from a seedling sprouting to a wildfire consuming tens of thousands of acres of trees. This change is multi-dimensional and also occurs at various time scales. Often the timescale of change within a forest is comparatively long, as some trees within the analysis area have existed at the same location and similar form for hundreds of years. At a stand and landscape level, this change is often associated with many of the disturbance factors previously discussed. These disturbances often result in the establishment of a new age class or cohort.

A successive change in species dominance following disturbances is referred to as succession. Ecologists have recognized a number of successional patterns within forest communities based on site characteristics and the competitiveness of species (Oliver et al. 1996). A seral stage is a temporal and intermediate stage in the process of succession (Helms 1998). Forest Plan Amendment 21 identified three seral stages. These three seral stages were defined by tree size. Tree size is a more commonly and easily measured attribute than tree age. It is believed, as in Amendment 21, that there is a correlation between tree size, successional development, and tree ages. Although this correlation does not fit well under certain circumstances, it is generally accepted given the disturbance regimes and patterns of forest communities in the Northern Rockies.

Three seral stages were identified in this analysis to illustrate distribution of successional development, and hence tree size and age. These seral stages are independent of species composition. Here again, 2006 VMAP data was used to characterize tree size distribution within the analysis area. Detailed information relating to tree size classification can be found in Barber et al. (2011). Some edits were made to the VMAP tree-size data within the Crazy Horse Fire Area to better reflect current live tree sizes. Edits were made using 2011 NAIP satellite imagery. The three seral stages used here are similar to Amendment 21 in name and how they relate to tree sizes, but differ in their classification. Of note is the fact that Amendment 21 uses the term Late Seral to describe Old Growth. However, in the Glacier Loon Analysis, Old Growth is defined by meeting the criteria of Green et al. as mentioned previously. Therefore, Late Seral in this analysis would likely contain Old Growth areas, but it also contains large tree dominated areas, which do not meet the Green et al. Old Growth definitions. A more detailed discussion of Old Growth will follow.

Table 3- 17 and Table 3- 18 display the seral stage distribution by forested cover type within the analysis area.

TABLE 3- 17 CURRENT COVER TYPE OF THE GLACIER LOON PROJECT AREA.			
SERAL STAGE	GENERAL DESCRIPTION	ACRES	PERCENT OF FOREST AREA
Early Seral	Dominant/Codominant Trees <5 inches DBH	5,945	21
Mid Seral	Dominant/Codominant 5 to 15 inches DBH	17,572	62
Late Seral	Dominant/Codominant > 15 inches DBH	4,975	17

TABLE 3- 18 COVER TYPE SUMMARY (ALL OWNERSHIPS).				
COVER TYPE	EARLY SERAL ACRES	MID SERAL ACRES	LATE SERAL ACRES	TOTAL ACRES
				% FORESTED AREA
Hardwood Mix	0	0	8	8 / 0.02%
Intolerant Mix	18	14	37	69 / 0.2%
Ponderosa pine Mix	0	7	0	7 / 0.02%
Western larch Mix	399	1805	579	2,784 / 10%
Douglas-fir Mix	472	1959	589	3,021 / 10%
Lodgepole pine Mix	2815	8551	1642	13,009 / 47%
Engelmann spruce Mix	660	1793	1112	3,565 / 12%
Subalpine fir Mix	1580	3443	1006	6,029 / 21%
TOTAL	5,945	17,573	4,975	28,492 / 100%

As Table 3- 18 illustrates, all seral stages are dominated by the lodgepole pine mix cover type. This is the largely the result of past stand-replacing fires within the analysis area. Much of the mid- and late-seral lodgepole pine became established following the 1919 and 1929 fires; while much of the early seral lodgepole pine resulted from the 2003 Crazy Horse Fire.

The distribution of cover types and seral stages across the analysis area can be described generally. Much of the low elevation valley bottom areas are dominated by the lodgepole pine mix cover type. While the majority of the higher elevation foothills and slopes of the Mission Mountains are dominated by the subalpine fir mix and Engelmann spruce mix types. Western larch and Douglas-fir dominated areas are distributed throughout the analysis area with the exception of the highest terrain. In addition, many of the non-forested areas exist at the highest elevations. In terms of seral stage (size class) distribution, patterns are less defined. Early-, mid-, and late-seral stages are scattered relatively evenly throughout the analysis area, the exception being within the Crazy Horse Fire Area, which is dominated by the early seral stage. Figures 8 and 9 graphically display these distributions in the Silviculturist Report (Project File Exhibit I-1).

Old Growth

Old growth in this report is defined by Green et al. (1992) for the Western Montana Zone. The Silviculturist's Report (Project File Exhibit I-1) Appendix B includes the minimum and associate characteristics used to make old growth determinations. Stand inventories and subsequent review by the District Silviculturist and Wildlife Biologist were conducted to confirm that no actions associated with this project are proposed within stands that meet the Green et al. definition of old growth. The Wildlife Section in this document discusses the amount, location and spatial distribution of old growth habitat within the project area.

Statistical estimates of the amount of old growth can be confidently made at large scales. Forest Inventory and Analysis data have been used to produce statistical estimates of old growth for the entire Flathead National Forest and each fifth code watershed unit. The estimate of old growth

for the forest is 11.63 percent with a 90 percent confidence interval of 9.56 to 13.77 percent. The Glacier Loon Analysis Area falls into the fifth code watershed labeled 1701021101; the estimate of old growth for this watershed unit is 9.09 percent with a 90 percent confidence interval of 0 to 20 percent (Bush et al. 2004). These results, the process, and its appropriate application documented by Czapslewski (2004) are available on the USDA Forest Service Inventory and Analysis website at <http://fsweb.r1.fs.fed.us/forest/inv/index.htm>.

Forest Structure

Forest structure describes the vertical and horizontal distribution of components of a forest. Vertical structure describes the arrangement of trees and their crowns from the forest floor to the top of the forest canopy. This attribute can be classified as either single storied (tree crowns consisting of one main canopy layer), two storied (tree crowns forming two distinct canopy layers), or multi-storied or continuous (where tree canopies occupy three or more distinct canopy layers). Horizontal structure is often referred to in terms of density. In forestry, density can be measured in many ways, but is most commonly expressed in terms of basal area, trees per acre, or canopy cover. The amount of down woody material and the number of standing dead snags are also significant element so forest structure, which will be discussed.

Numerous combinations of forest structure exist within the analysis area and vary based on species composition, seral stage, and past disturbance. In terms of vertical structure, the following conditions exist. Most of the areas dominated by lodgepole pine and/or the early seral stage for all cover types are single storied. This is primarily due to stand dynamics in the early seral stages, and the result of stand-replacing disturbances in the lodgepole pine dominated forests. Some of the more xeric areas dominated by ponderosa pine, western larch, and/or Douglas-fir also exhibit single-storied canopies. Two-storied vertical structure exists in areas where remnant overstory trees exist above a smaller cohort. These cases are most commonly the result of mixed-severity fire regimes or past seed tree and/or shelterwood harvests. Some areas exhibit this structure due to historic non-lethal fire regimes that favored single-storied stands creating a single dominant overstory, but where recent fire suppression has allowed a second canopy layer to develop in the absence of fire. Multi-storied stand structures exist in many areas and especially in high elevation areas dominated by shade-tolerant species. This structure appears to be increasing across the Swan Valley landscape due to the absence of fire and proliferation of shade-tolerant understories (Arno et al. 1997; Barrett 1998, 2002; Freedman et al. 1985b). In many cases, within stand structure contains a mosaic of these three structural conditions.

Horizontal structure is also variable across the analysis area. Many of the early-seral areas have extremely high tree densities, over 1,000 trees per acre. Density is also high in many of mid- and late-seral areas, also as result of the absence of fire and subsequent shade-tolerant ingrowth. One measure of density is canopy cover, which is the proportion of the forest floor covered by the vertical projection of tree crowns (Berglund et al. 2008). This attribute of forest vegetation is readily measured using remote sensing technology. A summary of canopy cover percentages for tree dominated areas (areas where tree canopies are greater than 10 percent of the area) within the analysis area using R1 VMAP data is displayed in Figure 3- 4.

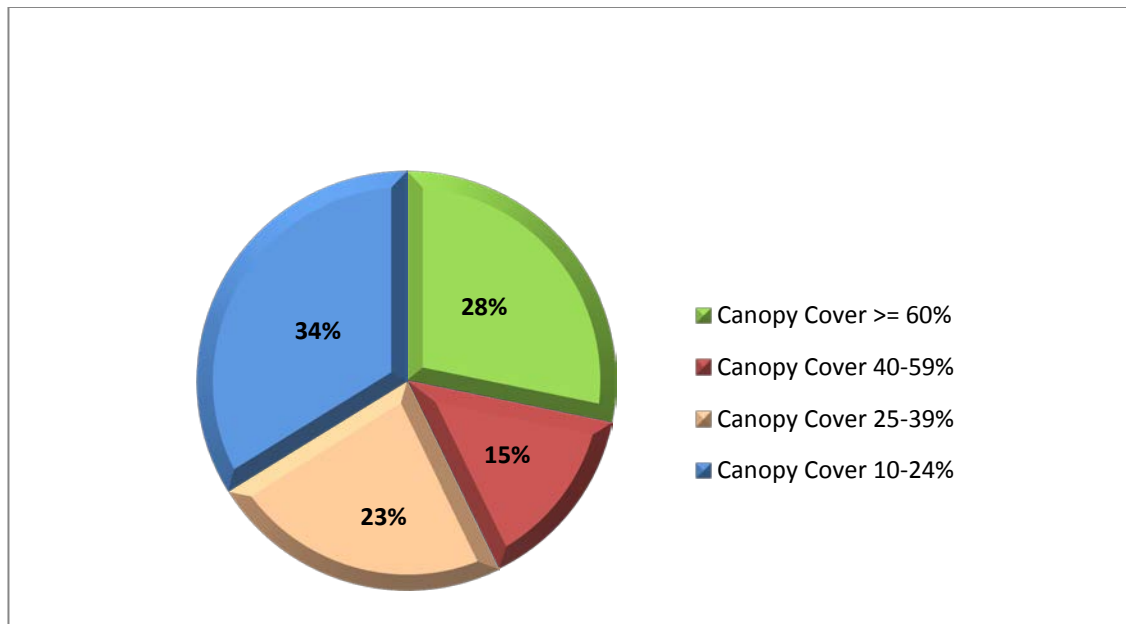


Figure 3- 4 Glacier Loon Analysis Area Canopy Cover Tree Dominated Areas.

Although highly variable, down woody material and standing dead snags exist at some level throughout most stands. Both down woody material and snags are the result of tree mortality. Tree mortality factors, such as insects, pathogens, fire, wind, and other disturbances all contribute to the pool of dead trees available as snags and eventually down woody material.

Similar to the broad estimates of old growth mentioned earlier, statistical estimates of the number of snags per acre and the amount of coarse down woody material per acre can be made analyzing FIA data at varying spatial extents. The confidence of estimates made using FIA data is higher as more data is incorporated. In this case, the Swan River Watershed was used to characterize these attributes across the landscape within which this project falls. Although this area is broader than the analysis area boundary, it allowed for the incorporation of more data and, thus, better estimates of the existing condition for snags and coarse woody material. It should be noted that these FIA data incorporate a wide range of forest conditions and sites. Table 3- 19 summarizes the estimates of standing dead snags per acre (greater than 9 inches DBH) and coarse woody material (tons/acre greater than 3 inches diameter) for the Swan River Watershed.

TABLE 3- 19 FIA SUMMARY ESTIMATES FOR THE SWAN RIVER WATERSHED (39 FIA PLOTS).			
ATTRIBUTE	ESTIMATE	LOWER 90% CONFIDENCE INTERVAL	UPPER 90% CONFIDENCE INTERVAL
Standing Dead Snags (trees per acre > 9 inches DBH)	14.2	9.1	20
Coarse Down Woody (tons per acre > 3 inches diameter)	22.5	15.2	30.7

EXISTING DISTURBANCE

Most, if not all, of the historical disturbance agents that affected the forest vegetation within the analysis area are still present today. The extent and effects of each of these agents varies through time. The following provides a snap shot in time of the existing disturbance agents observed within the analysis area. Appendix A of the Silviculturist Report (Project File Exhibit I-1) contains information related to disturbance agents observed within individual stands.

Fire

The occurrence of fires within the analysis area is well documented. District Fire Management Staff log all confirmed fire starts on the District. They also keep records related to prescribed fire operations. See the Fire and Fuels Section of this EA for detailed information related to fires in the project area.

Of recent significance were the 2003 Crazy Horse Fire and the 2008 Lindbergh Lake Fire. The Crazy Horse Fire burned approximately 3,200 acres within the analysis area and its effects to vegetation are still ongoing. The Crazy Horse III EA reported that the fire burned at three broad categories of fire severity. Sixty percent of the area burned under high fire severity (>80 percent immediate overstory tree mortality), 30 percent of the area burned with moderate severity (20 to 80 percent (average 50 percent) immediate overstory tree mortality), and 8 percent burned as low severity fire (<20 percent immediate tree mortality). In general those trees that did survive are primarily thick barked, fire resistant western larch, ponderosa pine, and/or Douglas-fir (USDA Forest Service 2004). This created a mosaic of variable stocking, age classes, and species across the fire area. However, most of the 3,200 acres within the analysis area was stand replacing.

Reforestation surveys of areas experiencing high severity fire and/or identified as having reforestation needs (whether salvage logged or not) were conducted in 2006 through 2010. In the vast majority of these areas reforestation surveys indicate that adequate natural regeneration of western larch, lodgepole and lesser Douglas-fir and Engelmann spruce is established. In those areas where surveys indicate less than ideal regeneration at present, additional surveys or artificial reforestation are planned. Of note is that significant stocking of aspen was also observed. It remains to be seen how these aspen seedlings will compete with conifer species and what the ultimate post fire aspen component will be.

Suppression efforts kept the Lindbergh Lake Fire relatively small and only approximately 45 acres burned within the analysis area. This fire started on the west shore and spread up a steep south east facing slope. Although this area is relatively steep and dry, only a portion of the fire burned severely with high tree mortality.

Insects and Diseases

Forest insects and diseases are major disturbance processes in forests of the Northern Rocky Mountains. Their effects can range from small-scale disturbances, killing individual trees; to wide spread outbreaks causing extensive tree mortality. Native forest pests have been part of our forests for millennia and function as nutrient recyclers, agents of disturbance, members of food chains, and regulators of productivity, diversity, and density (Black 2005). Aerial detection surveys, stand inventories, and silvicultural walkthroughs have identified which species are currently present and affecting the forest vegetation. The following section will identify the species present and discuss some of the characteristics associated with them.

The most recent aerial detection survey information available was conducted by USDA Forest Health and Protection Staff and was completed in 2010. Figure 12 in the Silviculturist Report (Project File Exhibit I-1) shows the digitized results of the 2008, 2009, and 2010 surveys within the analysis area. Aerial detection surveys are most useful in detecting insect and disease damage that can be easily identified from the air, such as mortality and defoliation. It is important to note that not all insect and disease agents have mortality signals that can be detected and that these surveys map and identify signatures of the previous year's activity (Forest Health Monitoring Program 2005). Table 3- 20 displays the major insect agents observed during the last three surveys within the analysis area. Of significant note is the amount of mountain pine beetle activity in both lodgepole and ponderosa pine.

TABLE 3- 20 AERIAL DETECTION SURVEY RESULTS - GLACIER LOON ANALYSIS AREA.			
INSECT/DISEASE AGENT	ACRES MAPPED	NUMBER OF TREES AFFECTED	OCCURRENCES
2008			
Mountain pine beetle (LPP)	682	736	31
Douglas-fir beetle	79	154	15
Subalpine fir Mortality (including western balsam bark beetle)	65	195	8
2009			
Mountain pine beetle (LPP)	703	2316	35
Mountain pine beetle (PP)	2	5	1
Douglas-fir beetle	12	26	6
Western spruce budworm	100	N/A	1
2010			
Mountain pine beetle (LPP)	2039	1696	61
Mountain pine beetle (PP)	25	34	5
Douglas-fir beetle	2	5	1
Subalpine fir Mortality (including western balsam bark beetle)	2	1	1

Review of the stand inventories and stand-level diagnosis also revealed a number of insect and disease agents present within the analysis area. The following paragraphs identify the major insects and diseases observed and provide a short discussion of their natural history. Miscellaneous insects and diseases observed which are having a minimal effect on existing forest vegetation are also mentioned. Project File Exhibit I-1 contains site-specific information related to these pests.

Mountain Pine Beetle

Mountain pine beetle (*Dendroctonus ponderosae*) is an aggressive bark beetle, which feeds in the inner bark of host trees, often girdling and killing the tree. Hosts include most pine species with lodgepole pine, western white pine, and ponderosa pine being of concern within the analysis area. Infested trees fade within 1 year from yellow-green to red-brown. Large-scale outbreaks are common, especially in lodgepole pine, when conditions are optimal and the beetles' food supply is abundant.

Amman and others (1977) developed a hazard rating system for lodgepole pine stands that focuses on three stand characteristics. Stands with an average age greater than 80 years, which have an average DBH greater than 8 inches, and exist within suitable climate for beetle brood development (<6,000 feet based on latitude) can be considered highly susceptible.

Currently, Forest Service entomologists use a more detailed hazard rating system developed by Shore and Safranyik (1992) which incorporates nearby beetle population data (Gibson 2004).

Mountain pine beetle was observed in numerous stands within the analysis area. Affects were primarily individual tree or small patches of lodgepole pine and ponderosa pine mortality. Attacks appeared to be a mix of older and current activity. These occurrences coupled with the aerial survey detection of mountain pine beetle, in and around the analysis area, suggest that given optimal conditions, mountain pine beetle populations have the potential to increase. The stand conditions identified earlier as high hazard occur in many of the lodgepole pine dominated stands within the analysis area. This is primarily due to age and average tree DBH (Table 3- 17 and Table 3- 18). Most of the associated elements contributing to high hazard (density, percent susceptible pine, and adequate environmental conditions) are also present.

Within the analysis area, current mountain pine beetle activity in ponderosa pine is consistent with recent observations of increased activity as identified in the 2010 Upper Swan Valley Ponderosa Pine Assessment. Mountain pine beetle is affecting ponderosa pine in two generalized scenarios. Younger plantations with high stand densities and adequate diameters are being most affected and serving as mountain pine beetle population growth centers (e.g., Units

13 and 35). Scattered mature dominant overstory ponderosa pines are also being attacked by mountain pine beetle (e.g., Units 32 and 37). These remnant legacy trees are of high social and ecological value.

White Pine Blister Rust

White pine blister rust (*Cronartium ribicola*) is an introduced pathogen that affects five-needled pines. It was introduced in 1910 and has spread throughout most of the range of its North American pine hosts. The fungus causes branch and stem cankers that eventually lead to top kill or death of most infected trees (Hagle 2003). Resistance to blister rust occurs naturally in some white pine. Silvicultural walkthroughs revealed that the majority of western white pine trees larger than sapling size were infected with blister rust. Effects ranged from mortality to dead branches.

Larch Dwarf Mistletoe

Larch Dwarf Mistletoe (*Arceuthobium laricis*) is a small parasitic plant whose principle host species is western larch. Lodgepole pine, mountain hemlock, and other conifer species are secondary or rare hosts. Dwarf mistletoes are obligate parasites depending on their host to survive, and are the most widely dispersed pathogen in the western United States. Effects include, witches brooms, top kill, reduced height and diameter growth, and occasionally mortality. Mistletoe-inflicted mortality usually does not occur until trees are mature and begin to decrease in vigor. Spread and intensification is usually slow (Forest Health Protection and State Forestry Organizations 2004). Hawksworth (1977) developed a 6-class dwarf mistletoe rating (DMR) system to quantify mistletoe infestations.

Larch dwarf mistletoe within the analysis area was identified in numerous stands, with Units 45 and 46 having the most significant infestations. Although not evaluated for each tree or stand, observations indicate Hawksworth ratings ranged from one to six. Some mortality was observed in overmature western larch trees. Infestation of advanced western larch regeneration growing under infested overstory western larch trees was also observed.

Root Disease

Root diseases are the most damaging group of tree diseases. In Montana, they are most common in Douglas-fir, grand fir, and subalpine fir. Once established, they become a disease of the site and can persist for decades in roots, stumps, and killed trees. Damage can range from diffuse mortality to large and/or small root disease "pockets." Tree species vary in their resistance to root diseases (Hagle 2004).

Root disease was observed within the analysis area. *Armillaria ostoyae* is likely the most common species present. Douglas-fir and true firs are the most susceptible to this species with larch and then pines being least susceptible. Mortality included both mature and immature trees and was primarily confined to small pockets and individual trees, except in Unit 47 where root disease is prevalent.

Miscellaneous Insects and Diseases

A number of additional forest insects and diseases were identified in the analysis area. They are listed here as miscellaneous because they were either observed very infrequently or their effects to forest vegetation were insignificant. Undoubtedly additional forest insects and disease occur in the project area.

- Indian paint fungus (*Echinodontium tinctorium*),
- Western gull rust (*Endocronartium harknessii*),
- Lodgepole pine dwarf mistletoe (*Arceuthobium americanum*)
- Douglas-fir dwarf mistletoe (*Arceuthobium douglasii*), and
- Pini (*Phellinus pini*),

Region One Forest Health and Protection Staff has developed a system to assess hazard ratings

for important forest insects using the FVS stand dynamics model. These systems evaluate stand conditions and assign hazard ratings at various points in time (Pederson 2006). This system was applied to some areas proposed for treatment where adequate input data exists. The results will be discussed in the Environmental Consequences section of this report.

Wind

Although the effects of wind to forest vegetation are constant, no evidence of recent large-scale wind events was observed. Due to observations of individual tree and small patches of blowdown, it is obvious that wind has been a disturbance factor within the analysis area.

Forest Management

National Forest System and private lands total 37,320 acres within the analysis area, 30,004 and 7,316, respectively. The Forest Service keeps records of past timber harvest activity, going back to around the 1950s. A portion of current NFS lands were previously managed by PCTC. These lands are now part of the National Forest System, as a result of the Montana Legacy Project (see Ownership and Development Section). Past harvests on these Legacy lands were determined through analyzing information previously obtained from PCTC, recent satellite imagery and past harvest GIS layers on file at the Flathead National Forest. Table 3- 21 displays the timber harvest activity by decade for all lands. In addition to the past timber harvest activities, a variety of forest management practices have affected the existing vegetation within the analysis area. These activities include:

- Artificial regeneration (planting),
- Timber stand improvement (pre-commercial thinning, etc.),
- Site preparation, and
- Fuels treatments (prescribed burning, slashing, piling, etc).

Comprehensive records of these activities are only available for NFS lands and are also reported in Table 3- 21.

TABLE 3- 21 PROJECT AREA PAST FOREST MANAGEMENT ACTIVITIES.								
OWNERSHIP	1950s	1960s	1970s	1980s	1990s	2000s	2010s	TOTAL BY OWNERSHIP
Forest Service Acres	756	1,517	323	1,007	537	398	0	4,538
Legacy Land Acres	0	323	0	591	909	902	327	3,052
Private Land Acres	0	0	510	425	1,161	944	0	3,040
Total Acres Treated	756	1,840	833	2,023	2,607	2,244	0	10,630
INTERMEDIATE HARVEST								
Forest Service Acres	0	84	0	455	152	403	0	1,094
Legacy Land Acres	0	0	0	269	0	0	0	269
Private Land Acres	0	224	428	699	46	301	0	1,698
Total Acres Treated	0	308	428	1,423	198	704	0	3,061
UNEVEN-AGED HARVEST								
Forest Service Acres	28	30	34	95	0	0	0	187
Legacy Land Acres	0	0	0	0	0	0	0	0
Private Land Acres	0	244	96	61	27	51	0	479
Total Acres Treated	28	274	130	156	27	51	0	666
TIMBER STAND IMPROVEMENT TREATMENTS								
Forest Service Acres	0	24	96	607	122	48	0	897
Reforestation								
Forest Service Acres	414	418	344	1,189	370	73	0	2,808
SITE PREPARATION								
Forest Service Acres	514	531	632	904	613	0	0	3,194

TABLE 3- 21 PROJECT AREA PAST FOREST MANAGEMENT ACTIVITIES.

OWNERSHIP	1950s	1960s	1970s	1980s	1990s	2000s	2010s	TOTAL BY OWNERSHIP
Fuels Treatments								
Forest Service Acres	629	780	362	978	1,329	1,056	20	5,154
Legacy Land Acres	0	0	0	0	0	0	26	26
Total Acres Treated	629	780	362	978	1,329	1,056	46	5,180
INSECT CONTROL								
Forest Service Acres	0	0	0	0	0	0	134	134
Grand Total (All Activities and Ownership. May reflect multiple activities on same acre.)	2,341	4,175	2,825	7,280	5,266	4,176	180	26,570

Areas that were regenerated in the 1950s through 1970s are typically fully stocked pole timber and small sawtimber stands averaging between 20 and 70 feet tall. Regeneration harvest that took place in the 1980s and 1990s has resulted in areas of primarily sapling sized trees with average heights of 10 to 20 feet. Regeneration harvests that occurred since 2000 are comprised of seedlings generally less than 5 feet tall. Intermediate harvest treatments retain the existing stand in a modified condition. These harvested areas typically have lower densities, with more growing space available for residual trees.

Ownership and Development

Development of forested land has been on going in the Swan Valley since roughly the turn of the century. Although still a rural area, an increasing amount of land is being developed primarily for residential purposes. Often this development results in areas converted into a non-forested condition. This is typically done for house lots, transportation systems, out buildings, and pastures. In 2002, it was estimated that 900 people lived in the Upper Swan Valley (Swan Ecosystem Center 2004).

On June 30, 2008, The Nature Conservancy (TNC) and The Trust for Public Land (TPL) announced they reached agreement to purchase approximately 310,000 acres of PCTC lands in three phases over two years culminating in December 2010. The lands in the agreement include more than 65,630 acres in the Swan Valley. By 2014, TNC had conveyed approximately 47,000 acres in the Swan Valley to the Forest Service. The Legacy Lands Acquisition included a timber supply agreement to provide timber to PCTC for 10 years through a timber reservation that TNC and TPL placed on deeds to honor the original purchase agreement with PCTC. **On January 5, 2016, the U.S. Forest Service received a letter announcing that the fiber supply agreement between TNC and Plum Creek had been terminated and that there were no plans for future harvest on Legacy Lands (Project File Section AA).**

The Lands Section in this EA discusses the ownership and development within the analysis area in greater detail.

COMPARISON TO HISTORICAL CONDITIONS

Comparisons of existing conditions to historical conditions can help put management objectives and options into perspective. The previous discussion related to historical and existing forest vegetation conditions within the analysis area and the surrounding landscape allows us to gain that perspective. The following key points summarize the comparisons between historical and existing conditions.

Disturbance

The scale, intensity, and frequency of the forest fires, the major disturbance factor within the analysis area, have been altered from historical conditions. Fire frequency has decreased due to elimination of traditional native burning coupled with effective modern fire suppression. Many of the non-lethal and mixed-severity fire regimes are now three to six fire intervals out of balance

(Project File Exhibit T-4). At the Lindbergh Lake sites, Barrett (2002) observed fire-return intervals to be four times longer than the historical mean. Potential increased fire intensity and shifted fire regimes have occurred within the analysis area, as well. Long-term fire exclusion and selective logging has promoted a shift toward the stand-replacement fire regime across a broad area in the Upper Swan Valley (Arno, Harrington, et al. 1995; Barrett 1998; Hart 1994). The scale of wildfires also appears to have increased. Ayers reported a “big burn” having an area of about 5 square miles in 1898. The 2003 Crazy Horse Fire grew to almost four times that size despite intensive suppression efforts. See the Fire and Fuels Section of this EA for a more detailed discussion of fire within the project area.

Insect and disease conditions have not changed extensively overtime within the analysis area. Many of the agents that are currently present (mountain pine beetle, larch dwarf mistletoe, root diseases, etc.) were also likely historically present. The exception is white pine blister rust which began to impact the area in 1910 and is currently having a significant effect on forest vegetation within the analysis area. It is debatable whether current levels of mountain pine beetle are within historic ranges, though in general it appears that they are. However, mature remnant ponderosa pine may be experiencing uncharacteristic impacts. These impacts are likely due to relatively high landscape mountain pine beetle populations, inherent low tree vigor, and conditions favorable to mountain pine beetles (increased stand densities, shade, competition and ideal weather).

Forest Vegetation Condition

The amount of forested area within the analysis area is similar to historical conditions, with some potential decrease due to development. The approximate distribution of seral stages is similar to historic conditions when comparing data from Amendment 21 to existing conditions data, with the highest departure in the late seral stage. Recognizing that Amendment 21 defined late seral as Old Growth and this analysis did not. As stated in Amendment 21 and the Upper Swan Valley Landscape Assessment (Project File Exhibit T-4), the amount of old growth within the entire Swan Subbasin in 1998 was below the historical range.

The distribution of cover types appears to be similar to historic conditions. Although within historic ranges, there may be some increases in lodgepole and spruce-subalpine fir dominated areas.

The amount of single-storied fire resistant shade intolerant tree species dominated areas appears to be less than historical information indicates. This is largely due to shifts in fire regimes, the absence of fire, past timber harvest, and shade intolerant in growth.

Ownership and Management

Ownership patterns have deviated from historical conditions with increased Federal ownership as a result of the Montana Legacy Project. Management of Federal and private lands is also similar to historic conditions.

DESIRED CONDITIONS

Desired forest vegetation conditions on NFS lands are directed by the Forest Plan. Project-level objectives consider Forest Plan direction in combination with current conditions. Stand-level desired conditions are developed by considering management direction and project purpose and need relative to site capabilities and current vegetative conditions. Regional strategies also help identify trends and desired conditions across the larger landscape.

FOREST PLAN DIRECTION

Forest Plan Amendment 21 and the associated appendices (USDA 1998b) provide management objectives and guidelines relative to forest vegetation and include the following:

- Manage landscapes to attain the 75 percent range around the median amount of old growth that occurred historically, including recruitment of additional old growth where needed from appropriate mid-seral stands and prescribed treatments within existing old growth where current conditions pose a major or immediate threat.

- Maintain or actively restore landscape composition, structure, and patterns to a condition similar to that expected under natural disturbance and succession regimes.
- Manage landscape composition and patterns to reduce the risk of undesirable fire, insect and pathogen disturbances.
- Where fuel conditions or fire regimes have been significantly altered, manage to restore the historical fire regime and reduce risk of undesirable fire events.
- Stand-level objectives for all seral stages include maintaining dominance of shade intolerant species such as western larch, ponderosa pine, and western white pine.

MANAGEMENT AREA DIRECTION

The Forest Plan sets management direction for the project area. Activities proposed with this project are located within the following MAs:

- MA 5 – Roaded timberlands in areas of high scenic value. Much of this MA lies along the Swan Valley Highway.
- MA 9 - Timberlands capable of providing white-tailed deer winter habitat.
- MA 15 – Timberlands where timber management with roads is economical and feasible.
- MA 15C – Timberlands where timber management with roads is economical and feasible and are key white-tailed deer summer range.
- MA 17 – Timberlands with riparian areas consisting of aquatic, riparian, and a portion of terrestrial ecosystems along perennial stream reaches, and some important streams with typically a seasonal flow.

PROJECT LEVEL OBJECTIVES

- Hazardous Fuels Reduction
 - o Reduce the associated risk of high-severity landscape wildfire risk within the WUI as identified in the Seeley Swan Fire Plan.
 - o Provide for a safer environment for the public and firefighters should a wildfire occur within proposed treatment areas.
 - o Increase the probability of stopping wildfires on (NFS) lands before they burn onto private lands.
- Improve Forest Health
 - o Improve and/or maintain the general health, resiliency, and sustainability of forested stands.
 - o Reduce the risk of insect epidemics and severe disease infestations within the project area.
- Provide Wood Products for Local Economies
 - o Provide forest products to the local timber industry – contributing to short-term forest products and providing for long-term sustainability of timber on NFS lands.

REGIONAL RESTORATION STRATEGY

Literature cited in the Northern Regional Overview, documents a downward trend in aerial extent of ponderosa pine, western larch, aspen, western white pine, whitebark pine, and many native grassland communities, and in some areas an increase in non-native invasive weeds. In many cases, these cover types were maintained by relatively frequent fire, and in some cases, fairly open forest conditions. This information could be an important project level focus for restoring resilient desired conditions (USDA Forest Service 2007b).

ENVIRONMENTAL CONSEQUENCES

This section describes the direct, indirect, and cumulative effects of the no action and the proposed actions to forest vegetation.

Table 3- 22 displays a summary of treatments by alternatives.

TABLE 3- 22 TREATMENT SUMMARY BY ALTERNATIVE.*						
	ALTERNATIVE B		ALTERNATIVE C		ALTERNATIVE D	
	ACRES	MBF	ACRES	MBF	ACRES	MBF
COMMERCIAL HARVEST TREATMENT ACRES AND ESTIMATED BOARD FOOT VOLUME (MBF)**						
Clearcut with Reserves	240	2,151	229	2,076	217	2,019
Seed Tree with Reserves	463	3,799	405	3,295	347	2,805
Shelterwood with Reserves	70	641	51	485	31	365
Commercial Thin	851	3,569	624	2,503	236	808
Modified Commercial Thin	0	0	119	357	125	375
Improvement Cut	117	243	117	243	84	175
Sanitation/Salvage	8	72	11	81	5	16
Total Harvest Acres and Board Foot Volume	1,749	10,473	1,556	9,049	1,045	6,562
NON COMMERCIAL TREATMENT ACRES						
Post and Pole	10		10		10	
Pre-Commercial Thinning	343		343		95	
Total Acres of Commercial and Non-Commercial Treatments	2,102		1,909		1,150	
Estimated Hand Planting (Occurring with Regeneration Units)	400		340		290	
LOGGING SYSTEM ACRES						
Tractor	1,697		1,549		1,038	
Skyline	44		0		0	
Mechanical	356		355		107	
Hand	5		5		5	
Total Logging System Acres	2,102		1,909		1,150	
SLASH TREATMENT ACRES						
Chip/Excavator Pile/Burn	13		14		13	
Chip/Pile/Remove	339		338		90	
Lop & Scatter/Pile/Burn	5		5		5	
Lop & Scatter/Hand Pile/Burn	10		10		10	
WTY	468		432		228	
WTY/Broadcast Burn	164		102		82	
WTY/ Excavator Pile/Burn Piles	751		730		556	
WTY/ Excavator Pile/Burn/Chip	311		237		125	
WTY/Hand Pile/Burn/Chip	41		41		41	
Total Acres of Slash Treatment	2,102		1,909		1,150	
* Management Requirements and Design Criteria will likely influence actual acres and volumes obtained during on the ground project layout.						
**Harvest volume estimates are rough estimates based on knowledge of volume removed during similar treatments within the Swan Valley. A more detailed volume determination and cruise will be conducted prior to implementation which will meet all Forest Service standards.						

ALTERNATIVE A - NO ACTION ALTERNATIVE DIRECT AND INDIRECT EFFECTS

The direct and indirect effects discussed in this section pertain primarily to effects that occur as direct or indirect (in time and space) results of the alternative. These may include immediate or longer term effects.

No actions would occur under this alternative, allowing the processes of vegetation succession and disturbance to continue in a similar fashion as they currently are. Some roadside firewood gathering, Christmas tree cutting, and continued wildfire suppression consistent with Forest Plan direction is expected. The direct and indirect effects of the No Action Alternative to forest composition, forest structure, seral stage distribution, and forest insect and disease conditions is discussed below.

FOREST COMPOSITION

In the short term, forest composition would continue to reflect the existing condition with the lodgepole pine mix and subalpine fir mix cover types dominating the analysis area at 35 and 16 percent, respectively. Areas dominated by western larch (7 percent) and ponderosa pine (<1 percent) would likely remain at current levels.

It is possible that the distribution of susceptible pine species and dominance of lodgepole pine would decrease over time as a result of continued mountain pine beetle mortality. As will be discussed in greater detail below, mountain pine beetle activity appears to be increasing within the analysis area and could likely be expected to do so for at least the next few years. In affected mixed-species stands, the lodgepole, ponderosa, and western white pine components would decrease and more growing space would be occupied by primarily western larch, Douglas-fir, subalpine fir, and Engelmann spruce. Where lodgepole pine exists as pure stands, species composition would be likely to shift in some areas and remain dominated by lodgepole pine in others depending on advanced regeneration, severity of mortality, and other factors.

Regeneration of western larch and other intolerant species would remain low and inhibited by lack of disturbance and increased shade. Schmidt et al. (1976) and Shearer (1971) report that western larch is a pioneer species whose seedlings are adapted to disturbed conditions, such as those found on bare mineral soil or following severe burns, and seedling survival is poor on undisturbed litter, humus, or sod of the mature forest.

Ingrowth and advanced regeneration of shade-tolerant species, such as subalpine fir, Engelmann spruce, grand fir, and Douglas-fir, would continue. These species have the ability to become established and successfully compete for growing space in a shaded understory environment (Pfister et al. 1977). When studying subalpine fir habitat types (~82 percent of the analysis area) in western Montana, Arno et al. (1985) found stands dominated by shade-tolerant species in the later seral stages.

Within the Crazy Horse Fire Area, competition and other succession factors would ultimately determine species composition. Lodgepole pine, western larch, and aspen were the most prevalent species in recent regeneration surveys. This would also be the case under the action alternatives where no activities are planned.

Additionally, the amount of western white pine and western larch would continue to decline as a result of forest pathogens, as white pine blister rust and western larch dwarf mistletoe continue to affect these species, respectively.

The effects to species composition based on this alternative include decreased proportions of long-lived, fire-tolerant, shade-intolerant species (such as western larch) in some areas and increased representation of shade-tolerant species, such as Douglas-fir, subalpine fir, and Engelmann spruce in other areas over time. Effects may also include a decreased representation of pine species, as a result of continued mountain pine beetle mortality.

FOREST STRUCTURE

Both vertical and horizontal structure would be generally expected to reflect existing conditions under the No Action Alternative with some incremental changes expected.

Single, two-storied, and multi-storied stand structures would be likely to persist. As stand dynamics progress over time, many of the areas currently in the early-seral stage and dominated by single-story stand structures would develop into two-storied or multi-storied stand structures. Some of the currently two-storied stand structures would also progress toward a multi-storied condition. Shade-tolerant species would continue to occupy more of the lower, middle, and upper canopy layers as these species become established and grow.

Stand densities would remain relatively stable as only individual tree or small patches of mortality are expected. The exception is the potential for larger scale lodgepole pine mortality from mountain pine beetle. Density would also continue to slowly increase in all seral stages as trees grow larger, tree crowns expand, and shade-tolerant species become established in the understories. Trees experiencing high levels of density-related competition would be less vigorous and less resilient to disturbances, especially in drought conditions (Barnes et al. 1998). In addition, some non-forested areas would likely increase in density as forests become established and/or grow in size.

These effects to horizontal and vertical structure would impact the fuel arrangements and potential fire behavior, resulting in more ladder fuels and subsequently higher crown fire initiation probabilities, and increased crown fire spread rates.

The No Action Alternative would have little effect on the existing condition of snags and down woody material. Snags would become established, fall, and be replaced over time. While natural decay processes would break down wood, cycle nutrients, and incorporate organic material into the soil.

SERAL STAGE DISTRIBUTION

The distribution of seral stages in the analysis area would not be expected to change in the short term under this alternative. A major natural disturbance could create increased early seral conditions and related decreases in mid and late seral stages, but it would be impossible to predict these disturbances. As trees grow, they would eventually shift into different seral stages, but this process often takes considerable time.

INSECT AND DISEASE CONDITIONS

Here again, insect and disease conditions would remain similar to current conditions as a result of this alternative. Trees and stands would continue to experience the effects of the major insects and diseases previously discussed including: mountain pine beetle, white pine blister rust, western larch dwarf mistletoe, and root disease.

The continued effects of mountain pine beetle would include individual and group tree mortality. This would decrease the proportion of susceptible pine and increase surface and standing dead fuel loadings. As stand conditions change over time, it is believed that the risk of larger-scale mountain pine beetle activity would increase.

Forest Health and Protection (FHP) monitor insect and disease conditions across the state of Montana. In their 2010 conditions report, they noted that the Flathead National Forest was one of only a few areas in the state that saw increases in mountain pine beetle activity in lodgepole and ponderosa pine (USDA Forest Service 2010a). In addition, FHP Staff visited the Swan Valley in 2010 and 2011. Although these visits were not specific to the Glacier Loon Project Area, the resulting reports discuss the mountain pine beetle conditions in the Swan Valley. In 2010, it was observed that there was wide-spread mortality caused by mountain pine beetle and that the current condition would be expected to continue for the next few years. In 2011, they found that mountain pine beetle activity on the Swan Lake Ranger District was at moderate to high levels, scattered throughout the District, and attacking lodgepole, ponderosa, and whitebark pine with

attacks ranging from a few trees per acres to pockets of 50 to 100 trees (Sturdevant 2010; Sturdevant 2011).

The FVS was used to model and assess the mountain pine beetle hazard rating of forest stands. Twenty stands were modeled (Figure 12, Project File Exhibit I-1) and were chosen because they are a representative sample of the susceptible lodgepole pine dominated areas within the analysis area, include stands where activities are proposed (which will allow for comparisons with the action alternatives), and have relatively new stand exam data (1993 to 2011). These areas were modeled for a 50-year time period starting in 2011 and had no treatments simulated. This essentially created a condition similar to the No Action Alternative where no human disturbance would occur. This also implies that stand conditions would not be affected by mountain pine beetle or other natural disturbance agents in the 50-year period. This situation would be unlikely given previous discussions of mountain pine beetle in the analysis area, yet it does allow for analysis of stand conditions as they relate to hazard in the absence of disturbance. The results of this simulation contained a mix of Low Risk, Moderate Risk, and High Risk hazard and are displayed in Figure 3- 5. Although all areas contain significant proportions of lodgepole pine, variation in all forest attributes exists among the stands. Results were consistent for all areas in that the hazard rating for no area decreased as time progressed; and in many stands, hazard increased over time. The detailed results of this simulation are included in the project file for this report (Project File Exhibit I-1).

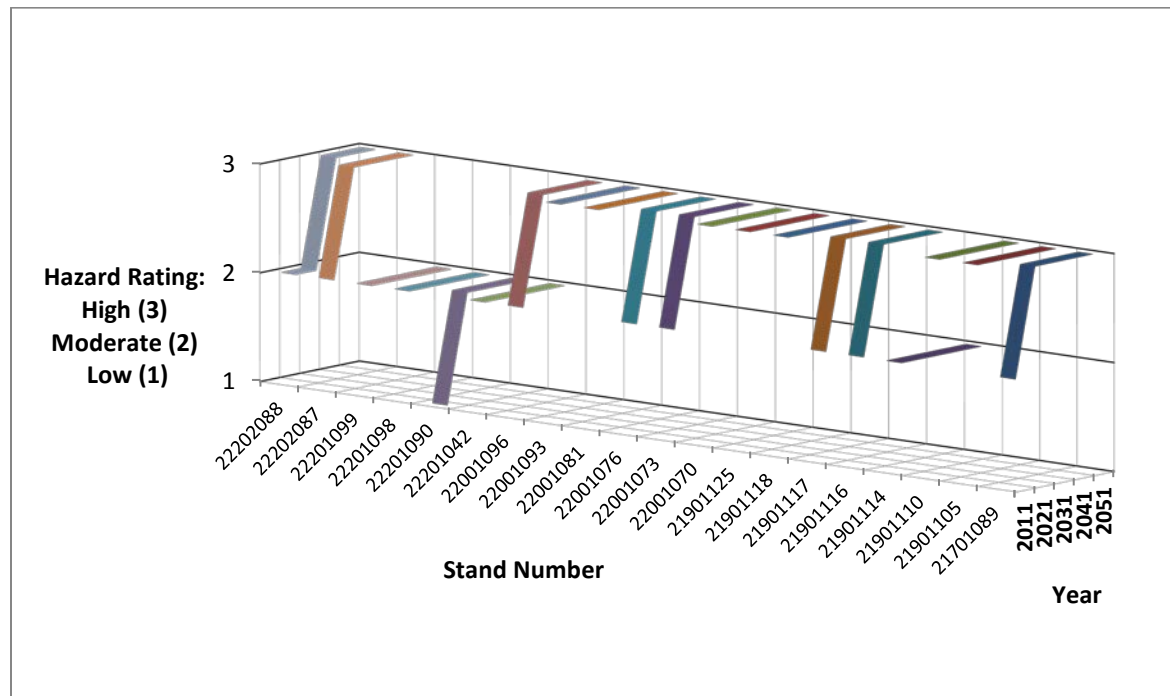


Figure 3- 5 No Action FVS Mountain Pine Beetle Hazard Ratings.

White pine blister rust would also continue to significantly affect the forest vegetation under this alternative. Most of the white pine trees within the analysis area are infected with blister rust. As the disease progresses, tree girdling and subsequent mortality would increase. White pine seedlings, which become established in the vicinity of overstory white pine trees, would be likely to become infected as well given the proximity to the disease and their likely non-resistant genotype. The effects would ultimately be a continued decrease in the proportion of western white pine within the analysis area.

The spread and impact of larch dwarf mistletoe is predictable. The trees currently infected within the analysis area would continue to experience decreased growth and potential mortality. It has been reported that dwarf mistletoe-related mortality usually takes 10+ years to occur once it has

spread through the entire tree crown, and the spread of dwarf mistletoe within a stand is approximately 1 to 2 feet per year, being highest in multi-storied stands (Forest Health Protection and State Forestry Organizations 2004).

Root disease would continue to affect areas where it is present, as it can persist on site for decades. Susceptible tree species would continue to be stressed and/or killed where affected by root disease. It has been reported that the area occupied by root disease in a stand can double every 10 years (Hagel 2004). Some lands could become essentially non-forested when susceptible species are the only species present and regenerating in a root disease area.

Tree damage such as windthrow, stem abrasion, and branch breakage, etc., is expected to remain at current natural levels.

ALTERNATIVE A – NO ACTION ALTERNATIVE CUMULATIVE EFFECTS

Past, current, and reasonably foreseeable actions on all lands within the analysis area were evaluated when considering the cumulative effects to forest vegetation associated with the No Action Alternative. Past actions that have affected the vegetation resource include forest management and other activities within the analysis area. These activities are discussed in the Existing Conditions Section of the Vegetation Resource Section and provide the baseline vegetation conditions. Given that, the following discussion focuses on the current and reasonably foreseeable activities on all lands, in combination with the effects of the No Action Alternative on NFS lands. See the Cumulative Effects Worksheet (Project File Exhibit I-2) for additional cumulative effects information.

FOREST COMPOSITION

Cumulatively, the effects to forest composition would continue to reflect the existing condition, where lodgepole pine and subalpine fir dominated cover types dominate. Western larch and ponderosa pine dominated areas would continue to remain subordinate. This is based on no current or reasonably foreseeable activities (such as regeneration or intermediate harvest) which would favor these species. Continued fire suppression activities, would also result in effects and forest composition trends similar to those previously described.

Some cumulative effects to forest composition likely occurred as a result of a 2012 harvest on Legacy lands called Fredswood. This sale consisted of approximately 154 acres of Overstory Removal Harvest, focused on removing large, overstory trees, but retained some seed trees of seral species in each treatment area. In 2011/12 TNC conducted a sale called Krafty 13 in Section 13, T.20 N, R.17 W. prior to this section being acquired by the Forest Service through the Land and Water Conservation Fund. Approximately 173 acres of overstory removal harvest occurred with retention of some seed trees. These seed sources will allow natural regeneration of seral species to occur, in addition to the mix of natural regeneration that is already occurring. This harvest is not expected to alter the forest composition across the project area, but will be concentrated in the area of the harvested stands.

FOREST STRUCTURE

The cumulative effects to forest structure are similar to the direct and indirect effects of the No Action Alternative where existing conditions would be reflected immediately, followed by increased stand density, continued multi-layer vertical structure, and accumulating fuels. This is primarily due to continued fire suppression and relatively low levels of current or foreseeable disturbance.

The exception to this is the 154 acres of Overstory Removal Harvests conducted on Legacy lands (Fredswood) and 173 acres of overstory removal (Krafty 13) on TNC owned Section 13, T.20N., R.17W., later acquired by the Forest Service through the Land and Water Conservation Fund. These harvests decreased stand densities, modified average stand diameters, modified vertical

structure from a two-storied structure to primarily a single-storied structure, and altered fuel arrangements.

Land development (~309 acres current or reasonably foreseeable) could affect forest structure by converting forested areas to non-forests.

SERAL STAGE DISTRIBUTION

Given little current or reasonably foreseeable regeneration (either natural or human caused), the cumulative effects to seral-stage distribution would be primarily a continued slow shift of seral stages as trees grow.

INSECT AND DISEASE CONDITIONS

Here again, the cumulative effects to forest insect and disease conditions are similar to direct and indirect effects of the No Action Alternative when considering other current and reasonably foreseeable activities. Since current and reasonably foreseeable activities that would affect insect and disease conditions are limited, the effects discussed above could be compounded or increased as existing conditions across all ownerships remain unfavorable over time (e.g., mountain pine beetle hazard increases with changing stand conditions).

There could be some exceptions to this, the TNC 327 acres of Overstory Removal Harvest likely had positive effects on insect and disease by emphasizing the retention of seral species. It is also possible that the Beaver Creek project, located outside the analysis area, could have positive effects on reducing insect and disease in stands susceptible to mountain pine beetle, by converting them to seral species that would have more resistance to insect and disease.

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

This section discusses the effects to forest vegetation from implementation of the three action alternatives. Since the proposed actions are similar between alternatives, varying primarily by the number of acres treated, the effects discussion will be combined. Where possible, the effects will be quantified for each alternative to allow for comparison. Table 3- 23 summarizes the proposed treatments by alternative.

The direct and indirect effects to forest vegetation will be discussed relative to the measurement indicators.

FOREST COMPOSITION

The proposed silvicultural and reforestation activities would result in effects to forest composition within the analysis area. Both intermediate harvest and regeneration harvest areas would alter species composition following treatment, and this would persist for varying periods of time. Indirect effects are also possible through interactions of species and disturbance agents, but will not be discussed in detail due to uncertainty in disturbance timing, spatial location, or degree.

As previously stated, management direction includes emphasis on long-lived, fire-tolerant, and shade-intolerant species, where appropriate. The presence of these species suggests that site capabilities are adequate, and they are appropriate areas to apply this direction. These species primarily include western larch, western white pine, and ponderosa pine.

Therefore, these species would be preferred and favored for retention. Due to susceptibility to mountain pine beetle, the relatively short longevity, and fire-intolerance of lodgepole pine, this species would be favored for removal in most situations. In all harvest treatments, species that are relatively rare within the analysis area and surrounding landscape would be favored for retention either selectively or by exclusion. These include species such as aspen, cottonwood, birch, western red cedar, and western and mountain hemlock.

Where intermediate harvest is proposed, the species composition would be altered through the

selection of tree species to be retained and removed. These effects would occur as long as the species favored persist and/or as long as the species removed do or do not become reestablished. The Intermediate Treatments proposed include primarily Commercial Thinning, but also Improvement Cuts, Sanitation/Salvage, and Pre-commercial Thinning. Specifically, Commercial Thinning prescriptions would be Thinning From Below. This implies that trees in the suppressed and intermediate crown classes would be removed first, while most of the co-dominant and nearly all dominant crown class trees would be retained. Due to the differentiation in shade tolerance among species, these treatments would primarily remove shade-tolerant species, such as grand fir, subalpine fir, Engelmann spruce, and Douglas-fir.

These species currently occupy the suppressed and intermediate crown positions. Conversely, the shade-intolerant species mentioned are currently occupying the dominant and codominant crown positions and, hence, would be favored. There are areas where shade-intolerant species occupy the majority of the stocking. In these areas, shade-intolerant tree species would be removed to reach the target residual density. However, this removal would not affect the species proportions in these situations.

The other proposed intermediate treatments would also affect species composition. Where Sanitation/Salvage Treatments are proposed, the focus would be on the removal of dead, dying, or susceptible trees and mostly remove lodgepole pine. Removal of trees that are already dead or dying would not measurably effect species composition. Where susceptible lodgepole pine is removed, stand composition would shift and decrease the representation of lodgepole and increase residual tree species proportions.

As the treatment descriptions suggest, improvement cutting is proposed in two situations. However, both situations address mountain pine beetle concerns. In these cases, ponderosa pine and non-susceptible species (e.g., western larch and Douglas-fir) would be favored for retention. Here again, the net result would be a reduction in lodgepole pine representation.

Where possible, Pre-commercial Thinning Treatments would favor long-lived, shade-intolerant, fire-resistant species. This could have no considerable effects on species composition depending on the current composition of the stand. A variety of existing situations exist in proposed areas. One example to consider is within the Crazy Horse Fire Area where Pre-commercial Thinning is proposed (Alternatives B and C only). Within the fire area, lodgepole pine, western larch, and aspen dominate the regeneration. Some areas have nearly pure species composition; other areas are mixed. In general, where western larch and lodgepole pine exist together, western larch would be the favored species. Retention and featuring of aspen would be assessed on a case-by-case basis and would be likely to be most prevalent in the vicinity of the many "pothole" wetlands found in the area.

Table 3- 23 shows the number of acres proposed for intermediate treatments under each alternative. Although the actual effect to species composition in these areas is not measurable until after treatment, this table provides a quantifiable opportunity to compare how many acres associated with each alternative would have species composition altered according to the effects discussed above.

TABLE 3- 23 ACRES OF INTERMEDIATE TREATMENTS BY ALTERNATIVE.			
INTERMEDIATE TREATMENT	ALTERNATIVE		
	B	C	D
Commercial Thinning	851	743	361
Sanitation/Salvage	8	11	5
Improvement Cutting	117	117	84
Pre-commercial Thinning	343	343	95
TOTAL	1,319	1214	545

Regeneration harvests are likely to have a more significant effect (in terms of species proportions

and duration) on species composition than intermediate harvests. This is due to the establishment of a new age class of trees where control of species composition is possible at establishment. This would be possible through manipulation of seed source and artificial regeneration. Regeneration harvests associated with the action alternatives include Clearcut with Reserves, Seed Tree with Reserves, and Shelterwood with Reserves Treatments. These treatments are designed to facilitate regeneration of the desired species discussed earlier (western larch, western white pine, and ponderosa pine) by creating the conditions previously referenced by Schmidt and Shearer. "With Reserves" indicates that certain trees would be retained indefinitely to provide species and structural diversity. The reserves would be comprised of western larch, ponderosa pine, and western white pine species, where available. However, this does not mean that all trees of these species would be reserved in these areas.

Where adequate site preparation is achieved, natural regeneration would be expected to occur and, in some cases, supplement planted seedlings. A variety of species would likely become naturally established. It is also likely that these species would primarily be shade-intolerant pioneer species, such as lodgepole pine and western larch. Some shade-tolerant species could become established on sites where moisture and seed sources are adequate (e.g., Engelmann spruce).

Artificial regeneration would focus on hand planting of western larch, ponderosa pine, and blister rust resistant western white pine. Planting of ponderosa pine would be limited to those sites where it is believed ponderosa pine would be able to successfully compete with other species and likely be limited to more xeric areas or micro environments.

Due to variations in seed source, periodicity, and unpredictability of adequate seed crops (Burns et al. 1990), and direct manipulation of species composition, artificial regeneration is planned for some areas (Table 3- 24). The actual number of acres planted would depend on post-harvest stand conditions and the results of reforestation surveys and needs. The number of acres planned for Regeneration Treatments by alternative is displayed in Table 3- 25. Of the acres proposed for Regeneration, species composition would be converted through planting and control of seed sources on all but 9 acres (except in Alternative D). These 9 acres include Units 45 and 46, where larch dwarf mistletoe infection is significant. That is, the current cover type would not be representative of the species composition following treatment. This would primarily be the result of converting lodgepole pine dominated and shade-tolerant species dominated areas to areas where primarily western larch, western white pine, and/or ponderosa pine would be the dominant species. Table 3- 25 displays the number of acres where species conversion of this nature would occur.

TABLE 3- 24 ACRES OF REGENERATION TREATMENTS BY ALTERNATIVE.			
REGENERATION TREATMENT	ALTERNATIVE		
	B	C	D
Clearcut with Reserves	240	229	217
Seed Tree with Reserves	463	405	347
Shelterwood with Reserves	70	51	31
Total	773	685	595

TABLE 3- 25 ACRES REGENERATED BY COVER TYPE.			
CURRENT COVER TYPE	ALTERNATIVES		
	B	C	D
Lodgepole pine Acres Regenerated	627	593	523
Douglas-fir Acres Regenerated	102	48	37
Subalpine fir Acres Regenerated	35	35	35
Western larch Acres Regenerated	9	9	0

Regeneration surveys would be conducted post treatment to assess regeneration success and species composition.

FOREST STRUCTURE

Forest structure would be affected by the proposed Intermediate Harvest, Regeneration Harvest, and associated treatments. Table 3- 24 above quantifies the acres of each of these treatments by alternative. This quantification can help serve as a comparison of the effects to forest structure between alternatives. Both the effects to horizontal and vertical structure will be discussed.

Intermediate harvests would modify existing forest structure primarily through density reduction. The treatment descriptions above provide a generalized description of the target residual stand density following treatment. Essentially, the number of trees that are currently growing within an area proposed for Intermediate Treatment would be reduced. By reducing the number of trees on a given area, the spacing between tree stems and crowns would be increased.

The post treatment within stand tree distribution would vary based on the existing stand condition, proposed treatment, and management objectives. In Commercial Thinning, Improvement Cutting, and Pre-commercial Thinning areas, a variety of distributions would be expected. Variability in tree distribution would be expected in most situations, with some areas having lower densities with relatively even spacing of residual trees and other areas having small clumps of trees with higher densities. This would largely be determined by the existing stand conditions, with species, size, and crown class being the most influential factors in reserve tree distribution. In some of the proposed Commercial Thinning and Improvement Cuts, tree distributions would be expected to be relatively homogenous with trees spaced at regular intervals. This would be the case where the treatment objective is to reduce stand mountain pine beetle hazard. Sturdevant (2010) indicated that mountain pine beetle attacked trees often occurred in clusters and that the hazard rating for stands with clumpy distributions is increased. More discussions regarding the effect to mountain pine beetle hazard will be discussed below. Post-harvest tree distributions in Sanitation/Salvage Treatments would also be variable by nature, as tree removal would be dictated by the location of dead, dying, or susceptible trees.

Vertical structure would be affected through the selective removal of crown classes. As discussed, Thinning from Below would target lower crown classes first. This would feature a more pronounced and defined single-storied canopy comprised of dominant and codominant trees. Due to the increases in multi-storied vertical structure previously cited by Barrett, Freedman and Habeck, and Arno, an increased representation of single-storied structures would add some diversity to the landscape.

Intermediate treatments would also result in immediate larger average stand diameters. Typically, the suppressed and intermediate trees would have smaller diameters than the dominant and codominant trees. By removing the smaller diameter trees, mathematical average stand diameters would increase. The exception to this would be in areas proposed for Sanitation and Salvage Treatments. This is because trees targeted for removal would not be necessarily associated with any particular size or crown position.

By removing a portion of the density, growing space would be made available to the remaining trees. Increased growing space and decreased competitive stress for nutrients, water, and sun light would result in improved, growth, vigor and resiliency to disturbance (Oliver et al. 1996; Smith et al. 1997). Much research has been conducted to explore this belief, considering variables, such as species composition, age, and geographic location. When looking at the response of trees to partial cutting in western Montana, Schwalm et al. (2002) found that height and diameter growth increased in residual trees of ponderosa pine, Douglas-fir, western larch, and lodgepole pine. Filip et al. (1989) observed increases in growth and vigor following thinning of western larch for trees both with and without larch dwarf mistletoe infection. Although sometimes small and negated by increased mortality following harvest, Dahms (1971) saw positive growth responses in older lodgepole pine. At a site on the Lolo National Forest south of the analysis area, research has indicated improved physiological performance of 300+ year old ponderosa pine and western larch following restoration cutting and burning treatments (Fiedler 2004; Harrington 2004; Sala et al. 2004).

Regeneration treatments would replace the existing forest structure as opposed to Intermediate

modifications. Clearcut with Reserves, Seed Tree with Reserves, and Shelterwood with Reserves Treatments are proposed in the action alternatives. These treatments would have a variable effect on the short and long-term effects to forest structure. Although the number of reserve trees would vary by treatment (see treatment descriptions), initially all treatments would result in a single-storied structure with variably distributed overstory trees. The reserve trees would exist above small seedlings and other vegetation. Over time the seedlings would grow into saplings, then poles, then larger trees. Following this progression, a two-storied stand structure would become apparent. This condition would be less pronounced in the Clearcut with Reserve Treatments, due to the lower number of reserve trees.

Resiliency refers to the capacity of a community to maintain or regain normal function and development following a disturbance (Helms 1998). Forest resiliency is related to disturbance agents, forest structure, and applies to multiple scales including:

- Individual tree level,
- Stand level, and
- Landscape level.

The effects to forest resiliency from the action alternatives will be discussed relative to fire and mountain pine beetle (see below).

In terms of resilience to fire, forest structure is directly related to wildland fuels and potential fire behavior. Recent emphasis on fuels management has led to studies focusing on the effects of manipulating forest vegetation and fire hazard and behavior. It has been found that reduced stand densities, retaining larger diameter fire-resistant species, managing surface fuels, and increasing height to live crowns has had positive effects on tree and stand survivability, decreased crown fire activity, decreased surface fire potential, and decreased fire severity (Agee et al. 2000; Agee et al. 2005; Graham et al. 1999; Omi et al. 2002; Skinner et al. 2002; USDA 2003). The Fire and Fuels Section of this EA contains more detail related to forest structure and fire behavior.

Standing dead trees (snags) and down woody material are significant components of the overall forest structure. These elements are specifically important to wildlife habitat and nutrient cycling. Forest Plan Amendment 21 includes standards for retention of these elements. The standards include numbers of snags and amounts of down woody material by potential vegetation group. All proposed treatments would be designed to meet these standards. Amounts of down woody material may be expressed as tons per acre. Tons per acre are a commonly and easily measurable specification. Existing snag densities and down woody amounts could be less than Amendment 21 standards due to stand conditions. Where feasible and needed to comply with Forest Plan standards, live trees would be left for snag recruitment and activity generated slash would be used to supplement existing down woody material. Some snags could be felled to mitigate safety hazards.

Understory trees also appreciably add to the forest structure. In most situations, these trees would be cut to achieve fuel management and site preparation objectives. This treatment is referred to as slashing. Often, these smaller understory trees act as ladder fuels, which provide an opportunity for fire to move from the forest floor to the tree crowns. One of the primary benefits these trees provide would be to serve as hiding cover for various wildlife species. Where not acting as ladder fuels, understory trees could be left over a portion of treatment areas to provide hiding cover and structural diversity.

Eventually the effects to forest structure from all treatments would diminish. Because trees grow over time, stand densities would increase, tree crowns would expand, advanced regeneration would become established and continue to grow taller, fuels would accumulate, and crowns would become stratified through stand dynamics. Refer to the Temporal Bounds Section of this EA for estimates on how long these effects could last.

SERAL STAGE DISTRIBUTION

Regeneration Treatments would affect seral stage distribution more so than Intermediate

Treatments. Note that seral stages for this analysis were defined by size classes outlined previously.

Intermediate Harvest Treatments would have no effect of the age class distribution within the treatment areas. However, as has been previously discussed, these treatments would have effects on the average residual stand diameters and on residual stand radial growth. It would be impossible to measure these increases until after harvest, but the following would be expected. It would be unlikely that immediate changes in average stand diameters would increase significantly enough to alter an area's classification into a particular seral stage. It is likely that increases in average stand diameters, coupled with expected increases in radial growth following treatment would accelerate the time required for an area to shift from early-seral to mid-seral or from mid-seral to late-seral stages.

Regeneration harvest would immediately effect an area's classification into seral stages. This is because existing mid-seral and late-seral areas would be converted to early-seral stages. It should be noted that the majority of areas proposed for Regeneration are dominated by lodgepole pine (Table 3- 25) and all of these areas have been classified as mid seral. However, some of these areas could be in later stages of succession development for the species, yet lodgepole pine diameters rarely reach the 15-inch size used to define late-seral conditions in this analysis. Table 3- 26 quantifies the number of acres where this conversion would occur by alternative.

TABLE 3- 26 ACRES CONVERTED TO EARLY SERAL STAGE (REGENERATION HARVESTS).			
EXISTING SERAL STAGE	ALTERNATIVE		
	B	C	D
Mid Seral	663	629	560
Late Seral	110	56	35
Total	773	685	595

INSECT AND DISEASE CONDITIONS

The effects to forest insect and disease conditions associated with action alternatives will be discussed relative to the major insect and diseases observed within the analysis area. Tree damage (including windthrow) associated with the proposed activities will also be discussed as it can affect the insect and disease conditions. Here again, Table 3- 22 helps to compare the effects between alternatives.

In general, proposed activities could have both positive and negative effects relative to forest insect and disease conditions. Decay associated with tree damage and increases in bark beetle populations associated with windthrow are two potential negative effects, while increased resilience to insect and disease agents would be a potential positive effect.

Damage to trees, as a result of logging, would be more common in Intermediate Harvest than Regeneration Harvest due to higher residual stand densities. This damage typically includes stem abrasion from skidding and yarding equipment, crown damaged as a result of adjacent tree felling, and root damage from logging equipment. These wounds create ideal entrances for decay organisms (Hunt et al. 1962). Black (2005) also cites references to logging damage increasing tree susceptibility to insects and disease. See the Design Criteria (Table 2- 16) for measures to address tree damage from logging during implementation.

Prescribed burning, including pile burning, associated with site preparation and fuels treatments could affect insect and disease conditions. Where residual trees exist and are exposed to fire, there could be the potential for tree damage and mortality (primarily in fire-intolerant species such as lodgepole pine) as a result of burning. If trees are damaged and stressed, they could become more susceptible to successful attacks from insects. This is commonly observed where Douglas-fir bark beetles and stressed residual Douglas-fir trees exist. This situation would be expected to be rare within the Glacier Loon Project Area, based on residual species composition and planned treatments.

When stand density is reduced, residual trees can become more susceptible to windthrow.

These effects could vary by tree species, tree size, and age, residual stand density, and site. Some generalities can be made regarding the risk of damage associated with windthrow.

Of the tree species likely to be reserved, western larch and ponderosa pine are considered to be more windfirm than Engelmann spruce, lodgepole pine, or Douglas-fir primarily due to rooting habits (Burns et al. 1990). Where high water tables or rocky soils exist, windthrow would be more likely due to shallow rooting depths (Koch 1996). Younger trees grown in dense stands would be susceptible to windthrow when densities are reduced. Larger trees grown under low densities or where their crowns have been exposed to winds would be relatively windfirm. The highest probability for windthrow associated with the action alternatives is with Intermediate Harvesting of lodgepole pine-dominated stands and where Regeneration Harvests would create leeward edges where lodgepole pine dominates (Koch 1996). Suggestions to mitigate windthrow associated with lodgepole pine have been offered by Koch (1996), Schmidt et al. (1986), and Alexander (1975). This information would be considered and incorporated where feasible during implementation of this project.

Where windthrow does occur, increases in bark beetle populations would be possible. Primarily Douglas-fir beetle, Spruce beetle, *Ips spp.*, and Western Balsam Bark beetle are attracted to these conditions. Widespread windthrow would not be expected and none of these beetle species are present in significant numbers within the analysis area.

A positive general effect from the proposed treatments would be related to the previous discussions regarding increased growth and vigor of residual trees following harvest and subsequent resiliency to insect and diseases. Black (2005) and Dix et al. (2006) acknowledge studies where thinning has increased vigor and, in turn, made trees less susceptible to insect attack.

Mountain Pine Beetle

The effects to mountain pine beetle conditions associated with the action alternatives would primarily relate to susceptibility. Previous effects discussions of mountain pine beetle conditions for the No Action Alternative and the existing mountain pine beetle conditions are relevant to the effects for the action alternatives. It should be noted that this project is not designed to attempt to alter mountain pine beetle populations within or adjacent to the analysis area. Research has shown that once an outbreak begins, very little can be done to affect beetle populations. Attempts at direct control of mountain pine beetle numbers once an outbreak begins have proven largely ineffective (Amman et al. 1998; Black 2005; Fettig et al. 2007). Population numbers appear to be dictated by the extent of suitable forest conditions, regardless of direct control efforts.

Susceptibility to attack from mountain pine beetle would be affected by the action alternatives. Stand conditions which are ideal for mountain pine beetle population growth include;

- Larger average lodgepole pine diameters,
- High stand density (both basal area and trees per acre),
- The proportion of density that is lodgepole pine,
- Stand age, and
- Elevation (Amman et al. 1977; Pederson 2006).

Proposed silvicultural treatments would affect these attributes at varying levels. A substantial body of literature exists that supports the theory that silvicultural manipulation is an effective means of increasing resiliency, reducing stand susceptibility, and associated losses. Fettig et al. (2007), Gibson (2004), and Amman et al. (1998) synthesize the literature supporting the effectiveness of silvicultural control of bark beetles. Much of the research points to two silvicultural strategies that have shown promise, one at the landscape level and one at the stand level. At the landscape level, heterogeneity is thought to be more resistant and resilient to insect damage. Silvicultural treatments designed to create age, size, and species mosaics could increase landscape heterogeneity and disrupt the continuity of bark beetle food supply.

At the stand level, evidence suggests that partial harvesting (thinning) could be an effective deterrent to mountain pine beetle infestation and associated losses. The specific reasons why these effects are seen in thinned stands is still uncertain, but likely related to increased tree vigor and/or stand microenvironments less favorable to mountain pine beetle. Despite this research supporting the effectiveness of these strategies, some studies have also shown that at times mountain pine beetle populations become so large and aggressive that the effectiveness of these treatments is diminished or non-existent. In addition, effectiveness is reduced when treatments are done at a relatively small scale (e.g., single or few stands) amidst a large unmanaged landscape (Sturdevant 2010).

Intermediate harvests could be designed to alter stand conditions making them less attractive to the beetles (stand conditions, temperature, air movement, pheromone transport, etc.) (Amman 1977; Dix et al. 2006; Fettig et al. 2007; Gibson 2004; Koch 1996). It has been seen that mountain pine beetle prefer larger trees; however, increased tree vigor, reduced stand density, and decreased proportions of lodgepole pine could counter balance the effect of increased residual tree growth and average diameters in intermediate harvest areas.

It is possible to qualitatively discuss the effects of the proposed treatments to susceptibility by treatment and by alternative at both the landscape and stand level Table 3- 24, Table 3- 26, and Table 3- 27 can also be used to quantitatively compare effects. Regeneration treatments included in Alternatives B, C, and D would inherently reduce stand susceptibility by removing all susceptible trees and establishing a new age class of trees. These areas would not exhibit conditions favorable to mountain pine beetle for many years, even if lodgepole pine was the primary species regenerated. Again, these treatments would also increase landscape-level heterogeneity by increasing age and size class diversity within the analysis area.

Sanitation/Salvage Treatments included in Alternatives B, C, and D would decrease stand susceptibility where proposed by removing all susceptible lodgepole pine trees from proposed harvest areas. Some alteration in stand microenvironments could affect stand susceptibility here, as well.

Commercial Thinning and Improvement Cutting Treatments proposed in Alternatives B, C, and D could reduce stand susceptibility by affecting species composition, density, tree vigor, and stand microenvironments. Where mountain pine beetle is a concern, proposed treatments would be designed to address stand hazard and create conditions less favorable for mountain pine beetle. Commercial Thinning Treatments would reduce stand densities to 80 square feet of basal area or less and residual trees would be relatively evenly spaced. Schmidt et al. (2007a) and Olsen et al. (1996) suggest that thinning to 80 square feet or less per acre is a way to reduce the intercompetition between trees and reduce mortality caused by mountain pine beetle and that mountain pine beetle attacked trees often occurred in clusters and that the hazard rating for stands with clumpy distributions is increased. Daylight treatments (an element of some Improvement Cuts) have been suggested by FHP Entomologist as any vegetation that provides shade or interferes with air movement through a stand increases the stands hazard rating (Sturdevant 2010). Although susceptibility would be affected in these areas, it is difficult to assess post treatment effects in these areas based on unknown future mountain pine beetle population dynamics.

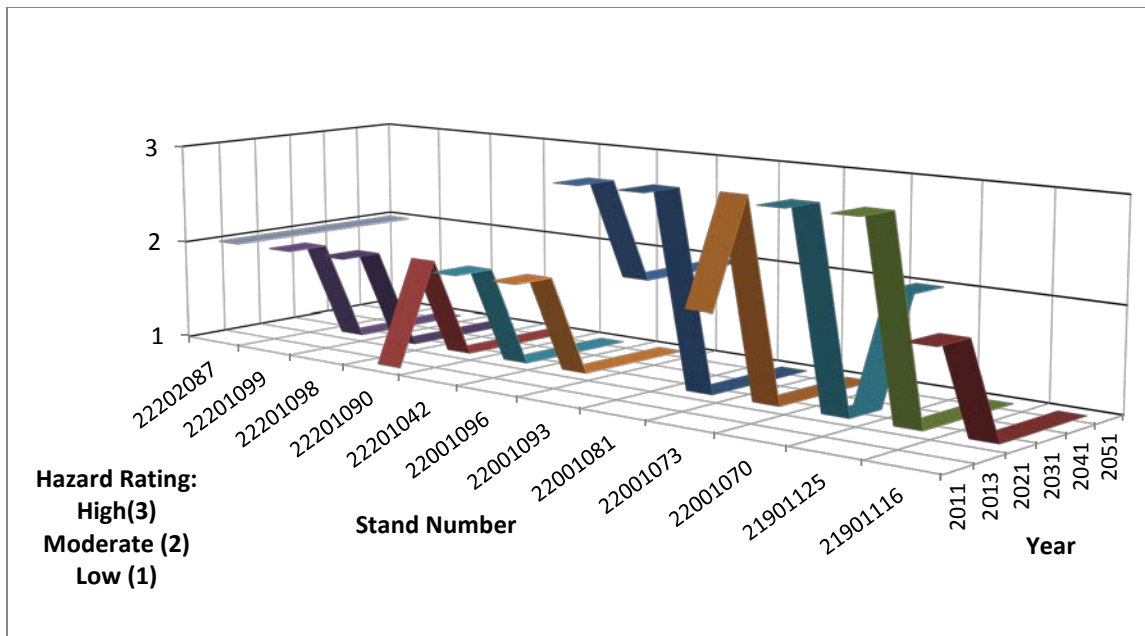


Figure 3- 6 Action Alternatives FVS Mountain Pine Beetle Hazard Ratings.

Similar to the effects analysis for the No Action Alternative, FVS was used to determine post-harvest mountain pine beetle hazard rating for some of the lodgepole pine dominated areas. Twelve of the 20 stands previously modeled had activities proposed in them, either Regeneration or Intermediate Harvests, and the treatment descriptions were used to simulate the proposed activities. Activities were initiated in 2013 and then the stands were modeled for 50 years into the future. Figure 3- 6 displays the results of this modeling and illustrates that the hazard rating either remained constant or decreased following treatment for all areas. It is expected that stand conditions and hazard ratings would change over time as stands age, densities increase due to growth, and understory vegetation redevelops. Detailed information associated with this modeling is available in the project file.

White Pine Blister Rust

The effects to white pine blister rust from the action alternatives would primarily be limited to regeneration and introduction of genetically rust resistant trees through planting. Some severely infected trees could be removed through Intermediate and Regeneration Harvests. See Table 3-22 for acres of regeneration and planting by alternative. White pine blister rust resistant western white pine seedlings would be included in the seedlings planted. It is hoped that over time resistance would be maintained in the gene pool.

Larch Dwarf Mistletoe

The proposed actions would affect the spread and intensification of larch dwarf mistletoe in both Intermediate and Regeneration Harvests. The impacts of larch dwarf mistletoe could be effectively reduced through silvicultural treatments that emphasize the removal or killing of infected branches or trees (Forest Health Protection and State Forestry Organizations 2004). Larch dwarf mistletoe is an obligate parasite; and once host trees are killed (through cutting), the mistletoe will die. Several factors influence the spread of larch dwarf mistletoe including vertical structure and infestation levels. In general both Regeneration and Intermediate Harvests would prioritize the removal of infested western larch and promote single-storied structures, which would reduce spread when compared to multi-storied stands with no treatment (Beatty et al. 1997). However, Jackson et al. (2006) found that though overstory removal and thinning of infected western larch led to improved residual tree growth, these actions negatively affected the spread and intensification among thinned trees.

There are situations where retention of larch dwarf mistletoe infected trees would be anticipated, which could result in increased spread and intensification. This situation would be likely to occur in, but may not be limited to Units 66 and 67 where large diameter larch dwarf mistletoe infected trees exist. Here these trees are highly valued for their structural and aesthetic contributions within this recreation site.

Root Disease

As discussed, root disease is a disease of the site which can persist for many years and that has no cure. Forest management actions proposed in this project could have both positive and negative effects to root disease. Regenerating affected sites with susceptible species, and partial harvests that leave susceptible species could intensify root disease by providing additional food bases for the disease to colonize. Managing for root disease tolerant species is one of the most effective and cost efficient means of addressing root disease (Hagle 2004). In all alternatives, root disease tolerant western larch and pine species would be favored in both Intermediate and Regeneration Harvest. Despite this focus, some susceptible species could be retained in Intermediate Harvests and naturally regenerate in regenerated areas.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Past, current, and reasonably foreseeable actions on all lands within the analysis area were evaluated when considering the cumulative effects to forest vegetation associated with the action alternatives. Past actions that have affected the vegetation resource include forest management and other activities within the analysis area. These activities are discussed in the Existing Conditions Section of this EA and provide the baseline vegetation conditions.

As with the cumulative effects discussion for the No Action Alternative, when considering the cumulative effects of the action alternatives, the direct and indirect effects previously discussed would apply, in combination with current and reasonably foreseeable activities. The activities, which discernibly affect forest vegetation, are identified in the Cumulative Effects Worksheet (Project File Exhibit I-2).

FOREST COMPOSITION

The cumulative effects to forest composition from the action alternatives, current and reasonably foreseeable overstory removal harvest and continued fire suppression would only differ in scale from the effects described in the direct and indirect effect discussion.

Approximately 154 acres of overstory removal harvest has occurred on Legacy lands within the analysis area in a sale called "Fredswood," and 173 acres of overstory removal harvest on TNC owned Section 13, T.20N., R.17W. prior to acquisition by the Forest Service via the Land and Water Conservation Fund. This treatment increased representation of seral species by favoring them for retention. Table 3- 27 includes these activities with the proposed action alternative treatments.

TABLE 3- 27 CUMULATIVE ACRES OF TREATMENTS BY ALTERNATIVE.			
TREATMENT	ALTERNATIVE		
	B	C	D
Clearcut with Reserves	240	229	217
Seed Tree with Reserves	463	405	347
Shelterwood with Reserves	70	51	31
Commercial Thinning	851	624	361
Sanitation/Salvage	8	11	5
Improvement Cutting	117	117	84
Pre-Commercial Thinning	343	343	95
Current and Foreseeable Overstory Removal	327	327	327

TABLE 3- 27 CUMULATIVE ACRES OF TREATMENTS BY ALTERNATIVE.			
TREATMENT	ALTERNATIVE		
	B	C	D
Cumulative Total	2,419	2,107	1,467

FOREST STRUCTURE

The cumulative effects to forest structure are similar to the direct and indirect effects of the action alternatives. Continued fire suppression, relatively low levels of current or foreseeable forest management, and land development are the only activities that could cumulatively affect forest structure.

The 327 acres of overstory removal that occurred on Legacy and TNC lands decreased stand densities, modify average stand diameters, modified vertical structure from a two-storied structure to primarily a single-storied structure, and alter fuel arrangements.

Here again, land development likely affected forest structure by converting forested areas to non-forests.

SERIAL STAGE DISTRIBUTION

Aside from the proposed actions, little current or reasonably foreseeable regeneration (either natural or human caused) would be expected.

INSECT AND DISEASE CONDITIONS

Again, the cumulative effects to forest insect and disease conditions would be similar to direct and indirect effects of the action alternatives when considering other current and reasonably foreseeable activities. Since current and reasonably foreseeable activities that would affect insect and disease conditions are limited, the effects discussed above could be compounded as conditions across all ownerships remain unchanged.

There are possibly some exceptions to this. Depending on stand and insect and disease conditions, the 327 acres of overstory removal harvest on Legacy and TNC lands likely had little effect to the overall trends for insect and disease. The potential effects of the Beaver Creek project lie outside of the analysis area for forest vegetation, but might have a positive effect in decreasing mountain pine beetle populations through the reduction in lodgepole pine dominated stands, although both mountain pine beetle and lodgepole will continue to persist in forest stands in the Glacier Loon project area.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change in MA designation on approximately 221 acres. Specifically, 213 acres would change from MA 15 to MA 5 and 8 acres would change from MA 15C to MA 5 along Lindbergh Lake. The direct effects of this change are reflected in the previous action alternative effects discussions due to deferral of proposed treatments in this area. These changes would, however, have some long term-effects that will be discussed relative to the measurement indicators used in this analysis.

This change would generally result in less silvicultural activities occurring as scheduling of timber harvest within MA 5 would be primarily limited to those treatments which maintain or enhance the scenic quality of the area. As such, the previous No Action effects discussion applies to these areas.

FOREST COMPOSITION

The long-term effects to species composition would be likely to include decreased proportions of long-lived, fire-tolerant, shade-intolerant species (primarily western larch and ponderosa pine) in some areas and increased representation of shade tolerant species, such as grand fir, subalpine fir, and Douglas fir in other areas.

FOREST STRUCTURE

As stand dynamics progress, two -storied and/or multi-storied stand structures would continue to develop and would likely dominate the area. Density would be expected to slowly and gradually increase as trees grow larger, tree crowns expand, and shade tolerant ingrowth occurs.

SERAL STAGE DISTRIBUTION

Distribution of seral stages would be similar to the existing condition with eventual shifts into mid- and late-seral conditions. In the absence of natural disturbance, early seral stages would be absent.

INSECT AND DISEASE CONDITIONS

Trees and stands in this area would continue to experience the effects of the major insect and disease agents observed, mountain pine beetle, western larch dwarf mistletoe, and root disease.

REGULATORY FRAMEWORK AND CONSISTENCY**NATIONAL FOREST MANAGEMENT ACT (NFMA)**

NFMA and accompanying regulations require that several specific findings be documented at the project level and include the following:

SUITABILITY FOR TIMBER PRODUCTION

The NFMA requires that no timber harvesting shall occur on areas classified as not suited for timber production, except salvage sales, sales necessary to protect other multiple-use values, or activities that meet other objectives on such lands, if the Forest Plan established that such actions are appropriate.

The silvicultural diagnosis process and the Forest Plan were used to determine that all areas associated with this project are suitable for timber harvest using the following criteria:

- Meet the definition of forestland;
- Technological feasibility exists to protect soil productivity and watershed protection. Forest Plan standards, Project Design Criteria, and applicable BMPs will be used to protect these resource values.
- There is reasonable assurance that lands can be restocked within 5 years of final harvest.
- None of the areas considered for harvest have been withdrawn from timber production

As stated earlier, all areas proposed for treatment are within MAs where timber harvest is allowed per Forest Plan direction.

MAINTENANCE OF THE DIVERSITY OF PLANT AND ANIMAL COMMUNITIES

Forest Plan (including Amendment 21) goals, objectives, standards, and guidelines address maintaining a diversity of vegetation and habitats across the forest to meet a variety of wildlife species and to provide for sustained yield of timber products. In addition to applying this Forest Plan direction, project designs prescribed by the Project Wildlife Biologist and Botanist also address plant and animal community needs.

APPROPRIATENESS OF EVEN-AGED MANAGEMENT AND OPTIMALITY OF CLEARCUTTING

The NFMA directs that clearcutting be used only where "it is determined to be the optimum

method.” Other even-aged methods can be used where “determined to be appropriate.” As stated in the treatment description section of this EA, the silvicultural diagnosis process was used to evaluate and determine that clearcutting is the optimal treatment to meet management objectives where proposed. Other even-aged methods are proposed as they are most compatible with the disturbance regimes found in the analysis area and the adapted silvics of desired shade intolerant species.

NATIONAL FOREST MANAGEMENT ACT FINDINGS FOR VEGETATION MANIPULATION

All proposals involving vegetation manipulation of tree cover for any purpose must comply with the following requirements.

- Best suited to the multiple-use goals stated in the Forest Plan for the area with impact. All proposed treatments are consistent with multiple-use Forest Plan direction and address the project’s Purpose and Need.
- Assure that the lands can be adequately restocked within 5 years. Previous Regeneration Harvests in the analysis area have been successfully stocked within 5 years. Regional reforestation indices also support that reforestation techniques have been successful and the 1980 to 2008 average 3-year survival of trees planted on the Flathead National Forest is 73 percent.
- Not chosen because they will give the greatest dollar return. Although timber harvest associated with this project would generate revenue, all treatments have been designed to meet project objectives not revenue generation.
- Be chosen after considering the effects on residual trees and adjacent stands. The effects to residual trees and adjacent stands were considered in the interdisciplinary development of this project. Residual tree protection measures are included in the Design Criteria section of this EA.
- Be selected to avoid permanent impairment of site productivity and to ensure conservation of soil and water resources. The Soils and Water Resources Sections of the Glacier Loon EA include protection and enhancement designs sufficient to ensure conservation of the resources.
- Be selected to provide beneficial effects to water quality and quantity, wildlife and fish habitat, regeneration of desired tree species, forage production, recreation uses, aesthetic values, and other resource yields. Following Forest Plan and MA direction, an ID Team considered all of these resources in the context of the surrounding landscape and this project as documented in the EA.
- Be practical in terms of transportation and harvesting requirements and total costs of preparation, logging, and administration. Standard ground-based and skyline logging systems and log hauling is prescribed for this project and has been determined to be practical for this project and a sale feasibility analysis has been conducted.

FLATHEAD NATIONAL FOREST PLAN DIRECTION

As discussed in the Desired Conditions Section of this EA, all planned activities would be consistent with Forest-wide and MA direction.

NORTHERN REGION DIRECTION ON HARVEST OPENING SIZE

Forest Service Manual 2470, Section 2471.1, Region 1 Supplement 2400-2001-2 generally limits the size of harvest openings created by even-aged silvicultural methods (clearcut and seedtree harvests) to 40 acres or less. To exceed this size, Regional Forester approval is required except where natural catastrophic events have occurred. The Glacier Loon Project proposed action

(Alternative B) would create one opening greater than 40 acres, represented by two units (47 and 48) that are connected to each other. Opening size could be as large as 88 acres (refer to unit tables and maps in Chapter 2). However, it is likely that during on the ground contract design, this large unit will be broken into smaller units due to field conditions. This opening would not be devoid of trees. It would contain from 5 to 15 trees per acre, scattered or clumped depending upon existing tree distribution. Table 3- 28 below lists the proposed harvest units that form this opening and the rationale for the unit design, as well as a map of their location.

TABLE 3- 28 UNITS THAT CREATE OPENING SIZES EXCEEDING 40 ACRES					
Unit	Alt. B Total Opening Acres	Alt. C Total Opening Acres	Alt. D Total Opening Acres	Proposed Treatment ¹	Rational for Exceeding 40 Acres and other Notes ²
47	12	12	0	CC/R	Primarily lodgepole pine
48	76	76	76	CC/R	Primarily lodgepole pine
¹ CC/R = Seedtree with Reserves ² Abbreviations: DF = Douglas-fir; LP = lodgepole pine; WL = western larch; AO = Armillaria root rot; DMT = dwarf mistletoe; MPB = mountain pine beetle; PVT = private; RHCA = riparian habitat conservation area; WUI = wildland urban interface					

The opening would be irregularly shaped or elongated, which reduces the potential impact of the opening to wildlife or visual appearance. All openings will meet grizzly bear hiding cover requirements such that no point in the unit is greater than 600 feet to cover. All openings consist of lodgepole pine dominated forests that have been impacted by MPB or are at risk of infestation. These stands are deteriorating and restoring a vigorous new stand on the site is desirable to meet project objectives. Without treatment these areas would likely become forest openings in the future due to high mortality from MPB or windthrow. Openings are in the (WUI and reducing excessive existing or potential fuel loadings caused by high stand densities or high tree mortality rates is a primary reason for the treatments.

Regional direction requires a minimum 60-day public notice of openings over 40 acres in size. This will be accomplished through the public review of both the Glacier Loon Project EA and EA. Also, as required, at least 45 days before the NEPA decision is signed, the Flathead National Forest Supervisor will submit a recommendation to the Regional Forester for exceeding specified opening size limits. The necessary approval from the Regional Forester will be received prior to signing the NEPA decision.

FOREST SERVICE MANUAL AND HANDBOOK

The FSH 2409.17 Silvicultural Practices direction was referenced and applied to the development of this project.

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INVASIVE PLANT SPECIES

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA. As a result, the effects to invasive species have not changed between the August 2012 EA and this Supplemental EA.

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 species (both plant and animal) create more than \$138 billion in losses each year nationally (USDA 2001d). 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 2001d). On NFS lands, an estimated 6 to 7 million acres are currently infested and increasing 8 to 12 percent per year (USDA 1995a). 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, increasing soil erosion, etc.). Non-native invasive species generally have no natural control in the place to which they are introduced, allowing them to spread aggressively and out-compete native plants and reduce overall native community biodiversity.

Forest Service Policy (EO 13112; FSM 2900) 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 1995a, 2001e; USDA Forest Service 2011a).

The desired condition inferred from EO 13112, FSM 2900, and the 2001 Flathead National Forest Noxious and Invasive Weed Control (NIWC) EA and DN 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.

ANALYSIS AREA

SPATIAL BOUNDS

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 average skidding distance logging equipment can potentially move vegetation and soil.

TEMPORAL BOUNDS

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, could persist indefinitely even after the canopy closes. The risk of invasive plant introduction and spread could occur immediately after activities begin, or until 5 to 10 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.

INVASIVE SPECIES MANAGEMENT

The Flathead National Forest implemented the NIWC DN, which evaluated the effects of treating invasive plants. The objective of the NIWC DN was to implement an adaptive and integrated pest management strategy to control and reduce the presence of invasive species on the Flathead National Forest. Currently inventory and treatment is prioritized by the Forest Weed Coordinator. The NIWC DN outlines factors for prioritization (Project File Exhibit T-5, 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 Flathead National Forest 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 reclaimed to make inferences on how invasive species became established in these old road beds. Observations of historical 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 Flathead National Forest 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.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

The Flathead National Forest 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 TNC and the Forest Service (2003). The WRA identified species that pose a threat to native vegetation in addition to Montana's State weed list.

As project areas are surveyed during each field season, new infestations are inventoried. Data for the Glacier Loon Project invasive species analysis was primarily collected by surveys in 2011 across approximately 4,355 acres (85 percent) of the proposed harvest units. The data is 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 infestation data to create a GIS layer for environmental analyses. There are still many infestations that have not been entered into the NRIS Database; however, NRIS has been updated with known infestations located between 2005 and 2011, which includes the project area.

MEASUREMENT INDICATORS

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, etc.

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 analysis 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 et al. 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). The ML of a road indicates the type of traffic it can accommodate (USDA 2005). 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 roads 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 that is open for traffic. 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 majority of roads in the project area are the lowest level, ML 1, which is reserved for closed roads that can have any drivable surface, but are not open for any use unless needed for project work or emergencies. The majority of ML 1, 2 and 3 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 that 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 automatically lead to increased rates of spread of invasive species, but can create favorable conditions for establishment of invasive plants (Christen et al. 2006). The removal of native vegetation and the compaction of the soil, which restricts native plant growth, allow invasive species to invade unchallenged (Trombulak et al. 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 can be 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 0 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 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 specified and temporary

roads, and road reclamation for an average of 6 acres per mile [based on 50-foot width including cut/toe slopes and road bed (personal communication with the Transportation Planner)].

In the Glacier Loon Project, some temporary roads would use historic road templates; however, new temporary road construction is proposed in all action alternatives. These new temporary roads would be reclaimed by any site-appropriate combination of the following:

- Removing any installed culverts or temporary bridges,
- Re-contouring the road template to natural ground contour,
- 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/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 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 could encourage establishment into 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 could die back. For example, tansy ragwort could 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 will help to determine risk of introduction/spread and risk of establishment/persistence.

AFFECTED ENVIRONMENT

HISTORICAL 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, timber production, and livestock grazing (Parks et al. 2005). Exotic seed and plant material were transported with grain and feed, as well as 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 restricted access to 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. On the Flathead National Forest, most of these activities began on a large scale in the 1960s. Some roadless areas remain relatively invasive-free because of healthy undisturbed native plant communities where few vectors exist to spread invasives.

The Flathead National Forest has been less affected than many other public lands since most invasive species are best adapted to grasslands, shrub lands, and warmer/drier forest types than those that exist here. However, the Flathead National Forest has many roads, landings, clearings, gravel pits, trails, campgrounds, private inholdings, and other areas that are disturbed and highly susceptible to infestation.

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 Department of Agriculture 2010). Currently, there are about 8,900 separately recorded invasive plant infestations on the Flathead National Forest, comprised of 28 invasive species on approximately 23,000 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. Eighteen of these species occur in the project area (Table 3- 29). The most abundant invasive species in the project area are Canada thistle, oxeye daisy, reed canarygrass, and spotted knapweed. Refer to Project Exhibit J-7 for species descriptions.

TABLE 3- 29 NON-NATIVE INVASIVE PLANTS FOUND WITHIN THE GLACIER LOON PROJECT AREA (INFESTED ACRES ARE ROUNDED TO NEAREST INTEGER).			
SPECIES	COMMON NAME	SITES	INFESTED ACRES
<i>Achillea nobilis</i>	noble yarrow	1	1
<i>Artemisia absinthium</i>	common wormwood	4	1
<i>Centaurea stoebe</i>	spotted knapweed	124	218
<i>Cirsium arvense</i>	Canada thistle	115	154
<i>Cirsium vulgare</i>	bull thistle	17	4
<i>Cynoglossum officinale</i>	hound's-tongue	18	4
<i>Hieraceum</i> spp.	hawkweed	59	30
<i>Hypericum perforatum</i>	common St. John' s wort	36	33
<i>Leucanthemum vulgare</i>	oxeye daisy	76	123
<i>Linaria dalmatica</i>	Dalmation toadflax	4	1
<i>Linaria vulgaris</i>	yellow toadflax	11	1
<i>Phalaris arundinacea</i>	reed canarygrass	23	92
<i>Potentilla argentea</i>	silvery cinquefoil	4	1
<i>Potentilla recta</i>	sulphur cinquefoil	18	4
<i>Ranunculus acris</i>	tall buttercup	2	1
<i>Tanacetum vulgare</i>	common tansy	4	1
<i>Tragopogon dubuis</i>	yellow salsify	3	7
TOTAL		519	676

The Swan Lake District has 28 percent of the infestations on the forest (3,102 sites, 5,277 infested acres, 21 species). There are five districts on the forest, which means that Swan Lake has a large part of the infestations on the forest. Much of the infested acreage is most likely due to the patchwork of mixed ownership in the Swan Valley. Much of the land has, until recently, been owned by PCTC. The project area has about 4 percent of the infestations on the forest and 13 percent of the District's infestations.

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 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 Project Exhibit J-8 for infestation locations.

ENVIRONMENTAL CONSEQUENCES

The action alternatives all propose various amounts of harvest prescriptions and temporary road construction (Table 2- 16). Alternative B proposes the greatest amount of harvesting and road construction, while Alternative D has the least amount of harvesting and road construction. Alternative C is between the two in regards to amount of harvest acres and miles of temporary road.

ALTERNATIVE A – NO ACTION ALTERNATIVE DIRECT AND INDIRECT EFFECTS

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 could 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.

The No Action Alternative 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 the No Action Alternative does not propose 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 the lowest of all action alternatives.

ALTERNATIVE A – NO ACTION ALTERNATIVE CUMULATIVE EFFECTS

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 previous invasive species control decision (Project File Exhibit T-5).

There are many areas of disturbed soils (roads, trails) and open bare ground across the Swan Lake Ranger District, which can provide habitat for invasive species. Most notably are the newly acquired PCTC lands, commonly referred to as Legacy lands. Approximately 47,000 acres of PCTC lands changed ownership in the Swan Valley. Much of this land has regenerating forest stands and are abundant with invasive plants. There are areas of private land development in the project area that have 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 of these activities would be 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 Glacier Loon 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 could be susceptible to invasive species establishment. The areas that would have a higher risk of spread following a wildland fire are adjacent to roads, recreational trails, and suppression activities.

Independent of this project, the Flathead National Forest 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; however, it could also affect native plant species. The Flathead National Forest also uses biological control on tansy ragwort, spotted knapweed, Canada thistle and St. John's wort. These species-specific organisms have spread on their own, as well as with human help, into the project area. Currently, the Flathead National Forest treats many of the roads in the project area (Project File Exhibit J-10). Many are treated annually and some would be treated in 2012 for the first time in support of the Collaborative Forest Landscape Restoration Program (CFLRP).

The Swan Lake Ranger District has benefited from CFLRP, starting in 2009 and ending in 2019. This Act has supplemented the District's regular programs with funding for restoration projects. Weed spraying through contracts has been a large part of the program. With CFLRP, the Swan Lake Ranger District has been able to control many more infestations in a short amount of time than the usual Forest Program would be able to sustain. Many of the roads in the Glacier Loon Project Area would benefit from this project.

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

Chapter 2 (Table 2- 16) 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

All units proposed for vegetation management in all action alternatives contain known infestations or are within 0.25 miles of an infestation. There is likely 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 (Project Exhibit J-8). Many invasive species, like spotted knapweed, cannot survive under closed canopies. When vegetation recovers after activities cease, it can be assumed that any existing infestations of sun-loving invasive species would recede over time. However, some species like hawkweed and Canada thistle can grow under the canopy and would need treatment to control their spread. Infested open areas within units would most likely persist after activities cease unless controlled.

The infested units have a high risk of spread when heavy equipment moves through them, disturbing the soil and removing canopy cover. Units which are not currently infested but have infestations within 0.25 miles 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. Alternative D has the least amount of risk of introduction and spread.

Ninety-three percent of the 140 miles of road corridors (system and non-system roads; National Forest System and other ownership) in the project area either contain or are within a 0.25 miles of an infestation (Figure 3- 7). There are likely more road prisms on the ground than in the GIS layer, and there are likely more infestations along roads that have not yet been inventoried. Reclamation is proposed for newly constructed temporary roads. Figure 3- 8 shows the total miles of proposed road construction within 0.25 miles of an infestation, by alternative. There are also some roads proposed for decommissioning in all action alternatives. Alternative B has half

as many miles proposed for decommissioning as the other two action alternatives. Decommissioning ranges from water-proofing the road to obliteration and recontouring.

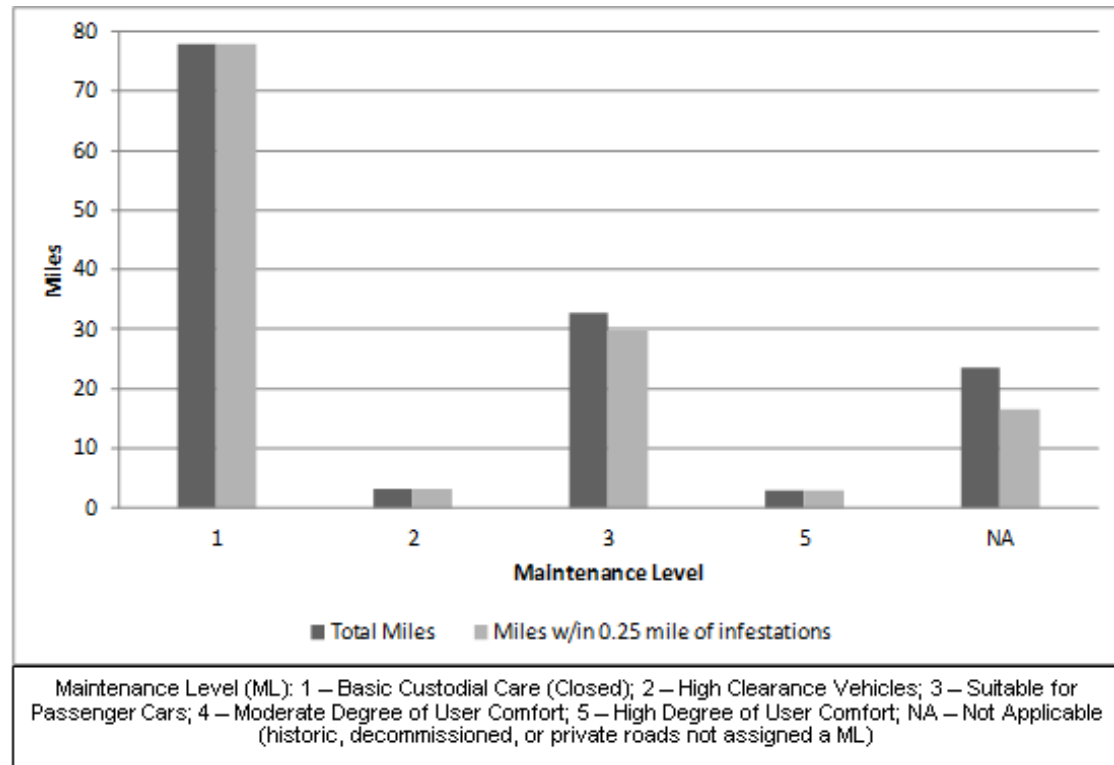


Figure 3- 7 Total Miles of Existing National Forest System Road and Miles of Existing Road within 0.25 Miles of an Infestation in the Glacier Loon Project Area.

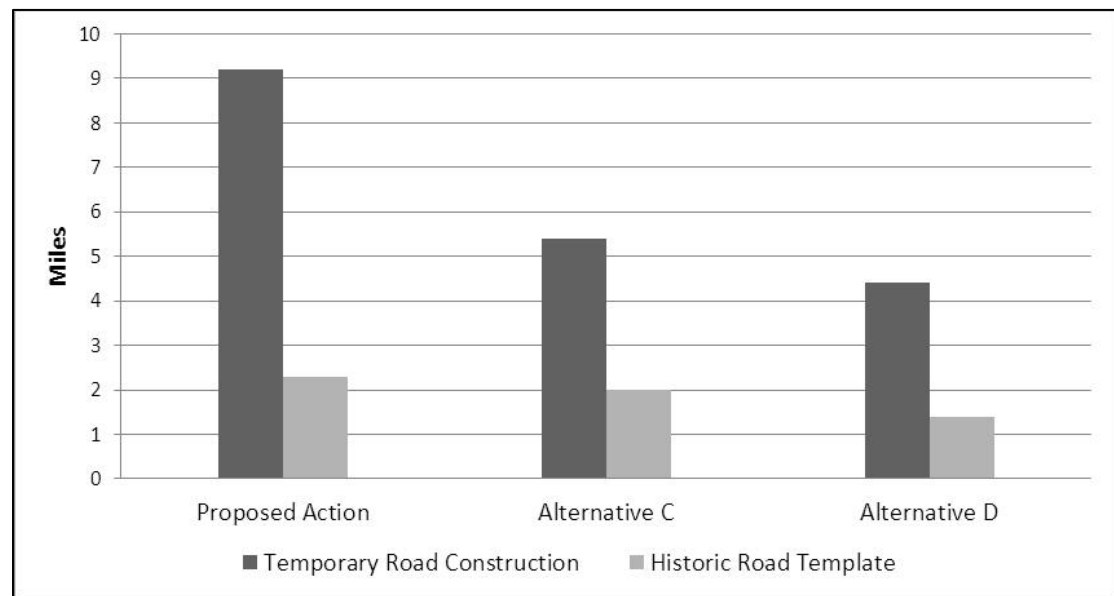


Figure 3- 8 Total Miles of Proposed Temporary Road Construction within 0.25 Miles of an Infestation by Alternative in the Glacier Loon Project Area.

Some the proposed temporary road templates would be constructed on historic road templates.

These historic road templates are likely infested. In areas of new road construction, there could be infestations nearby, especially on parent roads. There could be a high risk of moving seed from the infested main roads down the proposed temporary roads and introducing invasive species, if they are not already present, to natural areas. The existing roadside infestations would likely spread onto the 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 and it cannot be changed at the Forest level. Although this is desired, this action would be economically impractical for the contractor(s), as well as futile in this project area with its widespread infestations. Use of dedicated skid trails would minimize the risk of spread across units (See Design Criteria, Table 2- 16). Alternative D has the fewest miles of road proposed of all the action alternatives 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, OHV use, 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 ML 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 certainly 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 (Figure 3- 7). 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. Invasive plant seeds spread by equipment from unit to unit ideally could be limited by cleaning machinery between unit operations; however, it is impractical for the contractor to clean equipment multiple times during logging operations. Drifting seed would establish easier on prepared soil than on intact soil. Harvesting equipment and temporary road activities would detrimentally disturb up to 164 acres in Alternative B, 148 acres in Alternative C, and 101 acres in Alternative D (See the Soil Section in this EA 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 D 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 other action alternatives.

Temporary roads would be built for unit access, as well as portions of historic roads would be used to implement this project, in all action alternatives. These activities include new temporary road construction and reclamation, road maintenance, BMPs, and reconstructing historical road corridors for temporary access. These activities would create new ground disturbance for potential weed establishment, as well as disturb existing weed infestations along the historical routes. All the action alternatives propose varying amounts of temporary road construction, both new construction and re-construction over the historical template (Table 2- 16). Regardless of proposed reclamation activities, these road activities would disturb soil and existing infestations, which would change the landscape in those areas for the long term. Seeding, where necessary, would minimize the risk of establishment of invasive species (See Design Criteria, Table 2- 16). Native or desired non-native species would compete with invasive species on disturbed soils of the reclaimed temporary roads. However, temporary roads constructed over the historical template would remain on the landscape, as these roads would not be completely reclaimed via revegetation. Some roads would be recontoured to the natural ground contour to facilitate natural hydrologic processes. Soil compaction and disturbance of native vegetation 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.

There are a few proposed units in each alternative that require winter harvesting (See Soil Design Criteria for units and description). These units are not heavily infested with weeds, which winter logging would benefit. With frozen soil and 10 inches of snow, there would not be any soil disturbance. Ideally, snow would weigh down and cover any existing weed seed heads, reducing the amount of seed transported by equipment. With no soil disturbance, and fewer seeds moving on the landscape during winter, these units would not see a sizeable increase of infestations.

In addition to harvest activities, resource enhancement projects are proposed in all alternatives. One resource enhancement project is addressed below. The other resource project proposes to replace a culvert between Meadow Lake and Bunyan Lake on NFS Road #9552, as well as some trailhead work (NFS Road #351). This would result in movement and disturbance of the road surface to remove the culvert and install a larger culvert or bridge at the site. National Forest System Road #9552 is infested with weeds; disturbing the area would increase the amount of weeds; and, if equipment is not washed, there would also be movement of weed seed down NFS Road #9552.

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 a unit recovers following thinning harvest, 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 harvest, the longer the habitat would remain suitable for sun-loving species, and the longer the risk of establishment and persistence would exist.

The amount of light reaching the forest floor could 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 canopy (Project Exhibit J-9). Figure 3- 9 shows how many acres 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.

While the closure of overstory could limit the duration of the risk of establishment and persistence for some sun-loving species, it could elevate and prolong that risk for shade and edge-tolerant species, such as hawkweed and Canada thistle, since these species could quickly colonize an area before the native vegetation has a chance to recover once activities cease. Currently, every unit within the Glacier Loon Project Area is infested with at least one of these edge species or within 0.25 miles of these species (Project Exhibit J-8).

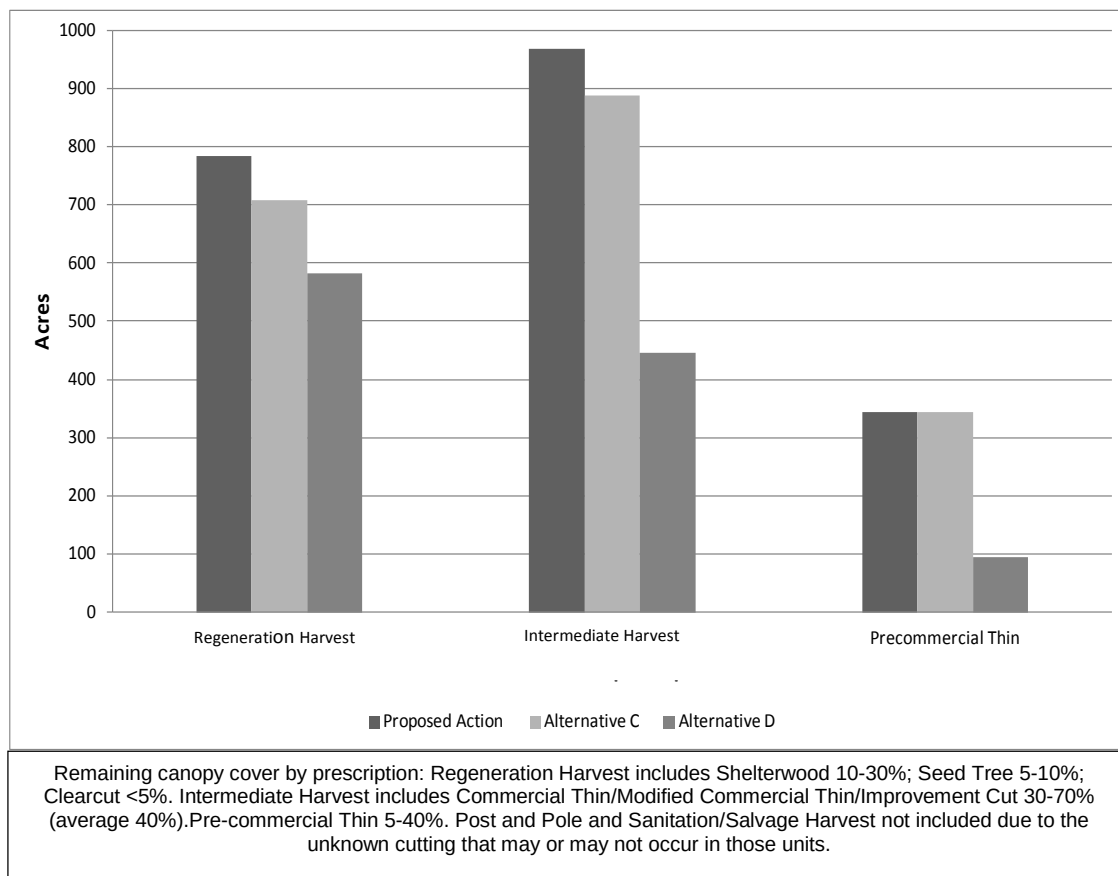


Figure 3- 9 Increase in Light Availability by Alternative.

Intermediate Treatments, like Commercial Thinning, would leave 70 percent or less of the canopy, with an average of 40 percent canopy cover retained (Project Exhibit J-9). Commercial Thinning would not have as high of a risk of sun-loving species spreading through the units as regeneration harvests; however, there would still be a moderate risk of introducing and spreading sun, shade, and edge-tolerant species. Of the action alternatives, Alternative B would have the highest increase in light availability, and Alternative D would have the lowest increase of light availability.

Other activities, like tree planting, could also contribute to the risk of introduction and spread. Associated vehicles and personnel could be vectors for introduction and spread. However, planting activities would be short-term with minimal impact to the soil. In addition, planting conifers 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. As discussed in Chapter 2, tree planting varies by action alternative. The remainder of the treatment units would be either site prepped or left alone for natural regeneration. Alternative B would plant the most conifers, providing the most revegetation; however, since Alternative B removes the

most vegetation, the revegetation activities would not greatly diminish the harvest effects.

The other resource enhancement project proposes shrub planting at the bottom of a draw that currently has an old road template or skid trail. The area has weeds infesting the draw, which drains into a pond occupied by water howellia. Approximately 400 shrubs would be planted. As described with tree planting, there would be some soil disturbance while planting, but with shrub growth comes less light onto the ground. The established weeds would have competition for light and any introduced weeds would struggle to survive. According to 2011 surveys, oxeye daisy, spotted knapweed, and hawkweed occupy the area. Although the hawkweed would most likely survive under the shrub canopy, the daisy and knapweed could diminish with time. Chemical treatment would be necessary to completely eradicate these infestations.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

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, forest products gathering, invasive species control, land development, special use permits, and other activities. 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 source of invasive plant seed, had and would 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 on the Forest in the NRIS Database is 2003, and the earliest chemical treatment record is from 1991, but there have been invasive species on the Flathead National Forest for much longer. Previous activities (timber harvest, road construction and maintenance, recreation, land development, agriculture, 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. Refer to the Cumulative Effects Worksheet (Project File Exhibit J-5) for additional information on cumulative effects to invasive species.

PROXIMITY OF KNOWN INFESTATIONS

The project area contains approximately 3 percent of infestations across the Forest and 8 percent of the Swan Lake Ranger District's known infestations (Table 3- 30). This is due to the many activities 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 could 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 roads. Many of the main haul routes would be along main access roads, which are already treated for weeds under a previous decision (Project Exhibit J-10).

TABLE 3- 30 NON-NATIVE INVASIVE SPECIES FOUND FOREST-WIDE AND IN THE GLACIER LOON PROJECT AREA.				
SCIENTIFIC NAME	COMMON NAME	FOREST ACRES	DISTRICT ACRES	PROJECT ACRES
PRIORITY 1A - NOT PRESENT IN MONTANA				
<i>Centaurea solstitialis</i>	yellow starthistle	0	0	0
PRIORITY 1B - LIMITED PRESENCE IN MONTANA				
<i>Butomus umbellatus</i>	flowering rush	0	0	0
<i>Chondrilla juncea</i>	rush skeletonweed	0	0	0
<i>Cytisus scoparius</i>	Scotch broom	0	0	0

TABLE 3- 30 NON-NATIVE INVASIVE SPECIES FOUND FOREST-WIDE AND IN THE GLACIER LOON PROJECT AREA.				
SCIENTIFIC NAME	COMMON NAME	FOREST ACRES	DISTRICT ACRES	PROJECT ACRES
<i>Isatis tinctoria</i>	dyer's woad	1	0	0
<i>Lythrum salicaria</i> , <i>L. virgatum</i>	purple and wandlike loosestrife	0	0	0
<i>Myriophyllum spicatum</i>	Eurasian water milfoil	0	0	0
<i>Polygonum cuspidatum</i> , <i>P. sachalinense</i> , <i>P. polystachyum</i>	Japanese knotweed complex	1	0	0
<i>Potamogeton crispus</i>	curlyleaf pondweed	0	0	0
PRIORITY 2A - COMMON IN ISOLATED AREAS IN MONTANA				
<i>Berteroa incana</i>	hoary alyssum	1	0	0
<i>Echium vulgare</i>	blueweed	0	0	0
<i>Hieracium aurantiacum</i>	orange hawkweed	2598	388	24
<i>Hieracium caespitosum</i> , <i>H. floribundum</i> , <i>H. piloselloides</i> , <i>H. pratense</i>	yellow hawkweed complex	1815	494	6
<i>Iris pseudacorus</i>	yellowflag iris	0	0	0
<i>Lepidium latifolium</i>	perennial pepperweed	0	0	0
<i>Ranunculus acris</i>	tall buttercup	30	17	1
<i>Senecio jacobaea</i>	tansy ragwort	507	1	0
PRIORITY 2B - ABUNDANT AND WIDESPREAD IN MONTANA				
<i>Cardaria draba</i>	whitetop	0	0	0
<i>Centaurea repens</i>	Russian knapweed	0	0	0
<i>Centaurea diffusa</i>	diffuse knapweed	0	0	0
<i>Centaurea stoebe</i>	spotted knapweed	5532	2876	218
<i>Cirsium arvense</i>	Canadian thistle	3228	1337	154
<i>Convolvulus arvensis</i>	field bindweed	1	0	0
<i>Cynoglossum officinale</i>	hound's-tongue	181	134	4
<i>Euphorbia esula</i>	leafy spurge	1	0	0
<i>Hypericum perforatum</i>	St. John's-wort	2131	415	33
<i>Leucanthemum vulgare</i>	ox-eye daisy	4107	2244	123
<i>Linaria dalmatica</i>	Dalmatian toadflax	2	2	1
<i>Linaria vulgaris</i>	yellow toadflax	67	13	1
<i>Potentilla recta</i>	sulphur cinquefoil	400	284	4
<i>Tanacetum vulgare</i>	common tansy	295	160	1
<i>Tamarix</i> spp.	salt cedar or tamarisk	0	0	0
REGULATED PLANTS - NOT LISTED AS NOXIOUS IN MONTANA				
<i>Bromus tectorum</i>	cheatgrass	19	12	1
<i>Hydrilla verticillata</i>	hydrilla	0	0	0
<i>Eleagnus angustifolia</i>	Russian olive	0	0	0
ADDITIONAL INVASIVES OF CONCERN FOR THE FLATHEAD NATIONAL FOREST				
<i>Achillea nobilis</i>	noble yarrow	12	3	1
<i>Arctium minus</i>	common burdock	1	1	0
<i>Artemisia absinthium</i>	common wormwood	274	99	1
<i>Campanula rapunculoides</i>	creeping bellflower	1	0	0
<i>Carduus nutans</i>	musk thistle	0	0	0
<i>Cirsium vulgare</i>	bull thistle	879	185	4
<i>Euphorbia</i> species	spurge (all)	0	0	0
<i>Phalaris arundinacea</i>	reed canarygrass	753	670	92
<i>Potentilla argentea</i>	silvery cinquefoil	80	47	8
<i>Tragopogon dubuis</i>	yellow salsify	346	18	7
Total		23,271	9,402	762

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 would be transported. Unpaved roads (ML 1-3) tend to have vegetation growing along the sides or down the middle that hang directly over the road bed which could 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 would not drive off of the pavement, and therefore would not travel through infestations. However, these vehicles could create wind at high speeds, which is a vector for spread. Unfortunately, there are no preventative measures to reduce the risk of spread except for public education. The Flathead National 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 3, which indicates the traffic flow is low, yet the risk of picking up seed and spreading it would be high if there are infestations along the road corridor. The majority of roads in the project area are closed to vehicles (historical roads and 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 (Figure 3- 7).

In the action alternatives, the Glacier Loon Project proposes to build new temporary roads and use historical road templates for some of those roads. New temporary 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 and 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.

The historical road template has been left behind from previous actions such as other vegetation management projects. Although these past projects disturbed soil and fragmented the landscape and vegetation, the roads they left behind are useful now when project activities are planned in the same areas. There would still be ground disturbance as a result of the use of these templates and the subsequent "water-proofing" of the temporary roads after project implementation. Closing these roads would be both beneficial and detrimental. The benefit of closing the road corridor would be restricting human vectors from moving existing infestations around the landscape and allowing the native vegetation to grow back over the corridor. The drawback to obliterating an infested corridor would be allowing infestations to continue untreated. Design Criteria (Table 2-16) would require an equipment-cleaning clause, spraying along haul routes before project activities, and seeding disturbed areas with an approved seed mix. Yet, unfortunately, the risk of introduction, spread, and establishment would still be high due to the amount of weed infestations in the project area.

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 1 percent of the soil on NFS lands (See Soils Section of this EA). All action alternatives would affect less than 1 percent of NFS lands in the project area (Table 3- 31). Much of the NFS lands in the project area have been disturbed by other means, mostly through fire, timber management, and road construction, which means that much of the project area contains suitable conditions for infestations. Although there is a required equipment cleaning clause in the Timber Sale Contract, the problem would occur when equipment travels through existing infestations, moving infested soil or plant material. 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 D would have the least amount of cumulative soil disturbance. The risk of establishment and persistence would be moderate because of widespread infestations in primary access corridors. Fire effects were not considered in the vegetation management calculations.

TABLE 3- 31 CUMULATIVE EFFECTS SUMMARY OF SOIL DISTURBANCE AND LIGHT AVAILABILITY IN THE PROJECT AREA.						
	PROPOSED ACTION		ALTERNATIVE C		ALTERNATIVE D	
	ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
SOIL DISTURBANCE (ACRES)**						
Past	20	<1	20	<1	12	<1
Present	164	<1	148	<1	101	<1
Reasonably Foreseeable	0	0	0	0	0	0
Total	184	<1	168	<1	113	<1
LIGHT AVAILABILITY (INCREASE IN ACRES)						
Past***	10,303	35	10,303	35	10,303	35
Present	783	3	698	2	605	2
Reasonably Foreseeable	101	<1	101	<1	101	<1
* Percentages (percent) are of the total amount of NFS land in the project area. **Detrimental soil disturbance acreage from Soils Section of this EA. ***Numbers reflect total acres affected by activities, which may be counted multiple times due to the canopy recovering prior to the next activity. Providing totals would not be an accurate reflection of the existing condition.						

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 would be 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.

LIGHT AVAILABILITY

Past harvesting in the project area increased the amount of acres with more light availability by 35 percent (Table 3- 31). Generally, acres which are opened up by activities would be 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. This project area has the unique circumstance of including recently acquired PCTC lands. The majority of those lands have been clearcut with little weed control following harvesting. The project would increase light availability from 2 to 3 percent depending on the alternative.

Known fire history includes fires from 1910 to present, although they have been occurring long before humans were in the area. The last wildland fire was the 44 acre Lindbergh Lake Fire in 2008. It created a mosaic burning pattern with some high-severity patches, but overall was not a severe fire. Generally, high-severity wildland fires completely burn up native vegetation, including the overstory, and create suitable conditions for invasive species to establish. Native vegetation is recovering since the last fire in the project area. It is possible that invasive species increased during that time, but without historical records, it would be difficult to make that assessment.

Considering the frequency of vegetation management in this project area, the forest canopy may not reach closure across all the impacted areas. Increasing light availability in the project area would carry 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.

FOREST PRODUCTS

Public use of forest products (firewood, boughs, berries, etc.) could contribute to the cumulative effects to invasive species. While obtaining forest products, forest users could introduce and/or

spread weed seed in their collection areas. Popular collection sites would have the most impact with repeated entries. The project area is adjacent to many other ownerships and access to NFS lands is abundant. Building more system roads, whether closed or open to motorized access, would allow more access to NFS lands. Temporary roads would be closed or reclaimed and public access would be short-lived. Collection of forest products occurs often and would continue to occur in the project area.

INVASIVE SPECIES CONTROL

The Flathead National Forest 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; however, it could also affect native plant species. The Flathead National Forest also uses biological control on tansy ragwort, spotted knapweed, Canada thistle, and St. John's wort. These species-specific organisms have spread on their own, as well as with human help, into the project area. Currently, the Flathead National Forest treats many of the roads in the project area (Project Exhibit J-10). Many are treated annually and some would be treated in 2012 for the first time in support of CFLRP.

The Swan Lake Ranger District has benefited from CFLRP, starting in 2009 and ending in 2019. This Act has supplemented the District's regular programs with funding for restoration projects. Weed spraying through contracts has been a large part of the program. With CFLRP, the Swan Lake Ranger District has been able to control many more infestations in a short amount of time than the usual Forest Program would be able to sustain. Many of the roads in the Glacier Loon Project Area would benefit from this project.

Without prevention measures, inventories, and treatment, the risk of spread would increase in this project area and would further affect suitable habitat. The Glacier Loon Project Design Criteria (Table 2- 16) 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 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.

RECREATION

Recreation across NFS lands has increased over the past few years and would continue to influence the spread of invasive species on the Flathead National Forest and in the Glacier Loon Project Area; however, the amount of ground disturbance and travel through infestations from hiking and camping, compared to large-scale vegetation management, would be much less and generally limited to established roads, trails, campgrounds, and a few dispersed locations. Campgrounds, hiking, biking and horse trails, motorized trails, lake and river access points, and other areas frequented by recreationists all require construction and maintenance. People and associated activities are vectors contributing to the introduction and spread of invasive species within the project area.

Dispersed and developed camping increases the risk of introducing invasive species to popular areas, as well as trampling of native vegetation surrounding these sites. The main developed campground in the project area is Lindbergh Lake Campground and Boat Launch. It is a very popular destination and experiences high numbers throughout its open season. The Weed Program treats campgrounds on a regular basis due to the number of visitors and the risk of those visitors providing vectors for weeds to move into the campgrounds and out onto the forest. Although the project would not affect the operation of the campground, the campground contributes to the risk of introducing weeds to the project area.

Trail construction and maintenance would 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. Other recreation activities, such as

off-trail hiking, hunting, trapping, outfitters and guides, berry picking, collection of other forest products, and horse riding could also provide vectors for the spread of invasive species. Although it does not seem that snowmobiling or cross-country skiing would affect invasive species, the creation of the trails, trail maintenance, and grooming removes native vegetation from the landscape and would create edge effects into adjacent forested areas. They could be a vector and spread invasive species through trail maintenance and recreationist travel over seed stalks during mild winters. There are a few trails in the project area that would not be affected by the Glacier Loon Project, but are contributors to the weed problem in the analysis area.

LAND DEVELOPMENT AND EXCHANGES

Past development and clearing on private lands most likely 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 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.

Recently the Forest Service acquired 4,461 acres of PCTC lands in the Glacier Loon Project Area. Much of PCTC management consisted of regeneration harvests with little or no weed treatment or prevention. This management has left the Forest Service with the problem of controlling thousands of acres of weeds. This land has been inventoried recently for invasive species and rare plants. Now, the Flathead National Forest is determining the best approach to control these infestations. As previously mentioned, CFLRP would be instrumental in weed control in the Glacier Loon Project Area.

OTHER ACTIVITIES

As with many other activities, special use areas, such as access roads and utility corridors, would increase the risk of introducing and spreading invasive species, as well as removing native vegetation. There are several road easements, many utility permits for fiber optics, phone and power lines, and various other special use permits.

There is one Forest Service gravel pit that has been used and would continue to be used in the Glacier Loon Project Area. A second Forest Service gravel pit is very near the project boundary. Gravel pits are a common seed source for invasive species to spread along roads and in recreation areas; wherever the gravel is used. Construction of the gravel pits removes all vegetation in the area, as well as the soil layers, making natural revegetation extremely difficult.

CONCLUSIONS

As observed on the ground, as well as through databases and GIS, this project area is densely infested with weeds. Eradication is infeasible, and control is extremely difficult with a patchwork of ownerships and a high amount of forest recreationists contributing to the weed problem. The risk of invasive species spread, introduction, establishment, and persistence as a result of project actions would be high in all action alternatives of the Glacier Loon Project, although Alternative D has a lower risk than the other action alternatives. Alternative B would carry the highest risk of introduction, spread, establishment, and persistence than the other action alternatives due to more soil disturbance, as well as travel through infestations, proximity to known infestations and increased available light in the road corridors. 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.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change in MA designation on approximately 221 acres. Specifically, 213 acres would change from MA 15 to MA 5 and 8 acres would change from MA

15C to MA 5 along Lindbergh Lake. The direct effects of this change are reflected in the previous action alternative effects discussions due to deferral of proposed treatments in this area.

This change would generally result in less silvicultural activities occurring as scheduling of timber harvest within MA 5 would be primarily limited to those treatments which maintain or enhance the scenic quality of the area. Timber harvest designed as such would typically be less frequent and at a lower intensity. This proposed MA change would reduce the risk of future spread and introduction of invasive species, although there would still be risk with any foreseeable actions since there would still be ground disturbing activities and canopy removal as a result of scenic prescriptions.

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 NIWC Decision Notice (Project File Exhibit T-5). These documents were designed to meet Forest Service policies for invasive species control and associated legal requirements. The Glacier Loon Project would incorporate and be consistent with the NIWC 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

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA. This section has been updated to reflect results of the U.S. Fish and Wildlife five year review that concluded that the threats to water howellia identified at the time of ESA-listing have been removed or largely minimized and has recommended it for delisting (USDI 2013). It also updated the amount of howellia occurrences in the Swan Valley and globally, and includes minor corrections to make the analysis more readable. The analysis of effects includes a modified determination of “may effect, not likely to adversely affect” that received USFWS concurrence (Project File Section AA). The analysis also considers that harvest activities on Legacy lands have been completed. Finally, the analysis has also been updated to account for increased buffered distances between vegetation management treatment units and unoccupied water howellia ponds to 300 feet (occupied water howellia ponds were already buffered by 300 feet in the original EA).

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 July 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. **Recently, the USFWS released a 5-year review of the status of water howellia and has found that the threats to water howellia identified at the time of ESA-listing have been removed or largely minimized and has recommended it for delisting (USDI 2013).**

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. **A recovery plan was finalized in 2007 (USDI 2007b).**

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 deadly pathogen, white pine blister rust (**Project File Section AA**). 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's Regional Forester added whitebark pine to the Regional Forester's Sensitive Species list, effective December 24, 2011 (USDI 2011c). **Since it is listed as a Regional Forester's Sensitive Species, it was analyzed in the BE for the Glacier Loon Project with other RFSS plants (Project File Exhibit J-2).**

Forest Service Sensitive Species Policy (FSM 2670) directs National Forests to assist states in achieving conservation goals for endemic species; complete Biological Evaluations (BE) 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 USFWS. The FSM (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 significant 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 Flathead National Forest also has an obligation to protect Montana State-listed rare plants.

ANALYSIS AREA

SPATIAL BOUNDS

THREATENED SPECIES

The analysis area for this proposed project is based on the area of the project's influence/impacts on known occurrences or potential habitat for water howellia. There are 81 known water howellia occurrences in the project area and 48 occurrences in close proximity to proposed units or haul routes. Water howellia occurs in glaciated ponds and old oxbows, which limits the analysis area to the direct, indirect, and cumulative impacts from project activities to these habitats. The analysis area for impacts to water howellia includes the pond habitat and the surrounding catch basin of the pond.

REGIONAL FORESTER'S SENSITIVE SPECIES

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.

TEMPORAL BOUNDS

The temporal bounds could be up to 100 years after project implementation (Kuopat 2009). The recovery of individual plants and populations after a disturbance event is species-specific and could 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 corms). Following project implementation, vegetation conditions could be suitable for some TES plant species to become established immediately, while other species could take between 50 and 100 years to return to the tree and shrub canopy cover conditions that are suitable habitat.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

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 analysis was conducted to evaluate the potential for additional sensitive plant occurrences within the activity areas. Sensitive and rare plant species are grouped in habitat guilds (Project Exhibit J-15). Known vegetation types and elevation ranges of the project area were considered in evaluating suitable habitat for rare plants. All proposed units were evaluated for potential habitat and those identified areas were surveyed for Threatened, Endangered, and Sensitive (TES) plants and invasive species.

Surveys for TES plants within the project area were conducted primarily during the 2011 field season across 4,355 acres (85 percent) of the proposed units. Additional surveys in proposed units will be completed in the summer of 2012. Project effects and Design Criteria (Table 2- 16) for invasive species management will be analyzed separately.

AFFECTED ENVIRONMENT

THREATENED PLANT SPECIES

WATER HOWELLIA (HOWELLIA AQUATILIS)

Water howellia occurrences are distributed throughout the Pacific Northwest in scattered clumps across Montana, Idaho, Washington, and California. There are 220 known occurrences in Montana, all in the Swan Valley. This is 72 percent of the known 306 global occurrences. Water howellia habitat has been subject to various management activities including dredging, draining, road construction, logging, and grazing (Shelly 1988; USDA Forest Service 1997). Reed canarygrass (*Phalaris arundinacea*), an introduced species, has threatened some populations across its range, while not impacting other populations (Lesica 1997; USDI 2013). The National Heritage Program Network (NHPN) has ranked this species as G3, meaning that it is at a moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors (NatureServe 2014). The Montana Natural Heritage Program (MNHP) has ranked the species as S2, which means at risk because of very limited and potentially declining numbers, extent and/or habitat, making it vulnerable to global extinction or extirpation in the state (MNHP 2014). Water howellia is currently listed as threatened by the USFWS.

TABLE 3- 32 GLOBAL ELEMENT OCCURRENCE BREAKDOWN OF WATER HOWELLIA BY OWNERSHIP (USDI 2013).

Montana	Forest Service	187
Montana	Forest Service / Private	5
Montana	Private	24
Montana	State	4
Idaho	Private	6
Washington	U.S. Fish and Wildlife Service	37
Washington	U.S. Department of Defense	23
Washington	State	3
Washington	Bureau of Land Management	1
Washington	Private	8
California	Forest Service	7
Oregon	Metro	1
	TOTAL	306

TABLE 3- 32 GLOBAL ELEMENT OCCURRENCE BREAKDOWN OF WATER HOWELLIA BY OWNERSHIP (USDI 2013). * Updated January 2014 (Flathead National Forest records, MNHP, and USFWS 5 year review).

Baseline conditions were prepared for only the Swan Valley meta-population. Because water howellia ponds are located in the valley floor in gentle rolling terrain, past activities such as road construction, timber extraction and other development has occurred frequently in areas where ponds occur. A summary of these human-influenced conditions, within a 300-foot buffer surrounding water howellia ponds, is displayed in Table 3- 33.

TABLE 3- 33 EXISTING CONDITION OF 218 KNOWN OCCURRENCES IN THE SWAN VALLEY (INTERPRETED FROM AERIAL PHOTOS).	
TIMBER MANAGEMENT (WITHIN 25 YEARS) *	
Adjacent to pond (to the edge of pond)	72
Within 300 feet of pond (not to edge of pond)	58
No activity within 300 feet of pond	88
ROADS	
Open road within 300 feet of pond	53
Closed road within 300 feet	71
No activity within 300 feet of pond	94
REED CANARYGRASS (PHALARIS ARUNDINACEA)	
Present within ponds**	27 of 62 ponds (monitored annually from 1998 to 2007)
LIVESTOCK USE IN PONDS	
Observed within ponds**	0 detected since monitoring began; 6 detected prior to 1998
*Harvest is only noted as occurring if it is evident from an aerial photo. A light or partial cut that is undetectable from the photo was not recorded as recent harvest. If the area was previously harvested but the canopy has recovered enough to where harvest activity is undetectable on the photo, then it is not considered recently harvested. ** surveyed in 2007	

The Forest Service recently acquired approximately 47,000 acres of PCTC lands in the Flathead National Forest in the Swan Valley. Many of the PCTC populations are now Forest Service populations. The majority, if not all of the populations, had clearcutting up to the edge of the ponds, only complying with State-required Stream Management Zones (SMZ). Now that these populations are on NFS lands, they can be protected by a 300-foot buffer as required in the Forest Plan.

Associated Plant Community

Water howellia is an aquatic plant restricted to small pothole ponds, or oxbows, long since isolated from the flowing surface waters of the adjacent river. These wetland habitats are generally shallow – about 1 meter (3.3 feet) deep, but the species has occasionally been observed in water up to approximately 2 meters (6.6 feet) deep. The ponds typically occur in a matrix of dense forest vegetation, and are nearly always surrounded in part by a small ring of deciduous vegetation. The bottom surfaces of the wetlands usually consist of firm consolidated silts and clays overlain by 0 to 24 inches of organic sediments. These ponds are generally filled by snowmelt run-off and spring rains, later drying out to varying degrees by the end of the growing season, depending on annual patterns of temperature and precipitation. Water howellia occurs between elevations of 3 meters (10 feet) in Washington to 1,372 meters (4,500 feet) in Montana; all Montana occurrences lie between 945 meters (3,100 feet) and 1,372 meters (4,500 feet), and are found only in the Swan River Valley from just south of the community of Swan Lake, south to the Clearwater/Swan Divide. In the Swan Valley, 216 ponds and 2 old river oxbows are known to contain water howellia.

In Montana, most water howellia occurrences are in glacially-formed ponds surrounded by

diverse coniferous forests. These forests are of mixed species that include: grand fir, subalpine fir, tamarack, Engelmann spruce, lodgepole, white pine, ponderosa pine and Douglas fir. The broadleaf deciduous tree most frequently associated with the pond margins is cottonwood, but aspen is often present. In the northern end of the Swan Valley, paper birch is found near some pond margins. Shrub species bordering the ponds include:

- alder
- red-osier dogwood
- common juniper
- alderleaf buckthorn
- Bebb willow

Aquatic herbaceous species commonly associated with water howellia are:

- blister sedge
- two-headed water-starwort
- water horsetail
- variable leaf pondweed
- white water crowfoot
- hemlock waterparsnip
- small bur-reed

Conservation Strategy and Recovery Goals

A Conservation Strategy for Water Howellia was completed in 1994 and adopted into the Forest Plan in 1997 (USDA 1997). In this Conservation Strategy, management prescriptions guiding the conservation of the species on NFS lands are provided. A recovery plan has been issued in draft form by the USFWS and is still in the review period. Because no final document has been issued, there are currently no recovery goals officially identified for the species.

In 1998, a 10-year monitoring plan was implemented to detect changes in species distribution and abundance; it was completed in 2007. This study assisted in evaluating if current management prescriptions for water howellia are sufficient for continued viability of the Swan Valley metapopulation. The results of the monitoring plan are in review. Continued monitoring is recommended.

The USFWS concluded their 5-year review of water howellia in 2013 (USDI 2013). Their conclusion was that the threats identified at the time of listing have been mitigated through regulatory mechanisms such as the conservation strategy and incorporation of mitigation measures, such as the 300-foot buffer, into land management planning and project-level decisions. Reed canarygrass threatening ponds has been successfully treated in some states and does not seem to be invading other habitat as previously thought. Land management activities have been removed or minimized for most of the howellia population, due to large buffers. Grazing has been removed from howellia habitat, as well. Other threats, such as climate change and small, isolated populations, may either benefit water howellia or threaten it. In addition to management changes to howellia habitat, there have been almost 200 additional populations documented since the time of listing, including sites previously believed to be extirpated in Oregon and California. Because of all of these factors, the USFWS is recommending delisting water howellia, while maintaining current conservation measures.

Occurrences and Surveys:

General surveys for potential water howellia in the Swan Valley have been conducted since 1987 and have continued to 2011. The Flathead National Forest, with the cooperation of Montana Natural Heritage Program and The Nature Conservancy, has surveyed the majority of identifiable potential water howellia ponds in the Swan Valley. Specific surveys for the Glacier Loon Project occurred in 2011. Each pond has been classified as occupied, unoccupied suitable habitat, or unsuitable habitat for water howellia. There are several occupied and unoccupied ponds (Table 3-34) within the project area, which have been buffered to 300 feet with the exception of a couple

ponds due to existing roads.

TABLE 3- 34 WATER HOWELLIA OCCUPIED AND UNOCCUPIED PONDS WITHIN THE GLACIER LOON PROJECT AREA.	
ELEMENT OCCURRENCE #	NEAR UNIT / HAUL ROAD
001	Units 60, 63, 216
002	NA
003	Road 79
004	Road 79
032	Road 79
033	Road 79
034	NA
035	NA
036	Units 61, 64, Road 79
037	NA
038	NA
039	Roads 11648B, 91229
040	Units 51, 215, Roads 11648B, 91229
041	NA
042	NA
043	Unit 51, Road 11648B
044	Unit 64, Road 79
052	NA
056	Unit 48
063	NA
064	NA
065	Road 91305
066	Units 7,8,10
067	Road 91305
068	NA
069	NA
084	Unit 38, Road 79Y
110	NA
111	Unit 39, Road 79Y
114	NA
118	Units 51, 215, 216
119	Road 561
120	Road 561
121	NA
122	NA
123	NA
124	NA
125	NA
126	NA
127	Units 20, 22, Road 9579
128	Units 19, 22, Road 9579
129	Unit 26, Road 9579C
136	Unit 204, Road 9578
137	NA
138	NA

TABLE 3- 34 WATER HOWELLIA OCCUPIED AND UNOCCUPIED PONDS WITHIN THE GLACIER LOON PROJECT AREA.	
ELEMENT OCCURRENCE #	NEAR UNIT / HAUL ROAD
139	NA
144	NA
145	NA
146	NA
147	NA
148	Unit 45, Road 9773
154	Units 59, 63, 64, Road 79
164	Hwy 83
165	Hwy 83
166	Hwy 83
167	Hwy 83
168	NA
169	NA
170	NA
171	NA
172	Unit 45, 46, Road 9773
173	Units 202, 203, 204, Road 9578
174	Units 202, 203
175	Units 202, 203, Road 90327
176	Units 202, 203
177	Hwy 83
178	Hwy 83
185	NA
186	NA
191	Unit 20, Road 9579
192	Units 25, 26, Road 9579
193	Unit 26, Road 9579
194	Unit 27, 28
195	Unit 26, 29, Road 9579
196	Units 26,29 Road 9579
197	Unit 29, Road 9579C
198	Unit 27, 29, Road 9579C
199	NA
200	Road 9579C
201	Road 9579C
204	Road 9591Y
u-006	Units 52, 53, 216
u-007	Units 47, 48
u-030	Road 90251
u-033	Unit 35
u-056	Unit 39, Road 79Y
u-057	Unit 39, Road 79Y
u-059	Unit 35, Road 79
u-TBD	Units 3, 4, Roads 9591, 91295 ⁴
u-TBD	Units 3, 4, 5, 6

TABLE 3- 34 WATER HOWELLIA OCCUPIED AND UNOCCUPIED PONDS WITHIN THE GLACIER LOON PROJECT AREA.	
ELEMENT OCCURRENCE #	NEAR UNIT / HAUL ROAD
u-TBD	Units 10, 11, 200, Road 91306
u-TBD	NA
u-TBD	NA
u-TBD	NA
u-TBD	Roads 91313, 561
u-TBD	NA
u-TBD	NA
u-TBD	Units 202, 203, 204, Road 9578
u-TBD	Units 202, 203, 204, Road 9578
u-TBD	Road 9773
u-TBD	Units 24, 25
u-TBD	Unit 26, Road 9579C
u-TBD	Unit 26, Road 9579C
u-TBD	Unit 26
u-TBD	Unit 29
u-TBD	Road 9579C
u-TBD	Road 9579C
u-TBD	NA
u-TBD	Unit 35, Hwy 83
TBD = To Be Determined by Montana Natural Heritage Program	

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 Glacier Loon 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 Flathead National Forest and in the Glacier Loon Project Area. Botanical surveys were not initiated in the area before the onset of the Forest's Botany Program in 1991. There are 51 recognized Regional Forester's Sensitive Plant Species (RFSS) for the Flathead National Forest (Project Exhibit J-12). The MNHP and NRIS Databases were queried to determine known sensitive plant occurrences within the project area. There are several known RFSS populations within the project area (Project Exhibits J-14 and J-15).

TABLE 3- 35 RARE PLANTS IN THE PROJECT AREA.														
HABITAT GUILDS														
SPECIES	NUMBER OF OCCURRENCES	AV	F	W	R	MCT	MC	MMC	GO	MS	CRS	S	A	D
common camas	9			X	X									
great sundew	2		X											
Howell's gumweed	1								X					X
northern bog clubmoss	1		X											
adder's tongue	1		X	X										

blunt-leaved pondweed	1	X												
pod grass	1		X	X										
water bulrush	3	X												
Magellan's sphagnum	1		X											
AV=Aquatic and vernal pools; F=Fens and fen margins; W=Marshes, seeps, springs, and wet meadows; R=Riparian; MCT= Vernal moist cliffs or mossy talus; MC= Mid-elevation moist coniferous forests; MMC=Margins of moist coniferous forests; GO=Dry grasslands & openings in ponderosa pine and dry Douglas-fir forests; MS=Mid- montane/Subalpine grass/forb; CRS=Canyon walls, crevices, rock outcrops and slides S=Subalpine forests; A=Alpine; D= Disturbed areas														

SUITABLE HABITAT

The Glacier Loon Project Area contains habitat types for sensitive plants associated with riparian, seeps, springs, wet meadows, marshes, aquatic and vernal pools, mid-elevation moist coniferous forest and margins, dry grasslands and openings associated with Douglas-fir and ponderosa pine forests, subalpine and disturbed habitat groups listed in Project File Exhibit J-15.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A – NO ACTION ALTERNATIVE DIRECT, INDIRECT AND CUMULATIVE EFFECTS

In consideration of the No Action Alternative, threatened and sensitive plants will be considered together as the direct effects of Alternative A are the same to both. This alternative proposes no ground-disturbing activity. Therefore, there would be no direct effects to threatened or sensitive species as a result of this project. The response of each of the threatened and sensitive plant species to management activity varies by species, and in some cases, is not fully known. Local native vegetation has evolved with and is adapted to the climate, soils, and natural processes, such as fire, insect and disease infestations, and windthrow. Any management or lack of management that causes these natural processes to be altered could have impacts on native vegetation, including threatened and sensitive plants.

In Alternative A, there is a foreseeable trend toward increased dead lodgepole pine throughout the project units which would increase fuel loading over time. Historically, such fuels have been consumed, particularly in lodgepole pine stands, by stand-replacing fire. As discussed in the Fire and Fuels Section, the probability, potential extent, and possible intensity of a stand-replacing fire increases under Alternative A. There is the risk that an extreme fire event could affect nearby water howellia habitat, which is limited to specific pond conditions and is not known to be perpetuated by fire. Water howellia may be adapted to low-intensity burns that were historical in the area, but the effects of high-intensity burns have not been studied and are unknown. If such an event occurred, the actual effect to water howellia would be influenced by a variety of site specific factors, such as removal of surrounding forest vegetation and the risk of establishment by invasive species. Populations of Spalding's catchfly are not known to exist in the area or on the Forest. Discussion of potential indirect effects from Alternative A would not be meaningful. To the contrary, major disturbances such as windfall or fire can enhance ecological processes and aid ecosystem recovery by restoring some of the structural complexity and landscape heterogeneity that has been lost through past forest management by humans. Disturbance-associated sensitive plants are often rare due to the lack of the habitats to which they have adapted.

Spread and establishment of invasive plant species could occur under the No Action Alternative. The risks of spread and establishment would come from the continued use of open roads in the project area, as well as potential wildland fire as discussed above. Wildland fire could expose bare mineral soil, either by burning all vegetation and the duff and organic soil layers, or by suppression activities, such as creating dozer lines. The proximity of existing infestations to activities can increase these risks. The risk of introduction, spread, establishment and persistence of invasive species in the project area would not be facilitated by project activities of the action alternatives (ground disturbance, vehicle traffic, movement of equipment) under Alternative A. With the possible exception of possible high-intensity fire, the risk of invasive species introduction, spread, establishment and persistence, and the resulting competition for resources with threatened and sensitive plant populations and native vegetation would likely be reduced in Alternative A, as compared to the action alternatives.

There would be no cumulative effects to threatened or sensitive species as a result of this project.

Past, present, and reasonably foreseeable actions within the Glacier Loon Project Area (Federal and nonfederal) include timber harvesting, invasive species control, road construction and maintenance, recreation, and fire suppression. These actions could have historically affected Federally-threatened plants and the Regional Forester's Sensitive Plants and could continue to have effects (See the Cumulative Effects Section under the Action Alternatives).

Cumulative effects from Alternative A could include the potential for stand-replacing fire. Stand-replacing fire could occur due to increased understory fuel; beetle infested trees would not be removed, and seedlings and saplings would continue the processes of natural forest succession. Native species have evolved and adapted to natural disturbance, such as fire on the landscape.

Fires primarily occur in the mid- to late-summer season, when annual plants have flowered and set seed. Perennial root-stocks would remain underground and would emerge following the fires. It is unlikely that Alternative A would cumulatively contribute to a marked decrease in threatened or sensitive plant populations or habitat.

WATER HOWELLIA

ALTERNATIVES B, C, AND D

DIRECT AND INDIRECT EFFECTS

Twenty-eight ponds occur within proposed treatment areas; however, treatment units do not overlap the occupied ponds due to the 300 foot buffer specified by the Forest Plan, thus no direct effects are expected for these ponds (Table 3- 16; Project Exhibit J-84). Twenty two of those occurrences and an additional 19 occupied ponds occur within 300 feet of haul routes. Activities are not planned in water howellia populations; however, the Glacier Loon Project could indirectly affect these sites.

There are 28 unoccupied ponds in the project area, of which 16 are in proposed treatment areas. Unoccupied ponds that are suitable habitat for water howellia would be buffered by 300 feet from project activities unless otherwise specified. There would not be any direct effects to unoccupied ponds; however there may be indirect effects to these ponds.

TIMBER HARVESTING

Harvesting in the surrounding uplands of water howellia ponds may impair natural vegetation recovery and alter the hydro logic processes (Lindenmayer et al. 2006) of occupied and unoccupied howellia ponds within proximity to treatment units. Changes to the hydrologic processes of ponds may result in either a decrease or increase in pond inundation levels. **Removal** of surrounding upland trees may decrease evapotranspiration from the surrounding upland vegetation and may result in increased inundation of ponds from runoff. Also, increased canopy openings near ponds may increase evaporation of ponds, potentially reducing water levels earlier in the growing season. Reproductive success of water howellia is directly linked with the fluctuation of water levels both annually and from year to year (Lesica 1990). Water howellia produce seeds underwater early in the growing season when ponds fill up and also produce seeds later in the season via above-water flowers. It then requires annual drying of ponds for fall germination on exposed pond substrate; however, repeated annual premature drying of ponds may reduce the ability for water howellia to replenish the seed bank from year to year. In addition, prolonged inundation of ponds in a given year may reduce fall germination and result in reduced seed bank replenishment during the subsequent growing season. The longevity of seed bank viability is not well understood. Some studies indicate that seed can retain viability for up to 2 years (Mantas 2000; Shelly 1994).

In addition, harvest activities may increase ground water and sediment flow in some of the micro-catchments containing water howellia. This may have effects on seed germination if enough sediment were to accumulate and deeply bury the existing seed bank. Increased siltation may also result in shifts in the pond's vegetation composition, supporting emergent vegetation in place of submergent vegetation types (USDI Fish and Wildlife Service 1996).

To mitigate these potential effects and in accordance with the Forest Plan Amendment 20, all occupied **and unoccupied suitable ponds** will be avoided with a 300-foot no-ground disturbance buffer around the ponds. The buffer zones would extend out 300-feet starting at the edge of the concentration of facultative wetland plants that are influenced by the hydrology of the wetland. Buffer zones would prevent effects of potential hydrologic alterations and/or siltation within the micro-catchment basins of ponds.

INVASIVE SPECIES

Project activities near occupied and unoccupied ponds have the potential for depositing or dispersing invasive plant seed. Invasive species within occupied ponds may affect water howellia by competing for light, nutrients, space, and water. **Reed canarygrass (*Phalaris arundinacea*) is known to occur in several of the original monitored water howellia ponds in the Swan Valley.** This grass is highly competitive in wet habitats and can form a monoculture which displaces native plants (Apfelbaum et al. 1987). Reed canarygrass seeds are not typically windblown and spread would most likely occur with a vector source (such as recreationists, wildlife, birds) spreading seeds from pond to pond or through water courses that connect ponds. Currently, 3 of the occupied ponds in the project area are infested with reed canarygrass, and 4 of the unoccupied ponds are infested. Potential for spread of reed canarygrass from infested ponds to 'clean' ponds is low since there are no activities planned in the buffered area surrounding infested ponds. The risk of infestation is further reduced by washing equipment prior to entry onto NFS lands.

ROADS

Alternative B includes 9.3 miles of new temporary road construction; these would not lie within the buffers of the occupied or unoccupied ponds (**Alternatives C and D proposed less new temporary roads; 5.4 and 4.5 miles, respectively**). No new permanent road construction is proposed. In Alternative B, an estimated 2.3 miles of temporary road are proposed over historic templates (**Alternative C and D have less temporary road proposed**). System roads would be used for haul routes. These roads would need to be maintained to standard to prevent further resource damage on the landscape, which would be accomplished through state BMPs. Road BMPs **without appropriate design** could cause siltation into ponds which could result in the burying of water howellia seeds too deep for germination, or shifting the pond's vegetation composition supporting emergent vegetation in place of submergent vegetation types (USDI Fish and Wildlife Service 1996). However, the BMPs associated with these roads in the project area would be adapted in the project design features to ensure no sediment or other deposition occurs in the nearby ponds. **If ground-disturbing BMP-related activities occur within 300 feet of these ponds, natural filtration zones, sediment retention structures, or straw bales would be applied to prevent sediment deposition into these ponds. Road dips would be constructed as to drain road runoff away from the ponds. There are many ponds within a short distance of roads that would be used for project activities (Table 3- 36).**

TABLE 3- 36. WATER HOWELLIA OCCUPIED AND UNOCCUPIED SUITABLE PONDS NEAR HAUL ROUTES AND ACCESS ROADS WITHIN BMPs.	
ELEMENT OCCURENCE #	NEAR ROAD
33	79
36	79
44	79
67	91305
84	79Y
111	79Y
119	561
120	561
127	9579
128	9579
129	9579C
147	91305
148	9773
154	79
191	9579
195	9579
u-057	79Y
u-TBA (3 ponds)	9579

TABLE 3- 36. WATER HOWELLIA OCCUPIED AND UNOCCUPIED SUITABLE PONDS NEAR HAUL ROUTES AND ACCESS ROADS WITHIN BMPs.	
ELEMENT OCCURENCE #	NEAR ROAD
u-TBA	9773
u-TBA	9579C
u-TBA	9591

There are 4.1 miles of road decommissioning proposed in Alternative B (both Alternative C and D propose 8.4 miles of road decommissioning). Most of these roads do not occur within 300 feet of occupied or unoccupied suitable ponds. However, there are two roads proposed for decommissioning that occur within 300 feet of occupied and unoccupied suitable ponds in all three action alternatives (Table 3- 37). Road 9579 is completely revegetated and the proposed mode of decommissioning is passive (no-ground disturbing work is anticipated). Road 79Y is proposed to be actively decommissioned for the first 800 feet (water bars, scarification, seeded and mulched) and passively decommissioned by natural revegetation for the remainder of the road. The occupied and unoccupied suitable ponds that occur near this road would not be affected since they occur beyond that 800-foot active decommission. Since there would not be any active decommissioning within 300 feet of these ponds, there would not be any impacts to those ponds. There could be beneficial effects by closing these roads and allowing them to revegetate naturally and reducing the human impacts to the surrounding landscape.

TABLE 3- 37. WATER HOWELLIA OCCUPIED AND UNOCCUPIED PONDS NEAR DECOMMISSIONED ROADS.	
ELEMENT OCCURRENCE #	NEAR ROAD
84	79Y
111	79Y
192	9579
193	9579
195	9579
196	9579
u-056	79Y
u-057	79Y

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Land ownership in the Swan Valley is divided into a checkerboard pattern. The Forest Service recently acquired PCTC lands, which has reduced the landowner checkerboard; however, past management activities from PCTC are still evident on the landscape. Past, present, and foreseeable actions on non-NFS lands in the Glacier Loon Project Area include timber harvesting, land development, road construction and maintenance, dispersed recreation, invasive species control, and fire suppression. These actions may have historically affected water howellia and may continue to have effects; these effects are further discussed below. Please refer to the Cumulative Effects Worksheet (Project File Exhibit J-5) for additional information regarding cumulative effects.

TIMBER HARVESTING AND ROAD CONSTRUCTION/MAINTENANCE

It is possible that past road construction/maintenance and timber management could have increased groundwater and sediment flow in some wetlands. This could affect seed germination, as discussed in direct and indirect effects section for water howellia. Increased siltation could result in shifts in the wetland vegetation composition, supporting emergent vegetation in place of submergent vegetation types (USDI Fish and Wildlife Service 1996).

Cumulative effects would only occur if water howellia habitat was impacted by activities associated with the proposed action alternatives. Any affected occupied or unoccupied suitable ponds would be buffered by a 300-foot no-ground disturbance buffer. On Forest Service projects, hauling and associated road maintenance on roads with nearby ponds prevents sediment from reaching those ponds. There may be discountable effects associated with road use, but these effects would not meaningfully contribute to cumulative effects to water howellia habitat. Non-Forest Service projects do not provide the same protections for water howellia. Prior to the Legacy Land acquisitions, a review of aerial photos indicate PCTC did not buffer howellia occupied or unoccupied suitable ponds by 300 feet; it appears they used a state streamside management zone (SMZ), which is less than 300 feet. The Nature Conservancy, who acquired the PCTC lands and then donated these lands to the Forest Service, had been logging these lands due to timber reservation rights included in the deeds. It appears that TNC has been observing the 300-foot no-ground disturbance buffer (Mantas 2012). It is unclear whether that buffer was also applied to unoccupied suitable ponds. When the Glacier Loon Project was originally proposed, TNC had proposed the Fredswood Project, to be completed in 2012. It is now completed. It consisted of 154 acres of overstory removal and road BMPs. The Forest Service acquired Section 13 (T20N, R17W) in 2013 through the Land and Water Conservation Fund. Prior to acquisition TNC conducted overstory removal harvest on 173 acres (Krafty 13) and associated road BMPs. If TNC buffered howellia ponds as agreed, there would be no effect to howellia viability.

Other road maintenance includes the State of Montana maintenance of 3 miles of Highway 83 and the Missoula County maintenance of 13 miles of county roads. These ongoing actions likely include road repair and weed spraying. Kraft Creek Road, Lindbergh Lake Road, and Highway 83 are the only non-NFS roads which have water howellia adjacent to or within 300 feet of the road. As these are ponds, there are strict regulations by the State for application of herbicide in and near water. It is highly unlikely that these ponds are sprayed with herbicide meant for terrestrial weeds, as well as highly unlikely that they are targeted for any aquatic weed treatment.

LAND DEVELOPMENT

Past and present lands sales from PCTC to private developers may have had effects and may continue to affect habitat and occurrences of water howellia. Development of lands may have reduced potential habitat in the past by altering hydrologic regimes and increasing the risk of new weed establishment. Water howellia that occurs on private land is not Federally protected, and private ownership may have led to removal of populations or degradation of habitat. PCTC has sold acreage in the Glacier Loon Project Area. There are two proposed subdivisions on approximately 300 acres within the project area. Currently, none of these privately-owned areas contain water howellia ponds, occupied or unoccupied.

RECREATIONISTS

Areas frequented by recreationists could contribute to the cumulative effects on water howellia. Some occupied water howellia ponds are located near roads, trailheads, or other areas frequented by recreationists. There are no NFS trails near water howellia ponds in the Glacier Loon Project Area. Hunting and driving are likely the most frequent recreational activities seen in the Glacier Loon Project Area near howellia ponds. There are trails heading into the Mission Mountains Wilderness, but no suitable water howellia habitat nearby. Trash and dumping at these ponds has not been observed.

INVASIVE SPECIES

The risk of infestation of invasive species resulting from past, present, and foreseeable activities, including this project, may contribute to the cumulative effects on known and potential occurrences of water howellia. Reed canarygrass is known in approximately 25 percent of the occurrences in the Swan Valley. Past activities may have contributed to the spread of reed canarygrass to these ponds. Now that the problem has been identified, the Flathead National Forest can better manage activities that may affect reed canarygrass spread in the Swan Valley. Areas within the project would be monitored for invasive weeds and management of invasive

species would occur in compliance with the Flathead National Forest Noxious Weed and Invasive Weed Control Decision Notice and Finding of No Significant Impact (USDA 2001c).

Ponds adjacent to areas of invasive species control on State and private lands may be at risk of exposure to herbicide. The effects of chemical controls conducted by State and private lands near water howellia ponds are unknown. However, use of pesticides near water is highly regulated by the Environmental Protection Agency with chemical labels dictating acceptable use of chemicals near water, as well as regulated by the State of Montana in regards to the certification and licensing process for pesticides. The effects of herbicides at or near water howellia ponds on the Flathead National Forest were analyzed in the Flathead National Forest Noxious and Invasive Weed Control EA and DN (USDA 2001c). This DN requires that threatened and sensitive plant species surveys be conducted prior to chemical treatment of a site. No chemical controls have been conducted at or near howellia ponds on the Flathead National Forest.

REGIONAL FORESTER'S SENSITIVE SPECIES

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

KNOWN OCCURRENCES

There are known occurrences of rare plant species within some proposed treatment units, as well as rare plant populations within the Glacier Loon Project Area, which would not be directly affected by harvest activities (Table 3- 35). The populations that would not be directly affected by this project are water bulrush (*Schoenoplectus subterminalis*), adder's tongue (*Ophioglossum pusillum*), blunt leaved pondweed (*Potamogeton obtusifolius*), northern bog clubmoss (*Lycopodiella inundata*), and many of the populations of common camas (*Camassia quamash*).

The Howell's gumweed (*Grindelia howellia*) population (along MT Highway 83) could be directly or indirectly affected by proposed harvest activities. There are harvest units located directly off of the highway and in the occupied sensitive species site that could affect individuals through soil disturbance and increased light availability. Direct effects would include removal of gumweed and associated native vegetation via equipment movement. Indirect effects include soil disturbance, which would provide habitat for invasive species, yet it would also provide habitat for the gumweed. Increased light availability would also provide habitat for weeds, as well as gumweed. Project Design Criteria (Table 2- 16) would mitigate impacts to the population; however, individuals could be affected. Prior to project implementation, the plant sites would be flagged to ensure there is no disturbance during activities.

Common camas (*Camassia quamash*) populations are scattered across the project area, with the potential for more populations that were not located during surveys. Proposed harvest activities and temporary road construction could have direct effects, such as disturbing populations and removing plants and indirect effects of changes in hydrology and siltation into wetlands, as well as an increase in the potential for invasive species infestation. Since camas usually exists in wetlands, it would normally be excluded from activities by a 50-foot buffer if less than an acre and a 100-foot buffer if greater than an acre. In areas where camas is not in a wetland, but in a low lying area, it would be excluded from ground-disturbing activities. However, the Glacier Loon Project has six units proposed within the RHCA buffers, which have been field reviewed by the Fisheries Biologist. For those populations not in a recognizable wetland (delineated by facultative wetland plant species), an exclusion would be acceptable, since it is not currently a listed species.

The other rare plant populations in the Glacier Loon Project Area that are near proposed units would not be directly affected; however, could be indirectly affected by road work, such as temporary roads, skid trails, and BMPs. Ground disturbance over the populations would not be a

concern, since these species are wetland plants occupying either open water or very wet meadow/fen conditions – areas that are not conducive to road building. There is the possibility of sedimentation from these road projects into the wetlands without the protection of buffers. Project Design Criteria would be applied to protect the habitat of these populations from project activities.

There are some temporary roads proposed that are near rare plant populations (Table 3-38). Since temporary road locations are ultimately determined by the timber contractor, it could be possible that those locations could be through rare plant populations. The effect of temporary road construction to suitable habitat is described in the next section. Project Design Criteria would ensure that the populations are avoided during temporary road construction.

TABLE 3- 38 PROPOSED TEMPORARY ROADS NEARBY RARE PLANT POPULATIONS.		
TEMPORARY ROAD NUMBER	TEMPLATE STATUS	PLANT POPULATION
021714A	New	common camas
021736B	New	common camas
191712D	Historic	blunt leaf pondweed
191722A	New	common camas

There are two Resource Enhancement Projects proposed in the action alternatives. One is described toward the end of the Suitable Habitat Effects Section. The other project is in all action alternatives and proposes removing a culvert and replacing it with a larger culvert or bridge on NFS Road #9552 between Meadow Lake and Bunyan Lake. There are four rare plant sites surrounding Meadow Lake. Since the direction of flow goes from Meadow Lake to Bunyan Lake, there would not be any direct or indirect effects to those sites.

If any more rare plant populations are identified during the 2012 field season or during project implementation, they would be protected as specified in the contract clause and in the project's Design Criteria (Table 2- 16).

SUITABLE HABITAT

The Glacier Loon Project Area contains habitat guilds for many sensitive plant species. Unknown occurrences of RFSS plants could be affected by soil disturbance and compaction, 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 could 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 could result in both a decrease and increase of wetland water levels and alter species diversity (Chadde et al. 1998). Timber harvesting often decreases canopy cover and consequently could decrease evapotranspiration rates of surrounding upland trees. This could result in increased inundation of wetlands from runoff. In addition, increased canopy openings near wetlands could increase evaporation of the wetlands, effectively reducing water levels earlier in the growing season.

Harvesting in upland forested areas could also alter suitable habitat. The removal of canopy cover allows more light to the ground, as well as more air movement, which could decrease humidity and increase temperatures. These changes to microclimate could 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.

Table 3- 21 displays the harvest types in each action alternative broken down by prescription. Alternative B proposes more Commercial Thinning than the other action alternatives. Treatment would remove up to about half of the trees within each unit, retaining a more forested appearance. Similarly, Alternative B also proposes more regeneration treatments than in the other action alternatives, which include Clearcut, Seedtree, and Shelterwood Harvests.

Regeneration Treatments remove most trees from the harvested area. Clearcutting leaves up to 10 trees per acre at less than 5 percent canopy cover. A Seedtree prescription leaves 5 to 15 overstory trees per acre, while a Shelterwood prescription leaves up to 30 or 40 trees per acre (Project Exhibit J-9). 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.

Included in the previous figures are units in Alternative B where portions of the treated acreage would be included in RHCAs. The prescriptions that would be included in RHCAs are Commercial Thinning, Seed Tree, and Clearcut Harvests. Normally, projects have been restricted from cutting in RHCAs, which has been beneficial to TES plant suitable habitat. Treatments proposed in RHCAs in this project would alter suitable habitat to unsuitable, especially when using Commercial Thinning and Regeneration Harvest prescriptions. A large concern is the risk of providing habitat for invasive species. Some RHCA harvest units are near known common camas populations.

Tree removal methods would be Tractor or Skyline (Table 3- 21). Ground-based harvesting includes mechanized equipment, such as tractors, clippers, skidders, forwarders, etc., and would create soil disturbance that could alter suitable habitat, prepare the soil for invasive species, and possibly remove existing rare plant populations. Skyline methods use cables to yard woody material up to a landing at the top or bottom of the unit. Skyline harvesting would be lighter on the land, but would still create some soil disturbance when trees are dragged across the units and when landings are created.

Reforestation would occur in Regeneration Harvest Units either by planting or natural regeneration. All action alternatives propose planting in many harvest units. These are units where inadequate natural regeneration of tree species is predicted. The remaining acres not proposed for planting would naturally regenerate with on-site seed and adjacent leave trees, usually lodgepole pine, larch, ponderosa pine or Douglas-fir.

Alternative D, followed by Alternative C, would have the least amount of timber harvesting and soil disturbance, affecting the least amount of TES plant habitat. Alternative B would have the most timber harvesting and would affect the most TES plant habitat.

Thinning Treatments

Pre-commercial Thinning is proposed in all of the action alternatives (Table 3- 21). 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. Thinning would remove ladder fuels and fire hazard. 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). Increased light and moisture would be available to the leave trees and to the understory vegetation, improving growth and vigor of these components.

Pre-commercial 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 would be less soil disturbance and virtually no removal of native vegetation. The action alternatives propose primarily Mechanical Thinning. Alternative D would have the least amount of Pre-commercial Thinning proposed and, therefore, would have the least effect to suitable habitat.

Fuel Treatment Activities

Fuel Treatments are proposed for each unit in each action alternative. Fuel Treatments would be a combination of mechanical methods and the use of prescribed fire. As with mechanical methods for timber harvesting, there would be ground disturbance that would provide suitable substrate for invasive species, as well as remove native vegetation and alter suitable habitat.

The objective of fuels treatment is to restore the role that fire has historically played in these stands – reducing tree density; reducing surface and ladder fuels; and stimulating grass, forb, and shrub growth. Suitable habitat in the proposed burn areas could be directly affected for a brief period due to burn over of the sites. Burning activities that occur after germination and prior to seed set for annual plants could possibly reduce population viability for plant populations. Perennial plants would also be burned over; however, depending on fire severity, rootstock would remain intact and experience temporary temperature increases in the soil. Although low intensity fire generally benefits native vegetation, it carries the risk of changing suitable habitat to unsuitable habitat if the burn severity is moderate to high. These direct effects would be a short duration and could indirectly benefit these plants by stimulating growth and removing debris from their stem bases. Understory prescribed fire and thinning of the canopy could stimulate the expansion of undetected populations by reducing competition and increasing light penetration for those species that thrive in open conditions. Unfortunately, fire activities could increase exposed mineral soil and increase the risk of these areas to invasive species establishment, which could affect the integrity of suitable habitat. Indirect effects of burning include siltation and changes in water chemistry due to the removal vegetation upslope of the affected wetlands. These effects could alter wetland species diversity of downstream areas.

Other burning activities that would occur in all action alternatives within timber harvest units include Excavator or Hand Piling and Pile Burning. Past observations have seen these piles present a 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 would also be inhibited by the lack of nutrients, they are better adapted to these sterile conditions, and once they are introduced, there would be no natural competition to prevent establishment and persistence of invasive species. These areas would be a priority for post-treatment monitoring and possible herbicide treatment. Hand Piling would be preferred due to the little to no soil disturbance for moving the slash into piles. Excavator piling would use heavy equipment and creates more soil disturbance in the unit other than the piles themselves.

Alternative D would have the least amount of Excavator Piling and Burning, followed by Alternative C and Alternative B. Alternative D would have the least amount of disturbance to native plant communities and the least amount of risk of weed infestation.

ROADS

There are approximately 140 miles of existing roads within the Glacier Loon Project Area. The majority (100 miles) are NFS roads. All action alternatives propose temporary road construction on historic templates, as well as new construction (Table 3- 21). Using an historic template would be preferable since soil compaction and vegetation removal has already occurred in those corridors.

Direct effects to suitable habitat would be the removal of vegetation and soil compaction. The construction of a new road template would remove vegetation, often putting it to the side of the corridor where it is left to decompose. Equipment would compact the soil, creating a drivable surface. This construction would remove the area from the productive land base for the life of the road, preventing regrowth of native vegetation. 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 could include re-contouring the entire road template to the natural ground contour and revegetating the disturbed area with native grasses. Eventually native vegetation would grow back, if it is not outcompeted by weeds.

Indirect effects to suitable habitat would include edge effects from road construction and changes to hydrology of wetlands supporting 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 et al. 2000). The extent of edge effects would be 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 could also 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 could indirectly impact native vegetation and sensitive plant suitable habitat. Roads are well known as corridors for invasive species, which could also indirectly impact wetlands and other natural areas (Trombulak et al. 2000; Tyser et al. 1992; Von der Lippe et al. 2007).

Temporary roads could pose the risk of siltation into wetlands and temporarily altering water chemistry, which could affect native vegetation. Presumably, once the temporary roads are reclaimed and the landscape and vegetation has had time to recover, any indirect effects to the downstream wetlands would cease. However, it has been observed on the landscape that if not reclaimed properly, temporary roads could have a lasting effect on the land. They could 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 for TES plants decreases. Re-contouring these roads and seeding them with an approved seed mix has inhibited weed spread in the past and would be included in the Design Criteria for the Glacier Loon Project.

Alternative B proposes the most temporary roads for construction or reconstruction. It would have the most effect to native vegetation and suitable habitat, in regards to direct effects and indirect effects. Alternative D would have the least amount of total impact TES habitat in regards to temporary road construction than the other action alternatives. It proposes the least amount of temporary road construction.

RESOURCE ENHANCEMENT PROJECTS

The other resource enhancement project is in all action alternatives and proposes to revegetate an historic road or skid trail that is currently causing some resource damage and possible groundwater issues. This road is just upstream from an occupied water howellia pond. The proposal includes 400 shrubs planted into the road bed. This would help the native vegetation and possibly provide habitat for rare plants in the future.

NON-NATIVE INVASIVE SPECIES CONTROL

Sensitive and rare plants adjacent to areas of chemical invasive species control could be at risk of exposure to herbicide. On the Flathead National Forest, TES plant surveys are conducted for each site before any chemical control treatments are implemented, as required by the NIWC DN (Project File Exhibit T-5; pp. DN-6 – DN-7). 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 would generally not persist in intact TES habitat due to differing habitat requirements. Invasive species are abundance in the Glacier Loon Project Area, and roads are sprayed on a regular schedule.

The MT Highway 83 corridor is different. Although much of the highway is bordered by NFS lands, it is maintained by the Montana State Department of Transportation and by the local counties. The Forest Service does not have control over what these agencies do for maintenance along their right-of-way corridor.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Past, present, and foreseeable actions within the Glacier Loon Project Area include timber harvesting, fuel treatment, wildland fire, and fire suppression, road construction and maintenance, recreation, invasive species control, collection of forest products, land acquisition and development. These actions could have historically affected TES plants and could continue to have effects.

TIMBER HARVESTING AND PRE-COMMERCIAL THINNING

Timber harvesting decreases canopy cover and increases light level to the forest floor. This could be beneficial for some sensitive species, but could have adverse effects for other species

requiring greater canopy cover (e.g., clustered lady's-slipper). Over time, changes in forest structure could alter native vegetation types and sensitive species habitat. In many cases, timber harvesting could create 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 far more fragmented in forest structure and size class across the landscape than in the past.

Additionally, harvesting activities would disturb soil, which increases the amount of exposed mineral soil. Soil disturbance would carry a higher risk of invasive species establishment; and if equipment is contaminated, also would have a higher risk of introduction of invasive species. Soil disturbance would also expose the dormant seed bank in the soil. The introduction and establishment of invasive species would affect the integrity of native and sensitive species habitats by outcompeting native vegetation and using up resources like space, water and light. It is likely that past timber harvesting has affected occurrences and/or suitable habitat of sensitive plants, although the extent is unknown. The Glacier Loon Project, as well as past and future vegetation management projects on federal and private lands, contributes cumulatively to the effects on sensitive plants and suitable habitat.

ROAD CONSTRUCTION, MAINTENANCE AND BEST MANAGEMENT PRACTICES

Past, present, and future maintenance of roads could have both adverse and beneficial cumulative effects on TES plant populations. Disturbance of roadsides could benefit those species with 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 could increase traffic along these roads and, thus, increase the risk of the introduction of invasive species that could affect TES plant populations or habitat. Maintenance, such as blading activities, could also disturb plant populations adjacent to roads. Road construction and maintenance could also affect wetland habitats by disrupting the hydrology (Trombulak et al. 2000).

The Howell's gumweed population along MT Highway 83 could have been affected by dusting from traffic. Since it is along the right-of-way and off of the main road, dust from traffic would settle on the plants and not wash off due to the glandular resin that makes the plants very tacky. Dust could impede photosynthesis and respiration, as well as contribute to molding by holding moisture on the leaves.

There are rare plant populations in the Glacier Loon Project Area that are in wetlands or ponds. It could be possible that past (and future) road construction could have affected groundwater and sediment flow in some wetlands. Increased siltation could 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 could have positively affected suitable habitat and native vegetation by reducing the above effects and decreasing the potential for invasive species invasion.

The 140 miles of roads within the Glacier Loon Project Area include system roads that are open year-round, seasonally, or closed year-round. Most of them (75.5 miles) are closed to the public and are not maintained. 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, whether they are grown over with tree saplings or native vegetation or are infested with weeds.

Temporary roads are proposed, and although they would be reclaimed by recontouring and revegetation, their construction would disturb the soil and permanently remove existing native vegetation from the landscape. For these areas, suitable habitat would be affected until these roads eventually grew back in, which would be a long-term effect.

FIRE

In general, NFS lands contain high fuel loads in the understory due to fire suppression over the

last century. Fire suppression has created a denser understory condition in many untreated stands where, historically, low intensity understory fires occurred regularly. The fires that have been eliminated from the understory played a role in reducing fuels, as well as encroaching vegetation. Fire suppression, resulting in closed-canopy forests, has reduced light levels and affected understory vegetation. Additionally, fire suppression activities, such as dozer lines and hand-dug fire lines, would increase exposed mineral soil, which could be vulnerable to invasive species establishment that would affect the integrity of TES habitat. When wildland fires occur, they could often burn hotter, affecting the soil and reducing its nutrient content. Native plants eventually would grow back, but often compete with invasive species for the remaining nutrients.

Fuels reduction, whether by the Forest Service or by other landowners, reduces the risk of catastrophic wildland fires and the need for extensive fire suppression activities. Since vegetation removal is part of fuels reduction activities, there would be a risk of disturbing unknown TES plant populations; however, an intense burn would also disturb existing TES populations. Over the past 100 years, fires have burned 9,975 acres in the project area, some of which could have burned more than once.

RECREATION

Campgrounds, hiking, biking and horse trails, motorized trails, lake and river access points, and other areas frequented by recreationists all require construction and maintenance. These activities would cumulatively affect sensitive plants by removing suitable habitat, especially in areas along streams, lakes, and associated wetlands. Dispersed and developed camping would also increase the risk of introducing invasive species to TES plant habitat, as well as trampling of native vegetation surrounding these sites.

Trail construction and maintenance near wetlands could affect wetland species by increasing siltation into wetlands or increasing the risk of introducing invasive species by recreationists. These linear, non-vegetated features could 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, outfitters and guides, berry picking, and horse riding could also impact sensitive plant habitat. Native vegetation and TES plants could experience cumulative effects of trampling and collecting from dispersed recreation.

FOREST PRODUCTS

Public use of forest products (firewood, boughs, berries, etc.) could contribute to the cumulative effects to sensitive species populations and habitat. While obtaining forest products, trampling and collecting of TES species could occur. Popular collection sites would have the most impact with possible habitat degradation. The Glacier Loon Project Area is adjacent to many other ownerships and access to NFS lands is abundant. Temporary roads would be reclaimed and public access would be short-lived. Collection of forest products occurs often and would continue to occur in the project area. Common camas has been traditionally harvested for its edible bulbs and could be at risk of over-harvesting for personal or commercial use.

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 Glacier Loon Project Area. The proposed activities would also carry the risk of introduction and further spread of invasives. The Flathead National Forest has an integrated weed management program that identifies and controls infestations across the Forest. Herbicide is the most commonly used treatment method to control invasive species, which could affect native plant species. The Flathead National Forest also uses biological control on tansy ragwort, spotted knapweed, and Canada thistle. These species-specific 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

Flathead National Forest treats many of the roads in the project area (See the Invasive Species Section of this EA). Many are treated annually and some would be treated in 2012 for the first time in support of the CFLRP.

The Swan Lake Ranger District has benefited from a Congressional Act called Collaborative Forest Landscape Restoration Program, starting in 2009 and ending in 2019. This act has been able to supplement the Swan Lake Ranger District's regular programs with funding for restoration projects. Weed spraying through contracts has been a large part of the program. With CFLRP, the Swan Lake Ranger District has been able to control many more infestations in a short amount of time than the usual Forest program would be able to sustain. Many of the roads in the Glacier Loon Project Area would benefit from this project.

Without prevention measures, inventories, and treatment, the risk of spread would increase in this project area and would further affect suitable habitat. The Design Criteria (Table 2- 16) proposed 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 high risk of spread, which could continue to negatively affect suitable TES habitat.

Howell's gumweed has been impacted in the past by herbicide spraying along the MT Highway 83 corridor by the Montana State Department of Transportation. This action has been occurring for many years and could have extirpated most of the population along that stretch of the highway; however, losing a portion of this population would not lead to a loss of viability to the species or lead to Federal listing.

Reed canarygrass has invaded many wetlands in the Swan Valley to the point of complete extirpation of native grasses and forbs. Unfortunately, due to state pesticide regulations, the Flathead National Forest has not been able to combat this threat effectively. This invasive plant is especially dangerous to TES plants that grow in wetland conditions. Many wet meadows that could have been occupied by common camas have been affected by this weed and other invasive species.

LAND DEVELOPMENT AND EXCHANGES

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 agriculture 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 are several parcels in the Glacier Loon Project Area that belong to private individuals or to industrial timber companies.

Past, present, and future land sales from corporations to private developers could have had effects and could continue to affect habitat and populations of TES plants. Plum Creek Timber Company land that has been recently acquired by the Forest Service has been surveyed for TES plants and weeds and would be managed for protection and restoration of important wildlife and fish habitat and wetlands into the future.

OTHER ACTIONS IN THE PROJECT AREA

There are several special use permits in the project area. Most are easements for private landowners and agencies to access their properties, as well as utility lines to those properties. These permitted actions could have removed suitable habitat from the landscape indefinitely. Since there are no historical plant surveys from many of these sites, it is unknown if currently listed rare species might have existed prior to activities.

SUMMARY OF EFFECTS

The proposed Glacier Loon Project could have direct effects on the Regional Forester's Sensitive Plant Species, specifically Howell's gumweed. Although not an RFSS plant, common camas

could also be directly affected by activities through placement of temporary roads and harvest equipment in units. There would be project Design Criteria designed to avoid known populations of all species; however, these two species are in areas where specific activities would occur. Sites would be flagged prior to implementation to protect the majority of the populations, yet individuals could be disturbed if they are not found during the flagging process.

Indirect effects to Howell's gumweed and common camas would include increased light to the understory and localized ground disturbance that could be easily infested by invasive species. In the case of gumweed, ground disturbance could be beneficial since the species occupies disturbed habitats, as long as it is not outcompeted by weeds. Common camas, on the other hand, does not do well in disturbed habitats and would not be able to compete with weeds.

Cumulative effects to TES Plants are difficult to determine since there are no historical plant surveys in the area. Currently, populations are stable. The amount of land development, roads, vegetation management and wildland fires within the project area has had an impact on the landscape and presumably any TES populations that may have existed at the time. There are future developments planned on private lands, as well as some timber harvest on legacy lands. The Glacier Loon Project would add to these projects and change the landscape further.

EFFECTS OF MANAGEMENT AREA CHANGES

Alternatives C and D include a proposed change in MA designation on approximately 221 acres. Specifically, 213 acres would change from MA 15 to MA 5 and 8 acres would change from MA 15C to MA 5 along Lindbergh Lake. The direct effects of this change are reflected in the previous action alternative effects discussions due to deferral of proposed treatments in this area.

This change would generally result in less silvicultural activities occurring as scheduling of timber harvest within MA 5 would be primarily limited to those treatments, which maintain or enhance the scenic quality of the area. Timber harvest designed as such would typically be less frequent and at a lower intensity. This proposed MA change would not affect TES plants since there are no known occurrences in the project area. The MA change may affect TES plant habitat in the long term; there would still be ground disturbing activity and canopy removal, which would still affect the natural succession of the stands.

DETERMINATION

WATER HOWELLIA (*HOWELLIA AQUATILIS*)

It is my determination that the Glacier Loon Project will have **“may affect, not likely to adversely affect”** on water howellia. This determination is based on implementation of a 300-foot no ground disturbance buffer around all occupied and unoccupied suitable ponds in and near harvest units, in accordance with the Flathead National Forest Plan Amendment 20. This determination is also based on the implementation of BMP activities for occupied and unoccupied suitable ponds near existing roads as outlined in the project design features to prevent sediment from reaching the ponds. If there were to be an effect from road activities and associated best management practices, they would be insignificant as they would be immeasurable and not detectable. In addition, any effects are discountable as they are extremely unlikely to occur. Harvest activities would remain 300 feet from ponds. There would not be any effects to water howellia from harvesting.

SPALDING'S CATCHFLY (*SILENE SPALDINGII*)

It is my determination that the proposed Glacier Loon Project will have **“no effect”** on Spalding's

catchfly, its habitat, or potential habitat for these species. This determination is based on the lack of known occurrences and suitable habitat within the proposed action area.

REGULATORY FRAMEWORK AND CONSISTENCY

In accordance with Section 7(c) of the Act, the USFWS has determined that the following threatened or endangered listed species are or may be present on the Flathead National Forest: water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*) (Project File Section AA). In addition, a letter was received on December 4, 2001 from R. Mark Wilson, Field Supervisor with the USFWS, identifying these threatened, endangered, and proposed species that may occur on the Flathead National Forest.

The Glacier Loon 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 ESA and NFMA. The BE and BA (Project File Exhibits J-1, J-2, and Z-2) analyze the potential effects of the alternatives.

FIRE AND FUELS

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA. This section has been updated to reflect the harvest activities that have occurred on Legacy Lands have been completed.

INTRODUCTION

Fire has been the major influence on vegetative patterns, composition, structure, age, and development of both individual stands and the larger landscape (Arno 1980; Arno 1976; Fischer et al. 1987; Habeck et al. 1973) in the Upper Swan and, specifically, the Glacier Loon Analysis Area. The mixture of forest types found in this analysis area developed under mixed-severity fire regimes, varying with moisture, temperature, and vegetative composition.

Natural Historic Fire Regimes best illustrate fire disturbance patterns. A fire regime describes the frequency, predictability, and severity of fire in an ecosystem. Fires regimes can range from non-lethal to stand-replacing levels, typically becoming less frequent as severity increases.

Drought cycles and fuel availability have a considerable influence on fire regimes. Wildland fires often occur during the driest months of the year, typically July, August, and early September, and can have considerable effects to an area during drought periods. The quantity and type of fuels also affect fire behavior. Fire fuels are made up of dead woody debris and living vegetation. Fuel quantities can vary considerably, depending on the vegetation composition and recent fire history.

Pre-settlement wildland fires generally burned through the summer season until extinguished by fall precipitation. In the settlement period before 1941, wildland fire suppression efforts were often not successful and resulted in fires burning thousands to tens of thousands of acres. Suppression efforts since then have altered pre-settlement fire regimes and reduced the number of forested acres burned each year. The combination of fire suppression, fire exclusion, and natural disturbance processes has allowed fuels to accumulate in unmanaged forested stands. This situation currently exists in the Upper Swan Area.

“Living with fire embodies an array of competing social values, multiple interests, and uncertain outcomes of how we manage land and fire. Coexisting with fire is contentious and complex because there are many diverse people, or stakeholders, involved with and affected by fire. We all have a stake in this problem. How we understand our differing situations and varying contexts determines the choices we make with respect to living with fire. Different people see issues of living with and managing fire through different lenses. For example, a forest ecologist studying a fire dependent ecosystem may see the use of fire as a management tool quite differently than the people who live or work in or near the forest.”
(Coexisting With Fire: Ecosystems, People, and Collaboration, Forest Service/Rocky Mountain Research Station General Technical Report RMRS-GTR-227 November 2009)

ANALYSIS AREA

The scale of the analysis area was chosen to allow sufficient size and time to illustrate the potential effects of the alternatives without those effects diminishing to unnoticeable levels. The following

descriptions identify the analysis area for this project.

SPATIAL BOUNDS

The spatial boundary for this analysis is the 37,320-acre Glacier Loon Project Area, which is included in the Upper Swan Area as defined in the Vegetation Section of this EA for landscape-level analysis. The fire regime patterns in the Upper Swan are characteristic of those in the northern Rocky Mountain Region. Elevation in the project area ranges from 3,220 feet at the Swan River, to 9,204 feet at the summit of Mount Shoemaker. Topography is a moderate relief landscape composed of valleys, ridgelines, and crests. The area has a mean slope of 30 percent with only 16 percent of the area having slopes greater than 40 percent. Most of the Upper Swan area falls within the montane ecotone with lesser amounts in the lower subalpine ecotone. The western larch/lodgepole pine fire-initiated forest and the Douglas-fir fire-initiated and maintained forest are the major forest cover types within the Upper Swan area.

TEMPORAL BOUNDS

The temporal bounds of this analysis are designed to capture the direct, indirect, and cumulative effects of the alternatives to forest fuels within the analysis area, in the context of historical fire regimes and fire history.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

The Fire History Analysis in the Upper Swan was based on the data collected between 1997 and 2002 for the Swan Lake Ranger District's TSMRS, Steve Barrett, Fire History Researcher, and Swan Lake Ranger District personnel. Local meteorological information was obtained from a remote automated weather station (RAWS) in Condon, Montana, for dates after 1962 and from the National Weather Service Station in Kalispell, Montana, for dates prior to 1962. Data gathered by the National Interagency Fire Management Integrated Database (NIFMID) evaluated fire ignition and suppression events and their associated causes from 1940 to the present.

The existing fuels data set was compiled using a combination of common stand exams, field visits, fire regimes data from Steve Barrett, and the Landscape Fire and Resource Management Planning Tools Project (LANDFIRE Project). The LANDFIRE Project was initiated by a request from Federal land agencies asking the principal investigators to develop maps needed to prioritize areas for hazardous fuel reduction.

The objective of the LANDFIRE Project is to provide the spatial data needed by land and wildland fire managers to accurately identify the amount and locations of lands or communities with hazardous fuel build-up or extreme departure from historical conditions. These data also facilitate the prioritization of ecosystem restoration and hazardous fuel reduction treatments to protect ecosystems, property, and people. Moreover, these data may be used during specific wildland fire incidents to maximize firefighter safety, pre-position resources and evaluate fire behavior under a variety of fire weather conditions. These spatial data and predictive models will be hierarchically designed so that they can be used at the national, regional and local levels.

LANDFIRE is a joint multi-agency project between the USDA Forest Service, the USDI Geological Survey (USGS), the Bureau of Land Management (BLM), the National Park Service (NPS), the Bureau of Indian Affairs (BIA), the USFWS, and TNC; with the principal investigators located at the USDA Forest Service Rocky Mountain Research Station Fire Sciences Laboratory in Missoula, MT, and the USGS National Center for Earth Resources Observation and Science in Sioux Falls, SD. For more information on LANDFIRE, visit www.landfire.gov.

Often, a combination of models and site visits was used to determine a specific fuel value estimate. The LANDFIRE Project was used primarily for the fuel characteristics; however, site visits to verify or

adjust values were performed by the District Fuels Specialist.

FLAMMAP was also used in this Fire/Fuels Analysis. FLAMMAP is a fire behavior mapping and analysis program that computes potential fire behavior characteristics (flame length, crown fire activity, etc.) over a landscape for constant weather and fuel moisture conditions. FLAMMAP exists as a stand-alone computer program and a version implemented in Wildland Fire Decision Support System (WFDSS).

MEASUREMENT INDICATORS

To focus the fire/fuels analysis and describe relevant effects, the following effects indicators have been used:

- Fire behavior indicators:
 - o Type of predicted fire.
 - o Predicted flame length (feet).
 - o Acres in each fuel category.
- Acres of slash reduction treatments.
- Acres of fuels reduced in the wildland urban interface (WUI).

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

FIRE REGIMES

A fire regime is defined as the frequency, predictability, and severity of fire in any given ecosystem. An analysis of fire history in the Upper Swan Area was used to determine:

- Spatial and temporal distribution of fire disturbances;
- Mean fire intervals in areas with similar bio-physical and climatic characteristics;
- Whether fire suppression has affected primeval fire regimes.

Areas of similar fire severity, frequency, size, and pattern have a similar fire regime (Brown 2000; Long 1998). The Upper Swan Landscape Assessment (Project File Exhibit T-3) defines three identified regimes in the area:

1. Frequent, low intensity non-lethal severity fire regime with 1 to 25 year intervals.
2. Less frequent and more severe mixed-severity fire regime with 25 to 75 year intervals resulting in scattered mortality.
3. Infrequent stand-replacing lethal severity fire regime with intervals greater than 75 years (Project File Exhibit T-3).

Barrett (2002) identified similar fire regimes, yet further classified the mixed-severity (MS) fire regime into three distinct classes;

- MS1 with fire intervals ranging from 15 to 25 years,
- MS2 (dominant fire regime) with fire intervals ranging from 40 to 100 years, and

- MS3 high elevation sites with highly variable fire and fire intervals.

Most fires burned with low to moderate severity with the occasional severe fire creating a diverse mosaic across the landscape of mature stands that burned repeatedly interspersed with younger fire-regenerated age classes. During the pre-settlement era in the Upper Swan Valley, valley bottom forests were dominated by mixed-severity fire regimes (~50 percent); low-severity fires were restricted to the driest terrain (~5 percent), and high severity fires were largely found on steep slopes at higher elevations and moist canyon bottoms (~45 percent) (Barrett 2002). Barrett (1998) looked closely at the areas unique riparian “pothole” stands from a fire history stand point. He found that even in these areas, frequent non-lethal and mixed severity fires burned within a few feet of the shoreline at intervals similar to adjacent drier sites.

Mixed-severity fire regime areas can experience the full range of severities during either a single event or consecutive events. Mixed-severity fire regime areas may experience fires of intermediate effects, often consisting of fine-grained spatial patterns resulting from a mosaic of varying severity. The mixed-severity fire regime in the analysis area is predominately a moderately low frequency with moderate to high-severity results.

In contrast, stand-replacement fire regimes typically have lethal fires with less than 10 percent of the forested canopy cover remaining after the fire; in analysis area, these are low frequency with high severity events.

The non-lethal and mixed-severity fire regimes generally are now three to six fire intervals from the historical range. At the Lindbergh Lake sites, Barrett (2002) noted fire return intervals to be four times longer than the historical mean. A potential increase in fire intensity and shifted fire regimes have occurred within the analysis area. Long-term fire exclusion and other factors have promoted a shift toward a stand replacement fire regime across a broad area in the Upper Swan Valley (Arno 1976; Barrett 1998; Hart et al. 1994). The scale of wildfires also appears to have increased. Ayers reported a “big burn” having an area of about 5 square miles” in 1898. The 11,281-acre Crazy Horse Fire in 2003 grew to almost four times that size despite intensive suppression efforts. The threat of abnormally high severity fires is one of the primary risks to ecological integrity of much of the western forest types like those found in the analysis area.

FIRE HISTORY

Recent studies have looked closely at the fire history and fire regimes in and around the analysis area. These studies combined with fire history data from historical accounts provide a picture of how fire has been a dynamic agent of change in the region's forest vegetation.

Fires were frequent in the Upper Swan Valley until the early 1900s, with the earliest fire evidence dating from about 1241 A.D. Barrett (1998) reported that 1768, 1814, 1850, 1889, 1919, 1929 were important fire years in the area. A GIS dataset from the Flathead National Forest GIS library spatially displays the locations of some of the major fires in those years within the analysis area (See Map 3-1. Fire History). In this area, fire occurred about every 20 years (range of 6 to 50 years) between 1687 and 1919, with the last major fire occurring in 1919. The 1919 fire(s) burned approximately 25,000 acres near the lake and to the north. This was largely a severe fire that occurred during a significant regional drought (Barrett 2002).

Within, or adjacent to, the analysis area, the following fires of significance have burned in the relatively recent past:

- In 1953, the Herrick Run fire burned approximately 780 acres on the western shore of Lindbergh Lake. This fire started near the shore and burned upslope and was primarily a high-severity fire.
- In 2003, the Crazy Horse Fire burned 11,281 acres with approximately 3,200 acres occurring within the analysis area.
- In 2008, the smaller Lindbergh Lake Fire burned upslope on the west side of the lake with 45 acres occurring at the south end of the analysis area.

- In 2005, the Holland Peak Fire burned approximately 1600 acres on the east side of the Swan Valley, 4 miles from the Glacier Loon Analysis Area.

These fires are the most recent large fires in the Upper Swan Valley, and they burned in a mosaic pattern, with variable severity. In the absence of fire for the past 80+ years, tree species, such as the more shade-tolerant Douglas-fir, alpine fir, and spruce have become well established as understory and have resulted in thick tree stocking in the timber stands being considered for treatment under the action alternatives.

TABLE 3- 39 PERCENTAGE OF HISTORIC FIRE (POLYGONS OVER 1,000 ACRES).		
FIRE YEAR	AREA IN ACRES	ANALYSIS AREA PERCENTAGE
1919	18,500	51
1919-1929	2,500	7
1929	3,800	11
2003	11,281	31

TABLE 3- 40 PERCENTAGE OF HISTORIC AND CURRENT FIRE REGIMES.				
	NON-LETHAL	MS-I	MS-II	LETHAL
Historic	31%	20%	21%	28%
Current	0%	8%	49%	41%

EXISTING CONDITION

CURRENT CONDITION CLASS DEPARTURES

Fire Regime Conditions Classes (FRCC) are 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 based on five ecosystem attributes (Lavery et al. 2000):

- Disturbance regimes (patterns and frequency of fire, insect, disease, etc.);
- Disturbance agents;
- Smoke production;
- Hydrologic function;
- 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.

Condition Class Departures are categorized by the National Fire Plan as displayed in Table 3- 41.

TABLE 3- 41 FIRE REGIME CONDITION CLASSES (SCHMIDT ET AL. 2002).		
CONDITION CLASS	ATTRIBUTES	EXAMPLE MANAGEMENT OPTIONS
1	Fire regimes are within or near an historical range. The risk of losing key ecosystem components is low. Fire frequencies have departed from historical frequencies by no more than one return interval. Vegetation attributes (species composition and structure) are intact and functioning within an historical range.	Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use.

TABLE 3- 41 FIRE REGIME CONDITION CLASSES (SCHMIDT ET AL. 2002).

CONDITION CLASS	ATTRIBUTES	EXAMPLE MANAGEMENT OPTIONS
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components has increased to moderate. Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: fire size, frequency, intensity, severity or landscape patterns. Vegetation attributes have been moderately altered from their historical range.	Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to the historical fire regime.
3*	Fire regimes have been significantly 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. This results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity or landscape patterns. Vegetation attributes have been significantly altered from their historical range (Laverty and Williams 2000).	Where appropriate, these areas may need high levels of conversion restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime.
*(NOTE: The Upper Swan Analysis Area has little Condition Class Departure 3 lands.)		

The acreage of the current condition class departure by historic natural fire regime on forested lands for the Glacier Loon Analysis Area with all ownerships is displayed in Table 3- 42. There are approximately 1,500 acres of non-forested rock outcroppings, lakes, ponds and gravel pits, etc., that are not considered in the fire regime and current condition class classification.

TABLE 3- 42 CURRENT CONDITION CLASS DEPARTURE BY HISTORICAL NATURAL FIRE REGIME WITHIN THE 37,320-ACRE GLACIER LOON ANALYSIS AREA.

HISTORICAL FIRE REGIME	CURRENT FRCC		
	DEPARTURE 1	DEPARTURE 2	DEPARTURE 3
Mixed Severity - 2	23,511 acres	5,225 acres	8,584 acres
	63%	14%	23%

Approximately 63 percent of the analysis area is within the natural historical range for fire regimes (Current Condition Class Departure 1), with 14 percent moderately altered from historical range for fire regimes (Current Condition Class Departure 2). This is largely a function of the moist landscape that occurs in the analysis area, resulting in generally longer fire intervals and less departure from the historical range. Approximately 23 percent of the analysis area has been significantly altered from the historical range (Condition Class Departure 3).

FOREST MANAGEMENT

Although timber harvest and associated fuel treatments have not replicated wildland fire, they have replaced wildland fire as the dominant process that changes the patterns of vegetation and woody debris accumulations in the forest. Since the 1950s, approximately 33 percent the Upper Swan Area has been regeneration timber harvested and fuels have been treated (prescribed burning and machine piling of slash with pile burning). These previously managed areas are considered to be in a Condition Class 1.

The forest management activities in the area have created fuel mosaics, which are breaks or changes in standing timber and surface fuel patterns. Along with road access, these fuel mosaics increase the success of initial attack, allow for effective fire suppression under the appropriate management response, and decrease the risk of high intensity stand-replacement wildland fire. The existing Forest Plan requires that all fires be suppressed (excluding wilderness areas covered under an approved Fire Management Guide or Plan), using the appropriate management response. The appropriate

management response in the analysis area is suppression using aggressive initial attack actions to control a wildland fire with safety of the public and fire management personnel being the first priority, and sequentially the protection of property/natural resources.

DROUGHT HISTORY

Studies indicate that severe single-year droughts occurred in the Northwest at least 10 times between 1940 and 1995, and they occurred in every decade (Barrett et al. 1997; Graumlich 1987; Karl et al. 1982; Meko et al. 1993). Local meteorological information from a WETS weather monitoring station in Condon, Montana, indicate drought fire season years (in which fire suppression occurred within the analysis area) in 1967, 1972, 1973, 1984, 1988, 1989, 1991, 1994, 1996, 2000, and 2001. This station was activated in 1962. The National Weather Service Station in Kalispell, Montana (active since 1899) was used to correlate the drought fire season years prior to 1962 with the number of fire suppressions in the area. These drought years were 1940 and 1961.

FIRE IGNITIONS AND SUPPRESSIONS SINCE 1940

The NIFMID identified 133 suppressed ignitions (92 lightning-caused and 41 human-caused) that occurred from 1940 through 2010 within the Upper Swan Area. Drought year dates were also cross-referenced with fire active dates recorded on the NIFMID, the results were 34 lightning-caused and 19 human-caused ignitions during these more large fire-prone years. Of the total 133 ignitions, 121 were promptly suppressed and averaged only 1.2 acres, the largest of the fires being the 2003 Crazy Horse Fire (lightning caused ignition) that burned 11,281 acres.

Since 1970, there have been 38 human-caused fires. There appears to be a direct relationship between the increase of forest use and WUI density with human-caused fire occurrence.

WILDLAND URBAN INTERFACE (WUI)

In 2004, Missoula County completed the "Seeley Swan Community Wildfire Protection Plan" (CWPP) (Project File Exhibit T-7). This plan described areas considered WUI in the project area. The majority of the project area proposed for treatment is designated WUI.

The Federal Register (January 4, 2001) supplied the three categories of WUI considered in the National Fire Plan. The WUI is defined as the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The Upper Swan Analysis Area only includes the Category 2 type of WUI called the Intermix Community, defined as follows:

Category 2 - Intermix Community

The Intermix Community exists where structures are scattered throughout a wildland area. There is no clear line of demarcation. Wildland fuels are continuous outside of and within the developed area. The development density in the Intermix ranges from structures very close together to 1 structure per 40 acres. Fire protection districts funded by various taxing authorities normally provide life and property fire protection and may also have wildland fire protection responsibilities. Areas with the Upper Swan categorized as Category 2 include small cluster developments, such as ranches, summer residences, hay meadows, timber production areas, ranch outbuildings, and other structures. Approximately 14,539 acres of the Glacier Loon Project Area is located within the WUI.

Although the amount of private ownership is finite within the analysis area, the current trend for development on private ownership is one of further subdivision and subsequent increase in population/dwelling-structure density. There is potential for development and increased private ownership within the PCTC land sections currently for sale.

These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites. When wildland fire enters these areas, the suppression efforts require a large commitment of firefighting resources. During the fires of 2000, large portions of otherwise high-priority fires remained unstaffed, because resources were committed to structure protection. Experienced fire managers know that the Intermix area is one of the most dangerous environments in which to conduct fire suppression operations. Poor ingress and egress compromise firefighters'

escape routes. Hazardous materials and other man-made materials produce toxic gases when burned and pose major threats to firefighters and the public. The high values at risk (homes, vehicles, domestic animals, etc.) can lead even the most seasoned wildland firefighters to take risks that he or she would not consider in the wildland environment.

HOME IGNITABILITY

Recent research (Cohen 2000b) addresses home ignitability, or the potential for a home to ignite, in the WUI. Cohen concludes that homes ignite via one of two processes;

1. Direct flame contact with the structure, and
2. 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 40 meters or more from a structure does not deliver sufficient heat energy to ignite the exterior of a home. However, lofted firebrands, such as those experienced in the 2000 Cerro Grande Fire in New Mexico, ignited surface fires on homes while leaving green needles on trees around the home (Cohen 2000a). Highly ignitable homes can ignite during wildland fire without fire spreading near the structure. This occurs when firebrands are lofted downwind from fires. The firebrands subsequently collect 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 1 kilometer or more (Cohen 2000a). Cohen concludes:

“Because homeowners typically assert their authority for the home and its immediate surroundings, the responsibility for effectively reducing home ignitability can only reside with the property owner rather than wildland agencies.”

Because of the problems and complexities associated with the Intermix Community, resource managers and fire managers find it desirable to exclude, to the extent possible, wildland fire from these areas and may use limited, carefully controlled, prescribed fire treatments or, more commonly, mechanical treatments to reduce fuels in such areas. The purpose of these fuel treatments is to provide firefighter safety and minimize future loss of property and natural resources. Sociopolitical and logistic constraints could preclude or limit prescribed fire use near residences (DellaSala et al. 1995; Kalabokidis et al. 1998). Limitations to use of prescribed fire within the WUI include public attitudes toward smoke, fear of escaped fire, negative visual effects of burns, and limited windows of opportunity in conditions dry enough to achieve fuel reduction objectives while still insuring containment near homes.

FOREST FUELS AND FIRE BEHAVIOR

The greatest effect of fire suppression and exclusion in unison with other natural disturbance processes has allowed biomass to accumulate in most unmanaged timber stands. The bulk of the biomass currently occupying the analysis area is in the form of dead standing and downed trees and shrubs, as well as live shade-tolerant true firs, spruce, 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.

Fuels, weather, and topography influence fire behavior. Fuels are the only factor that management can modify. 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, regeneration, and timber. 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 basically 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 will ignite, its rate of spread, and its intensity. Grasses and shrubs are vertically-oriented fuel groups, which rapidly increase in depth with increasing load.

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 could develop into a crown fire. Fuel moisture content has a substantial impact upon fire behavior affecting ignition, spread, and intensity.

Wildland fires would still occur and could 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 could be of low to moderate severity and result in only moderate or no damage to overstory trees. If downed fuels are present, tree mortality could occur even during moderate burning conditions. Fuels, weather and topography combine to determine how hot and fast a fire burns. Fuel conditions are described by quantity, arrangement, and size and used as one of the inputs in the FLAMMAP computer model to determine flame height.

FUEL MODELS AND FIRE BEHAVIOR

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

- The fuel load and the ratio of surface area to volume for each size class.
- The depth of the fuel bed involved in the fire front.
- Fuel moisture, including that at which the fire will not spread (called the moisture of extinction).

These are based on Albini's (1976) paper "Estimating Wildfire Behavior and Effects." The criteria for choosing a fuel model includes the fact that the fire burns in the fuel stratum best conditioned to support the fire. The 40 fuel models for fire behavior estimation are for the severe period of the fire season when wildland fires pose greater control problems and impacts on land resources.

Table 3- 43 lists fuel categories found in the units described in the action alternatives. These categories are a combination of representative fuel models and approximation of crown fuel characteristics. Categories 1 – 3 represent existing conditions, while Categories 4 – 6 describe fuel conditions following completion of various proposed treatments. (See: Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model, Joe H. Scott, Robert E. Burgan, 2005).

TABLE 3- 43 FUEL CATEGORIES FOUND IN THE UNITS DESCRIBED IN THE ALTERNATIVES.		
FUEL CATEGORY	DESCRIPTION	
EXISTING CONDITIONS		
1	This consists of mature stands dominated by lodgepole pine. A closed canopy with little understory vegetation and a high amount of timber litter fuel load characterize this category. Fuel model TL5 represents this situation. Compact timber litter and some dead down woody fuel are the primary fuels modeled for surface spread calculations.	
2	This fuel group consists of older Douglas-fir or mixed conifer stands with a closed canopy and a fairly high load of understory vegetation and timber litter. Fuel model TU5 is used to model this fuel category. This fuel model considers both the timber litter and understory vegetation when performing surface spread calculations.	
3	This category describes units with little or no understory and very little down woody fuel. Surface fire spreads in compact timber litter. This category is descriptive of young dense sapling and pole stands with closed crowns. TL3 is the descriptive fuel model.	
FOLLOWING PROPOSED TREATMENTS		TREATMENT TYPE
4	This category is descriptive of areas that have been piled after harvest, or had no fuels treatment other than whole tree yarding. The primary fuel for a surface fire is timber understory vegetation with little down woody fuel contributing to fire spread, fuel model TU1.	CT-Commercial Thin MCT – Modified Commercial Thin IMP-Improvement Cut SAL-Salvage
5	This category covers areas that have been harvested, and slash treatments are expected to significantly reduce understory vegetation, usually broadcast burning.	ST-Seed Tree SW-Shelterwood

TABLE 3- 43 FUEL CATEGORIES FOUND IN THE UNITS DESCRIBED IN THE ALTERNATIVES.

FUEL CATEGORY	DESCRIPTION	
	This category also includes areas treated with ecosystem burns. The primary fuels are residual woody fuels left after the treatment and light timber litter that slowly accumulates following the treatment, fuel model TL1.	CC-Clear Cut
6	This class describes the fuels remaining after sapling thinning activities. Surface fuels are described as compact timber litter with moderate dead down wood fuels. TL4 represents this fuel condition.	PCT-Pre-Commercial Thin

FUEL TREATMENT PRINCIPLES AND CONSIDERATIONS

Fuel treatments reduce the crown and surface fuels by thinning trees and burning, removing, or chipping fuel on the ground. Table 3- 44 describes the effects of some fuel treatment principles.

TABLE 3- 44 FUEL TREATMENT PRINCIPLES.

PRINCIPLE	EFFECT	ADVANTAGE
Reduce surface fuels	Reduces potential flame length	Improves control and reduces torching
Increase canopy base height	Requires longer flame to start torching	Reduces torching
Decrease crown density	Makes tree-to-tree crown fire less likely	Reduces potential for crown fire
Retain larger trees survival	Increases proportion of trees with thicker bark, taller crowns	Increases tree survival
Adapted from Agee, J. K. 2002. Fire behavior and fire-resilient forests. In: Fitzgerald, S. A., ed. Fire in Oregon's forests: risks, effects, and treatment options. Portland, OR: Oregon Forest Resources Institute: 119.126		

The proposed fuel reduction techniques focus on reducing the potential for crown fires and high intensity surface fires in treatment units, and thus reducing the resistance to control. Thinning of trees would reduce the crown density. Removing understory trees would also increase the canopy base height, making it more difficult for a crown fire to be initiated. The thinning would primarily focus on removing the smaller trees and species that are less resistant to fire, leaving larger, fire resistant species where possible. The proposed surface fuel treatment would reduce the amount of surface fuels to lower potential flame lengths. This would decrease the resistance to control and reduce the likelihood of crown fire initiation. The preferred method for surface fuel treatment would be first removal, then chipping, or lastly excavator piling and burning.

FIRE BEHAVIOR MODELING

Fire behavior modeling is performed to estimate a number of fire behavior characteristics. There are three main categories of inputs to fire behavior modeling;

1. Weather,
2. Fuels, and
3. Topography.

Weather is classified and discussed in more detail in the Climatology Section later in this report. Historic weather information is used as an input to estimate fire behavior. Fuels are classified as surface fuels and crown fuels. Surface fuels are described with a fire behavior fuel model number: Standard Fire Behavior Fuel Models (Scott et al. 2005). The fuels are classified based on several factors including type of fuel and amount of surface fuel present. These fuel models are used to predict fire behavior resulting from various weather inputs. Crown fuels are described by canopy bulk density (the foliage contained per unit crown volume), canopy base height (the average height from the ground to the lowest living foliage), and canopy fuel load (the volume of canopy fuel load) (Scott et al. 2001). Crown fuels are important for determining crown fire characteristics, such as whether a fire can transition from the ground to the tree crowns. The topography input related to fire behavior is percent slope. Slope can affect how a fire burns. Fires generally burn with more intensity and faster spread rates when burning on steeper slopes.

There are several outputs available with fire behavior modeling. The outputs of most concern for this project include flame length and type of fire. Fire behavior characteristics are used to estimate resistance to control. This is defined as the relative difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior (National Wildland Coordinating Group Handbook 3, 2004 and [updated in 2014](#)).

The flame length is important to fire suppression techniques. If flames are over 4 feet, suppression with hand crews is generally unsuccessful. If flame lengths are over 8 feet, mechanized equipment is not considered effective.

The type of fire is also very important to estimate how successful suppression efforts would be, or resistance to control. Fire scientists and managers recognize three general types of wildland fire depending on the fuel stratum in which the fire is burning.

Ground Fire

A ground fire burns in ground fuels such as duff, organic soils, roots, rotten buried logs, etc. Ground fires are generally ignited by surface fires. Ground fires have very low spread rates. For these reasons, ground fires are not predicted or further discussed in this analysis, because they would be secondary to and in association with a surface fire.

Surface Fire

A surface fire 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, and 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.

Crown Fire

A crown fire 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 branch wood found in the forest canopy. We generally recognize three types of crown fire: passive, active and independent.

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 growth. Passive crowning is common in many forest types, especially those with an understory of shade-tolerant conifers.

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 fuel bed 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.

Independent

An independent crown fire is one that burns in canopy fuels without aid of a supporting surface fire. Independent crown fires could occur rarely and are short-lived, requiring a combination of steep slope, high wind speed, and low foliar moisture content. Many apparently independent crown fires could 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.

CLIMATOLOGY AND FIRE BEHAVIOR THRESHOLDS

Weather information was obtained from <http://famweb.nwccg.gov/weatherfirecd/> for the Condon Remote Automated Weather Station for the time period from 2002 through 2011. The computer program, Fire Family Plus Version 4.0 (USDA Forest Service 2004) was used to analyze fire weather parameters associated with fire occurrence data in determining fire behavior thresholds. Thresholds evaluated are listed below. These thresholds can be used as general guidelines to help warn fire managers and firefighters of impending fire danger.

TABLE 3- 45 PERCENTILE WEATHER BY ENERGY RELEASE COMPONENT (ERC).	
FUEL CHARACTERISTICS	97% ERC
1 Hour Fuel Moisture	3.5
10 Hour Fuel Moisture	4.5
100 Hour Fuel Moisture	8.6
1000 Hour Fuel Moisture	11.0
Herbaceous Fuel Moisture	49.8
Woody Fuel Moisture	76.10
20 Foot Wind Speed	6.10

FIRE DANGER

The Energy Release Component (ERC), a number related to the available energy per unit area within the flaming front at the head of a fire, was used to categorize weather. The ERC is often used for planning and estimating the relative fire danger on any given day. The 97th percentile ERC would only be expected to occur on approximately 10 percent of the fire season days. The 97th percentile ERC weather conditions were calculated to be used as inputs when modeling fire behavior. For more information regarding the ERC, please refer to NFDRS – National Fire Danger Rating System Equations (Cohen et al. 1985).

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 1-3 inches in diameter, and
- 1000 hour fuels are 3+ 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 (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 measure 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 6 mph eye level wind (National Wildland Coordinating Group Handbook 3, 2004 and updated in 2014). 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 (National Wildland Coordinating Group Handbook 3, 2004 and updated in 2014). 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.

ENVIRONMENTAL CONSEQUENCES

This section describes the direct, indirect and cumulative effects of the proposed treatments on the fire and fuels resource. To focus the fire/fuels analysis and describe relevant effects, the following effects indicators are used:

- Fire behavior indicators:
 - o Type of predicted fire.
 - o Predicted flame length (feet).
 - o Acres in each fuel category.
- Acres of slash reduction treatments.
- Acres of fuels reduced in the wildland urban interface (WUI).

FIRE BEHAVIOR INDICATORS

TABLE 3- 46 FIRE BEHAVIOR INDICATORS BY FUEL TREATMENT.						
TREATMENT TYPE	FLAME LENGTH		ACTIVE ⇌ PASSIVE *CROWN FIRE		FUEL MODEL	
	PRE	POST	PRE	POST	PRE	POST
Commercial Thin Modified Commercial Thin Improvement Cut Salvage	7.8	1.0	2	0	TU-5	TL-3
Seed Tree Shelterwood Clearcut	8.3	1.8	2	1	TL-3	TU-1
Pre-Commercial Thinning	2.3	0.7	1	1	TL-3	TL-3
*Crown Fire Output Codes: 1=Surface, 2=Passive, 3=Active						

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Under Alternative A, no fuel treatment would occur. In the absence of disturbance, fuel conditions would generally persist or fuel loadings would increase throughout the project area. The overall result would be a continuation of current fuel loadings with an increased fire hazard over time.

CONTINUED DENSE UNDERSTORY AND LADDER FUELS

Large diameter Douglas-fir and larch in most of the ponderosa pine/Douglas-fir type forest stands would continue to lose vigor due to competition from dense understories of shade-tolerant tree species. 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 ground fire. Insects and disease have existed in the past and would continue in the foreseeable future within the project area. It can be anticipated that fuel build-up would continue due to tree mortality from these sources. Historically, stand-replacing fires were less common in the ponderosa pine/Douglas-fir forest types, where frequent moderate intensity fires maintained a mosaic pattern of vegetation with an overstory component of large diameter trees. If a stand-replacing fire were to occur in the Upper Swan Area today, the overstory trees that remain could be killed and the burned areas would likely regenerate to lodgepole pine. The No Action Alternative would likely cause

a fire to burn more intensely in the analysis area than the action alternatives. Depending on such factors as wind speed, and direction, fuel moistures, and other factors described above, it is possible that the lack of treatment could place residents, adjacent landowners and Flathead National Forest visitors adjacent to fires at risk due to increased fire intensity, should a wildfire occur in the next 10 years. The largest threat of stand-replacing fires in the lower elevations is to private property, homes, public safety, and firefighter safety throughout the landscape. In addition, the likelihood of a high-intensity wildfire starting in the affected areas on NFS lands and then spreading into non-NFS lands would be highest under this alternative.

ALTERNATIVES B, C, AND D

DIRECT AND INDIRECT EFFECTS

Nearly all treatment areas proposed by all action alternatives are directly or indirectly, linked to previously treated stands or natural fuel breaks. This helps to create larger, more effective treatment areas. These treated areas are important to either slow the spread or reduce the intensity of wildland fire, thus increasing the effectiveness of suppression efforts to protect values at risk.

The fuel treatment areas adjacent to the Intermix Community are designed to protect primarily private and government structures and improvements; secondarily, they are designed to protect NFS land resource values. Wildland fire can threaten a structure in three ways:

1. Direct exposure from flames,
2. Radiated heat, and
3. Airborne firebrands.

The treatments proposed are designed to reduce the potential for crown fires which would decrease the probability that airborne firebrands could reach structures. This would be of particular concern when viewing both long-range and short-range spotting potential of forested areas adjacent to developed areas.

The proposed treatments would also reduce the potential of direct exposure from flames and radiated heat by creating a “defensible space” around a property or structure. Defensible space refers to that area between a structure and an oncoming wildland fire where the vegetation has been modified to reduce the wildland fire threat and to provide an opportunity for firefighters to effectively and safely defend the structure. Fuels can be treated in a relatively small area immediately adjacent to structures to reduce exposure to flames and radiant heat. Some evidence suggests that fuel reduction within 40 meters (131 feet) of a structure can substantially reduce ignitions from direct exposure to flames or radiant heat (Cohen 1999). These stands would likely be managed into the future to maintain fire resistant tree species, light surface fuels, and no ladder fuels. This would provide an effective fuel reduction area to reduce the potential of the short-range and long-range spotting threat associated with those stands during wildland fire. Most of this work, due to the proximity immediately adjacent to structures, is accomplished by the landowner.

To reduce threat of ignition from firebrands, fuels would need to be reduced both near and at some distance from the structure. Firebrands that result in ignitions could originate from wildland fires that are at a distance of 0.6 miles (1 kilometer) or more (Cohen 1999). However, firebrands pose a greater threat the closer the fire is to the structures and other existing resources. Implementation of action alternatives would result in modifying the behavior of a wildland fire and would increase the likelihood that fire suppression efforts would be successful in containing the fire at a small size.

SLASH REDUCTION TREATMENTS

To further reduce hazardous fuel conditions that existed prior to (or were created by) harvest activity, slash reductions treatments would be implemented. Some tree boles, limbs, and foliage have been deposited in the forest floor adding to both fine down wood and coarse down wood material fuel loadings. In some areas, this material is scattered; and in other areas, it is concentrated in large amounts. As suggested by Brown et al. (2003a), this fine and coarse down wood contribute to fire

hazard and severity. Table 3- 47 summarizes the number of acres of slash reduction treatments by alternative.

TABLE 3- 47 FUEL REDUCTION ACRES BY ALTERNATIVE.				
ACTIVITY	ALT. A	ALT. B	ALT. C	ALT. D
Fuels Treatment				
Chip/Grapple Pile/Burn Piles	0	13	14	13
Chip/ Grapple Pile/Burn Piles/Remove	0	339	338	90
Lop Scatter/Grapple Pile/Burn Piles	0	10	10	10
Lop Scatter/Hand Pile/Burn Piles	0	5	5	5
Whole Tree Yard	0	468	432	228
WTY Broadcast Burning	0	164	102	82
WTY/Grapple Pile/Burn Piles	0	751	730	556
WTY/Grapple Pile/Burn Piles/Chip	0	311	237	125
WTY/Hand Pile/Burn Piles/Chip	0	41	41	41
Total Acres of Fuel Treatment	0	2,102	1,909	1,150

ALTERNATIVE A – NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Under Alternative A, no fuel reduction treatments would occur and the purpose and need would not be met. Fuel conditions associated with the infested trees would persist and fuel loadings would increase throughout the project area. The overall result would be a continuation of the current fuel loadings with an increased fire hazard over time. The potential of surface fires would not be reduced, resulting in no reduction in resistance to control and modify fire behavior characteristics. Mountain pine beetle populations would continue to increase as long as environmental conditions allow and susceptible trees are present. Fuel buildup would continue due to tree mortality from the pine beetle (Refer to Forest Vegetation Section).

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

Many of the stands targeted for treatment in Alternatives B, C, and D, are currently in a state that if a wildfire were to occur would likely exhibit fire behavior that is difficult to control during times of high fire danger.

All of the action alternatives support the purpose and need to varying degrees. Under these alternatives, the proposed harvest and associated activity fuels (slash) treatments would reduce the fire hazard and fire severity risk through reduction of fuel loading. As discussed above, harvest treatments would reduce the potential of surface fires and crown fires, thus reducing the resistance to control. This is indicated by reductions in flame length and crown fire potential after treatment. Due to these reductions in fire intensity, our ability to initial attack and control fires would be improved. This should allow firefighters to better protect human and natural resource values due to reduced fire behavior intensity and resistance to control. Throughout all treatment areas, fire tolerant species would be favored and in many areas these species would be planted.

The differences in effectiveness would mostly be related to the number of acres treated in each alternative and the location of the treatment areas. In general, the more acres of effective slash reduction treatments, the lower the fuel hazard and subsequent fire behavior characteristics. As displayed in Table 3- 48, Alternative B is the most effective in meeting the goals of the purpose and need due to the highest number of acres treated in the WUI. Alternative D would be least effective due to the least amount of acres treated in the WUI.

TABLE 3- 48 ACRES TREATED IN THE WUI BY ALTERNATIVE.

WUI Treatment	Alt. A (Acres)	Alt. B (Acres)	Alt. C (Acres)	Alt. D (Acres)
Fuels Treatment within the WUI	0	1710	1526	902
Fuels Treatment outside the WUI	0	392	383	248
Total Acres Treated	0	2102	1909	1150

RESILIENCE

Forest structure is directly related to wildland fuels and potential fire behavior. Recent Forest Service emphasis at the National level on fuels management has led to studies highlighting the effects of re-arranging and manipulating forest vegetation and the effect on fire hazard and behavior. It has been found that reduced stand densities, retaining larger-diameter fire-resistant species, managing surface fuel layers, and increasing height to live crowns, has had positive effects on tree and stand survivability, decreased crown fire activity, decreased surface fire potential, and decreased fire severity (Agee et al. 2005; Graham et al. 1999; Omi et al. 2002; Skinner 2002; USDA 2003).

ACCESS MANAGEMENT

All action alternatives propose changes to access management within the project area. In general, these include adding temporary roads (See Chapter 2 for a detailed listing of proposed access management changes). Much of the project area is readily accessible for fire management activities with existing roads or templates. Upon completion of the project, there would be no change in access as a result of the temporary road construction as all of these roads would be rehabilitated.

Decommissioning is proposed in all action alternatives ranging from 4.1 miles in Alternative B to 8.4 miles in Alternatives C and D. Re-contouring and removing of culverts on roads could limit fire management vehicle access to portions of the project area. This is often most critical during initial attack (the first response to a fire). During extended attack fires, or fires that take several days of fire management, it is not uncommon to use equipment to re-open roads for vehicle travel. Early detection would continue to play a key role in preventing small fires from growing into large fires. Fire detection efforts would not change and would continue to rely mostly on lookouts, aerial patrols, and public reports.

The precise location of a fire start cannot be predicted. Fire behavior of a start also cannot always be accurately predicted for an extended period because weather and fuels vary over time. If extreme fire conditions are predicted or exist, restrictions and/or closures may be put into effect to limit public access to the forest.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

The Cumulative Effects Worksheet (Project File Exhibit K-2) considers and describes proposed activities in addition to the past, current, and reasonably foreseeable activities listed at the beginning of this Chapter in Table 3- 1 and Table 3- 2. Those activities that cumulatively contribute indiscernible effects on fuel conditions are not included in this section. Those activities that cumulatively affect the fuels conditions are discussed below.

Harvest, underburning, whole tree yarding, and yarding of unmerchantable material, combined with slashing ladder fuels/excavator piling/burning, and Pre-Commercial fuel reduction treatments, would continue to reduce fuels and the associated risk of wildland fire. Pre-commercial Thinning would help to create healthy, vigorous stands of trees composed of a desirable mixture of tree species. These stands would be more resistant to insects and disease, be able to better withstand low-to moderate intensity wildland fires over time, and could be machine or hand piled as needed. The overall cumulative trend would be a continued improvement in forest health conditions as management moves stands towards desired future conditions.

PAST ACTIVITIES

A portion of the NFS lands within the Glacier Loon Project Area have been harvested in some manner (see Forest Vegetation Section). Timber harvest has also occurred on private and industrial lands in the project area. Most of this is on private timber lands; some on small private holdings. These past activities have broken up the fuel connectivity on a landscape scale. 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. Past treatments could make an area more defensible for fire suppression activities for decades.

Firewood cutting has an annual effect on forests 200 feet adjacent to roads open year round and seasonally. Larch and Douglas-fir are the preferred species; however, due to the high demand and scarcity of available area, lodgepole pine and any other dead species are removed. This activity has the potential to reduce coarse down woody material, snags, and fuel up to 200 feet from roads. It is difficult to know how many acres have been affected by this activity. Removing the dead fuel component creates a corridor of defensible area necessary for successful suppression activities. In areas of heavy firewood collection, the removal of dead wood breaks up horizontal and vertical fuel continuity; this action combined with the fuel-free road surface would assist in successful suppression operations.

Private land development has been occurring for the last century in the analysis area; however, it has been most intense in the last two decades. The vegetative conditions on small private land parcels are highly variable and range from grassland to dense old forest. The effect of private land development has been to convert some forested land to low density forest or grassland and roads. There has been a recent response to fire prevention education involving effective fuel reduction within some of these private in-holdings. Although in most cases, the desire of the landowners has been to maintain a forested setting, on one or more aspects, in the immediate vicinity of dwellings and structures that is contiguous with forested public lands. In many cases, small private forested areas have not been managed and forests have become densely stocked stands with large quantities of dead trees. These sites are highly vulnerable to insect and disease outbreaks and wildland fire.

REASONABLY FORESEEABLE ACTIVITIES

Firewood cutting is anticipated to continue along seasonal and yearlong open roads. This activity could have the potential to reduce coarse down woody material, snags, and fuel up to 200 feet from roads. This removal of dead standing and downed wood would reduce the amount of fuel left on NFS lands. Firewood gathering would contribute to the overall effort to reduce fuels in the WUI.

The 154 acres of overstory removal harvest (Fredswood TNC project) that occurred on Legacy lands within the analysis area decreased stand densities, modified average stand diameters, modified vertical structure from a two-storied structure to primarily a single-storied structure, and altered fuel arrangements. The Krafty 13 TNC overstory removal harvest that occurred on 173 acres prior to Land and Water Fund acquisition of Section 13, T20N, R17W had a similar effect. The change in the fuel and fire behavior characteristics from these projects are similar to the post treatment scenarios described in this analysis.

Private in-holdings in the Glacier Loon Area have been developed in the recent past with an increase in the number of residences adjacent to the project area. The probable development trend would be to expect further home construction within the limits of county zoning practices. It is reasonably foreseeable that some additional home development could occur on private lands within the project area with likely consequences being the removal of some additional vegetation on private lands to accommodate new landowner's objectives. The presence of more dwellings elevates the importance of fuel reduction to reduce the potential loss of life and property.

Other foreseeable actions include noxious weed control, road maintenance, administrative road use, public recreational use, and small forest products gathering for personal use. These activities would not be expected to contribute to, or inhibit, efforts to achieve desired stand conditions.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change to the MA for a portion of the Glacier Loon Project Area along Lindbergh Lake, including the highly visible portions of the project area from the lakeshore to the slope break, totaling approximately 221 acres. The proposal would change 213 acres from MA 15, which consists of timberlands where timber management with roads is economical and feasible as currently assigned, to MA 5, which consists of roaded timberlands in areas of high scenic value. The other 8 acres would be changed from MA 15C, timberlands with emphasis on white-tailed deer summer range, to MA 5.

This change would generally result in less fuel reduction treatment activities occurring as emphasis within MA 5 would be primarily limited to those treatments that maintain or enhance the scenic quality of the area. The long-term effects to species composition would be likely to include decreased proportions of long-lived, fire tolerant, shade-intolerant species (primarily western larch and ponderosa pine) in some areas and increased representation of shade-tolerant species, such as grand fir, subalpine fir, and Douglas-fir. The historical fire regimes would continue to trend toward less resilient fire regimes, characterized by increased fire behavior and more lethal fire events.

As stand dynamics progress, two-storied and/or multi-storied stand structures would continue to develop and would likely dominate the area. Density is expected to slowly and gradually increase as trees grow larger, tree crowns expand, and shade tolerant ingrowth occurs. This generally results in more intermediate vegetation that allows for crown fire initiation to occur.

Distribution of seral stages would be similar to the existing condition with eventual shifts into mid- and late-seral conditions. In the absence of natural disturbance, such as fire, early seral stages would be absent.

The effects of this change are also included in the direct and indirect effects section, as well, due to changes in the action alternatives associated with this change such as reduction or deferral of harvest opportunities within this area.

REGULATORY FRAMEWORK AND CONSISTENCY

The Glacier Loon Project is consistent with the following Forest Plan Fire Management Direction (Appendix G, Forest Plan 2001) and Fire and Fuels direction for all affected management areas:

- Implement prescribed fire to maintain healthy, dynamic ecosystems that meet land management objectives.
- Integrate an understanding of the role fire plays in regulating stand structure into the development of silvicultural prescriptions.
- Planned ignition prescribed fire may be utilized to reduce hazards from activity-caused fuel concentration and to maintain or enhance vegetative components or wildlife habitat (Forest Plan, pp. III-74).

AIR QUALITY

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA, therefore the potential effects to air quality in the Glacier Loon Project have not changed.

INTRODUCTION

The basic framework for controlling air pollutants in the United States is mandated by the 1970 Clean Air Act (CAA), as amended in 1990 and 1999. The CAA was designed to “protect and enhance” air quality. The primary means by which this is to be accomplished is through implementation of National Ambient Air Quality Standards (NAAQS).

Section 160 of the Clean Air Act requires 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, recreational, scenic, or historic value.” Stringent requirements are therefore established for areas designated as “Class 1” attainment areas. Class 1 Areas include Forest Service and USFWS wilderness areas over 5,000 acres that were in existence before August 1977, and National Parks in excess of 6,000 acres as of August 1977. Designation as a Class 1 Area allows only very small increments of new pollution above existing air pollution levels. The Bob Marshall Wildernesses and Glacier National Park were considered in the development of this project.

If a community does not meet or “attain” the NAAQS, it is designated as a non-attainment area and must demonstrate to the public and the Environmental Protection Agency (EPA) how it will meet standards in the future. This demonstration is done through the State Implementation Plan. Kalispell, Whitefish, and Columbia Falls are non-attainment areas addressed in this report.

Under the current State and Federal rules, wildland fires are considered natural events, so the smoke they produce is not considered as a cause of violations of air quality standards or visibility protection goals. Conversely, prescribed fires are considered active management so the smoke produced is considered as an impact on air quality and visibility standards.

This analysis discloses the potential effects to air quality from implementing the Action Alternatives and a No Action Alternative, to provide the decision maker with a means of comparing these alternatives. The analysis of both the action and no action alternatives include the effects of wildland fire smoke, prescribed fire smoke and fugitive dust.

Wildland fires are a natural combustion process that consumes both living and dead vegetative material and produces smoke that can have adverse impacts on air quality. The size, intensity, and occurrence of wildland fires depends directly on variables, such as meteorological conditions, the type of vegetation present, the moisture content of both live and dead fuel, topography and the total weight of consumable material available. Small fuel, such as dead grass and conifer needles, supports fire spread. Larger dead fuels are consumed to a variable extent depending on their moisture content. Under environmental conditions that reduce the moisture content of live fuels, such as drought and extreme heat, these fuels may also be consumed. Slope effects fire in much the same way wind does, the steeper the slope the greater the effect. The aspect of a slope influences the moisture content of fuels with north aspects being relatively damp and south slopes being relatively dry. Under the extreme condition of heavy fuel, drought, and hot, dry weather nearly all forest fuels are available for consumption. The impacts to air quality vary by the amount of smoke produced, which varies with burning conditions. Large amounts of smoke are produced under extreme burning

conditions.

Smoke produced from the prescribed burning of timber harvest residue and natural fuels could have an adverse effect on air quality. The amount of smoke produced is influenced by the same factors that influence the amount of smoke produced by wildland fires. Increasing the utilization of sub-merchantable material could reduce the amount of fuel remaining after timber harvest and so reduce the amount of smoke produced. The type and timing of burning, as well as weather conditions, influences the amount of smoke produced.

Air quality is affected by fugitive dust produced by vehicular traffic, especially on native surface roads. The silt content of the road surface layer, the distance traveled, the weight and speed of the vehicle, as well as weather conditions, influence the amount of dust produced. Paved roads produce a relatively smaller amount of dust than do native surface roads, especially during dry weather. Mitigation measures, that reduce the availability of fine silt particles, such as watering or dust suppressants, are effective. Reducing the speed of vehicles can reduce localized impacts.

This analysis includes the direct effects (effects resulting from the implementation of an alternative that occurs at the same place and time), indirect effects (effects resulting from the implementation of an alternative that occurs later in time or are further removed in distance but are reasonably foreseeable), and cumulative effects (effects resulting from the incremental impacts of past, present and reasonably foreseeable future actions regardless of who is responsible).

ANALYSIS AREA

SPATIAL BOUNDS

The analysis area for consideration of air quality impacts from the implementation of the action alternative is the area within a radius of 90 miles (145 kilometers) from the project area. The EPA's air quality permitting system suggests that sources within a radius of 100 kilometers (62 miles) be considered especially those located downwind of the source. Impacts from any burning within the project area would usually occur downwind in an easterly-northeasterly direction, as prevailing winds are from the west to southwest. Sensitive areas potentially affected include the WUI within and adjacent to the project area and possibly the Bob Marshall Wilderness and Glacier National Park.

TEMPORAL BOUNDS

Impacts from any burning within the project area would usually occur within 5 years of the initiation of the project. This is the time frame used for the air quality effects of the action alternatives. The No Action Alternative does have an undetermined potential for increased smoke related effects to air quality due to a possible large fire. This potential increases over time due to ground fuel accumulations increasing as dead trees fall in the forest. Concurrently, over time, the area is exposed to more potential ignition sources (primarily lightning). At some point, the stands would begin to regenerate and a reduction in fuel loading would begin as the rate of falling trees is exceeded by natural amelioration of the surface fuels.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

For the purposes of this analysis the following fuel loading values were used. They represent maximum expected loadings. The actual loadings would vary depending on site-specific conditions as well as utilization standards and market conditions at the time of harvest:

- For areas treated for fuel reduction, a value of 60 tons per acre was used.

- For areas planned for ecosystem burning a fuel loading of 20 tons per acre was used. Although ecosystem burns are not a part of this project, such burns are reasonably foreseeable and have been included in the cumulative assessment of effects. These estimates were developed using the First Order Fire Effects Model (FOFEM).

MEASUREMENT INDICATORS

The combustion products of smoke from wildland fires and prescribed burning include carbon dioxide, water vapor, carbon monoxide, particulate matter, hydrocarbons, nitrogen oxides, and trace minerals. Federal and State ambient air quality standards have been established for particulate matter (PM), which is the pollutant of most concern from smoke. Specifically, particulate matter less than or equal to 10 micrometers in aerodynamic diameter (PM-10) is the size that can penetrate the inner recesses of the lungs, causing health problems. It is also the size that most severely impacts local and regional visibility.

If a community does not meet or "attain" the NAAQS, it is designated as a non-attainment area and must demonstrate to the public and the EPA how it will meet standards in the future. This demonstration is done through the State Implementation Plan.

In July 1997, the EPA issued revised national air quality standards for ozone and particulate matter in the 2.5 micron class (PM 2.5). The EPA proposed the following implementation plan for the new standards, which took effect on September 18, 1998:

- Nationwide fine particulate monitors in place.
- States and EPA collect data from nationwide network.
- States submit to EPA their State Implementation Plans (SIP) describing how they'll meet and enforce the new standards.
- States implement their Plan to assure they attain the standards.

The current Federal and State standards are:

- **PM 10:** The concentration of PM 10 must not exceed 150 micrograms per cubic meter over a 24-hour period; or the annual arithmetic average must not exceed 50 micrograms per cubic meter.
- **PM 2.5:** The concentration of PM 2.5 must not exceed 65 micrograms per cubic meter over a 24-hour period; or the annual arithmetic average must not exceed 25 micrograms per cubic meter.

Particulate Matter 10 and 2.5 monitors are located in Libby, Kalispell, Whitefish, Missoula, Helena, and several other sites in Montana.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Quantitative air quality data is not available for the period prior to settlement of the analysis area late in the 19th century. However, it is known that fire played a major role in the development of vegetative patterns throughout western Montana. Journals from early day explorers and newspaper articles from the late 1800's often mention the smoky conditions from summer fires burning in western Montana and northern Idaho (Losensky 1992).

The annual amount of smoke generated from forest fires has generally decreased since the early

1900s, even with today's use of prescribed fire. Prior to the advent of effective fire suppression (about 1930), fires which started in the area burned unchecked from the time of ignition until weather changes stopped their spread. Smoke production varied as environmental factors changed. Smoke could have been produced for just a few hours or for as long as several months. During severe fire seasons, especially when stagnant high pressure systems persisted, regional air quality was no doubt poor. The number of acres burned by wildland fires decreased as effective fire suppression became common and as a result, air quality improved. During the last two decades of the 20th century, natural fuels resulting from decades of fire suppression have reached a level where larger, more intense fires are becoming common. The degradation of air quality is a direct result of these wildland fires.

According to the EPA's Report AP-42, Compilation of Air Pollution Emission Factors, some air pollution is generated by prescribed burning, although the net amount is believed to be a relatively smaller quantity than that produced by wildfires. The EPA states in this report that:

"Prescribed fire is a cost effective and ecologically sound tool for forest, range, and wetland management. Its use reduces the potential for destructive wildfires and thus maintains long term air quality."

The planning, scheduling, coordinating, and monitoring of prescribed fire on NFS land follows the guidelines described in the CAA and Amendments to the Act (1972, 1977, and 1990) that provide direction to protect and enhance the quality of the Nation's air resources and to protect public health and welfare.

EXISTING CONDITION

Montana is divided into 10 airsheds by the Montana State Air Quality Bureau. The project area lies entirely within Airshed 2. Airshed 2 is the primary analysis area for assessing the influence of the Glacier Loon 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).

Smoke produced within the analysis area would most likely be carried in an easterly-northeasterly direction by the predominantly westerly, synoptic scale, wind flow pattern that influences western Montana. Airshed 2 comprises Flathead, Lake, Sanders, and the northern portions of Missoula and Powell counties.

Smoke dispersal is usually best during the spring and early summer because daytime heating and general wind flows help smoke rise above ridge tops and into the free air winds where it is diluted and dispersed. Stable high pressure systems that often occur during late summer and fall hamper the vertical motion of air and reduce the smoke dispersion potential. However, infrequent, low pressure systems also move through the area during this period and improve smoke dispersal until high pressure re-establishes. As the heat of summer passed and night time temperatures begin to drop, air quality begins to deteriorate as night time inversions become more prevalent, trapping smoke in valley bottoms until adequate heating breaks the inversion later in the day. Weather patterns begin to change during the fall months with periodic cold front passages being interspersed with periods of stable high pressure. These cold fronts are often dry but can bring substantial moisture. Wind associated with these cold fronts provide good ventilation but also increase the risk that a prescribed burn could escape control. The late fall often marks the return of wet, foggy, and cloudy weather to the analysis area. During this time, periods of good ventilation occur during frontal passages, but valley inversions often hamper the dispersion of smoke. Winter weather is very similar, with smoke dispersion often being poor.

The mountainous topography of the analysis area also influences the dispersion of smoke. Smoke produced at higher elevations is nearer to the free air winds that occur at and above ridge tops, so dispersion is usually better than at lower elevation. Conversely, smoke produced at lower elevations is more likely to be effected by valley inversions and must rise farther to enter the free air wind. Burns on south exposures are more likely to be effected by local thermal winds than those on north slopes. Burns on slopes exposed to the prevailing wind would have better smoke dispersion than those located on the lee slope.

Smoke dispersal is best when the daytime heating is greatest. This usually coincides with the period of greatest atmospheric instability for the day. Free air winds penetrate into lower elevation at this time resulting in good vertical motion and smoke dilution. These conditions generally occur from 1:00 to 6:00 p.m. Smoke dispersal is usually poor for night-time burning due to the increase in atmospheric stability as cool air pools in valleys. This process also results in the development of valley inversions.

Studies conducted by the Montana Department of Health and Environmental Sciences have demonstrated that prescribed burning of logging slash, when burned in compliance with State regulations, is not a major contributor to reduced air quality in the Kalispell area.

Source apportionment studies for Kalispell, a nonattainment area, have shown that slash burning contributes less than 3 percent of the total PM-10 load, with road dust and wood stove smoke originating within the city itself being the major contributors. PM-10 readings, taken since 1988, have shown a trend in improving air quality during the months of September through November when most of the prescribed burning takes place. The potential impacts of smoke from prescribed burning has been minimized through successful airshed coordination.

Airshed 2 air quality is influenced predominantly by smoke and dust originating from areas located to the west, since the general wind flow direction for the area is from this direction. This includes grass burning in Idaho and Washington, as well as other agricultural areas in northern Oregon. Industrial emissions as well as those from internal combustion engines add to the level of regional haze and air pollution load. Prescribed burning of logging residue by private and other government entities adds wood smoke to the air mass. Wildland fires burning as far west as the coastal range of Oregon and Washington also contribute to air quality degradation. Dust, originating from tilled farm land, during dry windy weather, can add to local haze and reduce air quality.

ENVIRONMENTAL CONSEQUENCES

The Cumulative Effects Worksheet (Project File Exhibit K-4) considers and describes proposed activities in addition to the past, currently, and reasonably foreseeable activities listed in the beginning of this chapter in Table 3- 1 and Table 3- 2. Those activities that cumulatively affect air quality are discussed below.

FUGITIVE DUST

Fugitive road dust is a result of motorized vehicle use when road surfaces are dry. When a motorized vehicle travels on an unpaved road, the force of the wheels moving across the road surface causes pulverization of surface material. Dust is lofted by the rolling wheels as well as by the turbulence caused by the vehicle itself. This air turbulence can persist for a period of time after the vehicle passes.

The moisture content of the road surface has the greatest influence on the amount of fugitive dust produced. Within the project area, most activity would occur during the late spring, summer and fall months. July, August and September are generally dry so most dust production would occur during this period. Precipitation does fall during these months but is usually limited so it would only reduce dust production for short periods.

This analysis considers the fugitive dust associated with post-decisional project activity by both Forest Service, as well as the timber sale contractor. The actual amount produced would be influenced by dust mitigation measures taken directly by the Forest Service and by Missoula County as general road maintenance, as well as actual precipitation, and timing of log hauling. This analysis considers Alternative A (No Action) and Alternative B, which proposes the highest level of management activities. Alternatives C and D would have proportionately less impact on fugitive dust due to less proposed management activities.

ALTERNATIVE A – NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Alternative A, the No Action Alternative, would not produce fugitive dust beyond the amount produced by routine forest management activities. There would not be any fugitive dust associated with post-decisional project road use or ground disturbances. Therefore, there would be no direct, indirect, or cumulative effects to air quality from the implementation of this alternative.

ALTERNATIVE B DIRECT AND INDIRECT EFFECTS

This analysis considered impacts to air quality from dust associated with project implementation, specifically road dust. The direct effects of fugitive dust are reduced visibility on and adjacent to roads, and an increased level of small diameter particulates, specifically PM 2.5 and PM 10. The amount of dust produced would be influenced by dust mitigation measures taken directly from Forest Service and Missoula County as general road maintenance, as well as actual precipitation, and timing of log hauling. Indirect effects are limited to the air quality degradation, because of PM 2.5 and PM 10 particulates, since larger diameter materials would settle out near the point of production. PM 2.5 and PM 10 levels would rapidly disperse as they are carried by local and general winds.

ALTERNATIVE B CUMULATIVE EFFECTS

The cumulative effects of fugitive dust on air quality, as a result of the implementation of the action alternative, would result in a small but incremental decrease in air quality as PM 2.5 and PM 10 particles from this source combine with other particles produced both by the implementation of other aspects of this project, specifically prescribed burning, as well as other local and regional sources located upwind. Prescribed burning of logging slash, on other Federal, State or private lands, would also contribute particulates, as would agricultural burning and fugitive dust from tilled ground. Particulates from industrial and automotive sources would also contribute to regional particulate loading. Other vehicle traffic, agricultural and industrial sources within the analysis area would also contribute to the cumulative particulate loading. It is not possible to predict the amount of particulates contributed by these other sources. However, the State Monitoring Unit takes these sources into account, when they prepare smoke dispersion forecasts.

This process of monitoring and forecasting has been effective at achieving the Airshed Group's objectives, which are listed in the Montana/Idaho Smoke Management Agreement.

The cumulative effects on air quality, resulting from the implementation of the action alternative and from other local and regional pollutant sources, would likely result in PM 10 loadings, on an average daily loading equal to or less than the maximum annual arithmetic mean of 50 micrograms per cubic meter or a maximum daily concentration of PM 10 at or below 150 micrograms per cubic meter. There may be days when regional air quality does not meet these standards but, because of the Montana/Idaho Air Shed Group Monitoring Group's effectiveness, it is unlikely that any source associated with this project or any other present or reasonably foreseeable future burning project, would be a significant contributor.

PRESCRIBED BURNING SMOKE

The amount of smoke emissions, resulting from prescribed burning of both natural fuels and logging slash, would be mitigated by four general methods;

1. Fuel loading reduction,

2. Fuel consumption reduction,
3. Flaming combustion optimization, and
4. Impact avoidance.

FUEL LOADING REDUCTION

The Flathead National Forest has encouraged, through sale contract provisions, the increased removal of material that is smaller than the established utilization standard for a given timber sale. First, purchasers are required to pay for, and therefore encouraged to utilize, top wood smaller than the utilization standard. Second, the standard contract allows the purchaser to remove sub-merchantable material from Regeneration Harvests without prior consent of the Forest Service (Standard Contract Provision B(T) 3.41). Third, sub-merchantable material may also be removed from Commercial Thinning Units with prior Forest Service agreement. All these measures help decrease the amount of woody fuel that must be burned.

FUEL CONSUMPTION

The reduction of the amount of fuel consumed by prescribed burning would be accomplished through the use of spring burning. Harvested areas located on east, southeast, south, southwest and west aspects would be burned, to the extent possible, during the spring burn season, typically from late March through June. During this time frame larger diameter fuels and the duff layer usually have relatively high moisture contents that reduce the amount of these fuels consumed by prescribed burning.

FLAMING COMBUSTION OPTIMIZATION

When prescribed burning is determined to be the most appropriate fuel treatment, methods which increase the flaming combustion phase would be used. Concentration of logging slash by whole tree yarding or excavator piling increases the amount of material consumed during flaming combustion and also allows material to be burned in the late fall during cloudy weather when smoke is less obvious and the risk of escape is low. Purchasers are required to construct piles so they are compact and free of excess soil.

IMPACT AVOIDANCE

Smoke impact avoidance would be accomplished through daily monitoring of airshed conditions. In Montana, the open burning season runs from March 1 through November 30. All open burning in the state is regulated by the State of Montana Air Quality Bureau. Major prescribed burners, including the Forest Service, have formed the Montana State Airshed Group. Through a Memorandum of Understanding with the Montana Air Quality Bureau, this group has established a smoke monitoring system that provides daily air quality predictions and restrictions to its members. To accomplish this, the Airshed Group has a monitoring unit consisting of meteorologists and technicians that use weather forecasts, balloon soundings, burn plans, and air quality conditions to determine, on a daily basis, the need for restrictions on prescribed burning. The Forest Service is issued an annual permit to burn by the Montana Air Quality Bureau. Issuance of this permit is based on participation and compliance with burning restrictions issued by the Montana Airshed Group. Prescribed burning is reported to the Airshed Coordinator on a daily basis. If ventilation problems are forecasted by the monitoring unit, prescribed burning is either restricted by elevation or curtailed until good ventilation conditions return. The Forest Service would cooperate with the State in meeting the Requirements of the State Implementation Plan and the Smoke Management Plan (Forest Plan).

The following table displays, by alternative, the fuel treatment type, the total number of acres for each treatment category, the estimated total fuel loading, in tons, for that acreage and the estimated percent fuel reduction. Similar fuel treatment activities were grouped to simplify the analysis. This analysis considers Alternative A (No Action) and Alternative B which proposes the highest level of management activities. Alternatives C and D would have proportionately less impact on prescribed fire generated smoke due to less proposed management activities.

TABLE 3- 49 FUEL TREATMENT TYPES, TOTAL NUMBER OF ACRES FOR EACH TREATMENT CATEGORY AND ESTIMATED FUEL LOADINGS FOR THE GLACIER LOON PROJECT.

	ALTERNATIVE A	ALTERNATIVE B
Potential Pile Burn Acres	0	1470
total tons fuel	N/A	73,500
Percent fuels reduced	N/A	50%
Spring Underburn Acres	0	164
total tons fuel	N/A	3,280
Percent fuel reduction	N/A	60%

ALTERNATIVE A – NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

There would be no direct, indirect, or cumulative effects to the air quality of human health from Alternative A. Alternative A would not implement any prescribed smoke producing activities, such as pile burning, and would not directly contribute to air quality impacts. However, prescribed burning of logging slash, on other Federal, State, or private lands, would contribute particulates, as would agricultural burning and fugitive dust from tilled ground. Particulates from industrial and automotive sources would also contribute to regional particulate loading. Other vehicle traffic, agricultural and industrial sources within the analysis area would also contribute to the cumulative particulate loading. It is not possible to predict the amount of particulates contributed by these other sources.

ALTERNATIVES B DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

The estimated amount of smoke emissions, produced by prescribed burning associated with the action alternative, is portrayed in the following table. The project file contains the calculations used to develop these estimates. The actual amount of smoke produced would be equal to or less than these figures since worst-case conditions were used.

TABLE 3- 50 PARTICULATE AMOUNTS (TONS/ACRE) PRODUCED BY PRESCRIBED FIRE ASSOCIATED WITH ALL ACTIVITIES.

ALTERNATIVE	PM 2.5 TOTAL TONS PRODUCED	PM 10 TOTAL TONS PRODUCED
A	0	0
B	35.8	30.2

The direct effects of prescribed burning smoke, for each action alternative, are directly related to the total acres treated by prescribed fire. Alternative A – the No Action would not produce prescribed burning smoke. The direct effects of prescribed burning smoke are reduced visibility; and increased level of small diameter particulates, specifically PM 2.5 and PM 10, of concern for human health reason. Although, over time, wildfires would be expected to occur and produce smoke within the project area, the amount of smoke produced and the timing is not predictable, so for the purposes of this comparison, Alternative A is showing 0 tons of PM 10 and PM 2.5.

The indirect effects of prescribed burning smoke produced as a result of the implementation of the action alternative would be directly related to the amount of timber volume to be removed. Indirect effects are limited to the air quality degradation, as a result of PM 2.5 and PM 10 particulates, and increased haze. Particulate Matter 2.5 and PM 10 levels would rapidly disperse as they are carried by local and general winds.

The cumulative effects on air quality of prescribed burning smoke, produced as a result of the implementation of the action alternative, would result in an incremental decrease in air quality as PM

2.5 and PM 10 particles from this source combine with other particles produced both by the implementation of other aspects of this project, specifically fugitive road dust, as well as other local and regional sources located upwind. Prescribed burning of logging slash, on other Federal, State or private lands, would also contribute particulates, as would agricultural burning and fugitive dust from tilled ground. Particulates from industrial and automotive sources also contribute to regional particulate loading. Other vehicle traffic, agricultural and industrial sources within the analysis area would also contribute to the cumulative particulate loading. It is not possible to predict the amount of particulates contributed by these other sources.

WILDLAND FIRE SMOKE

This analysis considers Alternative A (No Action) and Alternative B which proposes the highest level of management activities. Alternatives C and D would have proportionately less potential reduction in wildland fire generated smoke due to less proposed management activities.

ALTERNATIVE A - NO ACTION DIRECT AND INDIRECT EFFECTS

No management activity would occur if Alternative A is selected. The direct effect of wildland fire smoke on air quality from implementing Alternative A is that fire occurrence, intensity, and size would be similar to fires in the recent past. Historical records from the past 30 years show that, on average, one fire occurs within the analysis area every 10 years. The Crazy Horse Fire occurred in 2003 and burned 11,000 acres.

These fires were generally small, burning less than 1 acre each. However, there is an increasing probability that one of these fires would escape initial attack and grow to several hundred to thousands of acres, burning for several days or even weeks. Fires of this scale and duration would impact air quality to varying degrees during the time the fire would be active.

An indirect effect of wildland fire smoke, from implementing Alternative A would be the gradual change in the existing fuel complexes as dead woody fuels accumulate secondary to insect, disease and weather disturbance. Live fuels, especially ladder fuels, would also increase over time as stand density declines and understory shade tolerant species increase in response to increased sunlight. As the fuel loading increases the incidence and intensity of wildland fires, and the smoke they produce, would increase. The current non-lethal to mixed lethal fire regime would change, over time, to a mixed lethal to lethal regime.

ALTERNATIVE A - NO ACTION CUMULATIVE EFFECTS

Due to the increases in fuels over time with the No Action Alternative, it can be anticipated that the intensity and extent of wildfires would increase in the project area as compared with historic more frequent interval fires as discussed in the Fire and Fuels Section of the EA. Associated smoke from such wildfires would increase as a consequence of taking no action as contrasted with Alternative B.

The cumulative effects of wildland fire smoke on air quality for the No Action Alternative would include all pollution sources contributing particulates to the air mass in addition to the smoke produced by wildland fires within the analysis area. The greatest cumulative effect would occur when wildland fires are burning outside and upwind of the analysis area and wildland fires within the analysis area burn at the same time. The cumulative effect of these sources could result in extended periods of poor air quality. The potential amount of smoke produced would vary by alternative and would be proportionate to the amount of fuel hazard reduction resulting from each alternative.

ALTERNATIVE B DIRECT AND INDIRECT EFFECTS

For the purpose of analysis, it was assumed that all of the acres proposed for treatment followed by prescribed burning, are burned by intense, stand-replacing wildland fire. In doing this, a basis for comparing the potential air quality impacts of wildland fire to the potential impacts of management activities is derived. The following table displays these estimates. Be aware that this is not an attempt to depict reality, but merely an analysis for comparison purposes.

TABLE 3- 51 PARTICULATE AMOUNTS (TONS/ACRE) PRODUCED BY WILDLAND FIRE.		
ALTERNATIVES	PM 10 TOTAL TONS PRODUCED	PM 2.5 TOTAL TONS PRODUCED
A	250	150
B	101.5	50.5

The comparison of relative impacts of implementing an action alternative versus a stand replacement wildland fire indicates that, on an acre-to-acre basis, an action alternative would produce from 50 to 60 percent of the smoke impacts of an intense wildland fire affecting the same area.

The indirect effect of wildland fire smoke on air quality, resulting from implementing the action alternative, would be that, over time, as vegetation recovers in response to both the burning and the increase in available sunlight, the fire potential on treated areas would increase from the immediate post-burn level. The potential spread of fire would increase, but the intensity, and smoke production, would generally decrease from the current situation.

ALTERNATIVE B CUMULATIVE EFFECTS

The cumulative effects of wildland fire smoke on air quality for the action alternative would include all pollution sources contributing particulates to the air mass in addition to the smoke produced by wildland fires within the analysis area. The greatest cumulative effect would occur when wildland fires are burning outside and upwind of the analysis area and wildland fires within the analysis area burn at the same time. The cumulative effect of these sources could result in extended periods of poor air quality. The potential amount of smoke produced would vary by alternative and would be proportionate to the amount of fuel hazard reduction resulting from each alternative, and for this analysis the alternative with the greatest impacts would be alternative B, and the data from this alternative was used. It should be noted that the airshed impacts between the alternatives is minimal from a landscape perspective, and not measurable at that scale.

EFFECTS ANALYSIS OF POTENTIAL IMPACTS TO CLASS I AIRSHEDS

Certain wilderness areas and National Parks established before August 1977 were designated as Class 1 Areas. A Class 1 designation allows only very small increments of new pollution above already existing air pollution levels. The Clean Air Act Amendments of 1977 included a program for prevention of significant deterioration of air quality, generally referred to as the PSD program. This program is to prevent areas currently having clean air from becoming more polluted (Hessburg et al. 2005). The Bob Marshall Wilderness and Glacier National Park are Class 1 Areas.

The naturally occurring visual range in the East (United States) may be between 105 to 190 kilometers (65 to 118 miles), while natural visual range in the West is between 190 to 270 kilometers (118 to 167 miles) (Interim Air Quality Policy on Wildland and Prescribed Fires, EPA, 1998). The existing condition of the representative standard visual range for the Class 1 Areas of concern for this project is as follows:

TABLE 3- 52 STANDARD VISUAL RANGE FOR THE BOB MARSHALL WILDERNESS AND GLACIER NATIONAL PARK.		
10TH PERCENTILE	50TH PERCENTILE	90TH PERCENTILE
97 kilometers (60 miles)	178 kilometers (110 miles)	249 kilometers (154 miles)
(http://www.fs.fed.us/r6/qa/natarm/r1/bob_marshall.htm)		

The analysis shown in the above table indicates the probability that transport winds from a direction that would carry smoke toward the Bob Marshal Wilderness Area and Glacier National Park, would occur on about 20 percent of days. If burning occurs on one of these days, smoke could impact visual quality and could also deliver air borne pollutants to these Class 1 Airsheds. Smoke dilution would greatly reduce the level of pollutants reaching these points of interest. The effects of visual impairment would be less noticed during spring weather because wilderness use is very limited due to deep snow. The probability of impacting the Bob Marshal Wilderness and Glacier National Park is considered to be quite low due to the distance to these areas.

The cumulative effects on Class 1 Airsheds from the implementation of the action alternative and other present and reasonably foreseeable future actions are not known at this time. The production of air pollutants associated with the implementation of this project would vary over time and would not be continuous. Therefore, impacts would be episodic in nature and the potential of occurrence would end when the implementation of this project is completed.

REGULATORY FRAMEWORK AND CONSISTENCY

By participating in the Montana and Idaho Interstate Airshed Group, complying with the MOU with the Montana Air Quality Bureau, and meeting the requirements of the Sip and Smoke Management Plan, the proposed activities would comply with the Forest Plan and CAA.

HYDROLOGY

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA. This section has been updated to reflect the harvest activities that have occurred on Legacy Lands have been completed. This section also considers the potential cumulative effects of the reasonably foreseeable Beaver Creek Project and a few other smaller projects.

INTRODUCTION

The Glacier Loon Fuels Reduction and Forest Health Project is primarily located along the west side of the Swan River Valley with a few activities located on the east side of the Swan River. The **two** primary watersheds in which activities are located are Glacier Creek and the Upper Swan River above its confluence with Beaver Creek. These waters eventually flow into Swan Lake. The other area that will be analyzed within the project area will be the Swan River Valley Bottom. This is not a true hydrologic area, but it encompasses the project activities outside of Glacier Creek and Upper Swan River Watersheds. Lindbergh Lake will be discussed as an individual entity in the report where activities are proposed on the west face of the Lake due to overall interest in the Lake's water quality

Historic movement of continental glaciers is the primary process responsible for the present day drainage patterns in the Swan River Valley. Alpine glaciers formed at the high elevations in the mountains moved downslope. This scoured the valley hillsides from the ridge tops to the valley floor. Another glacial body formed on the Seeley Swan Divide, moved north, taking the ice from the surrounding mountains to the north. Because of the tremendous weight of the ice and the rubble it carried, the valley bottom was scoured and compacted to a relatively flat form with numerous hummocky areas where many ponds and wetlands formed.

The highest elevations of the project area lie within the Mission Mountains Wilderness. This area is dominated by bare rock slopes with numerous lakes such as Crescent, Glacier and Turquoise Lakes. Also the highest precipitation zone, this is an area where very little forest management has occurred with the exception of **fire suppression, prescribed burning** and recreation use.

On the southeast side of the project area is Lindbergh Lake, the largest body of water in the Swan Valley south of Swan Lake. This lake has been the focus of interest and studies since Charles Lindbergh visited "Elbow Lake" in September 1927 (Project File Exhibit M-6). Information gained from four separate studies will be used to help analyze proposed activities where the studies supply information that can be used on trends and potential changes in water quantity and water quality in the Glacier Creek and Upper Swan River Watersheds, Swan River Valley Bottom Area, and Lindbergh Lake.

The Glacier Loon Hydrologic Analysis Area has a high density of streams in the upper elevations due to the abundance of water from snowpack and fractured land form. Many streams in the upper reaches flow only seasonally during snow melt though most sections are perennial along the flatter valley floor. In some sections of stream the gravel bed is so porous the water goes subsurface, and then reappears in upwellings as cold ground water. These upwellings are preferred places for native fish spawning.

Elevations of the watersheds in the Glacier Loon Analysis Area range from less than 3600 feet to about 8800 feet. Weather systems move predominantly from the southwest to the northeast with precipitation ranging from about 30 inches a year at the lowest elevation and over 100 inches at the

highest elevation. Most precipitation falls as winter snow. Snow melt is the primary influence on the area's runoff regime. Peak flows normally occur during the first couple weeks in June, augmented by warm spring temperatures and rain, though an earlier smaller peak usually occurs in early to mid-May.

ANALYSIS AREA

SPATIAL BOUNDS

The hydrologic analysis for the Glacier Loon Project, where activities are proposed, is composed of three areas: Glacier Creek Watershed (35,805 acres), the Upper Swan River Watershed (27,100 acres) which includes Lindbergh Lake, and the Swan River Valley Bottom Area (8,720 acres). The west face of Lindbergh Lake (6,238 acres) will also be evaluated for some aspects of the hydrologic analysis as a separate area to respond to concerns raised by the public during the comment period on the scoping of the proposed action and during field trips to the project area. Map 3-2 displays the areas analyzed for the Glacier Loon Project. These three areas will be evaluated for direct, indirect and cumulative effects of the proposed activities.

Only Glacier Creek and the Upper Swan River Drainages are considered true "catchments" or watersheds hydrologically. These two areas are an appropriate size to analyze potential effects to the Hydrologic Resource from forest and access management through models and other resource tools. The next larger stream catchment, the Swan River Basin as a whole, will not be analyzed for water quality or water quantity for direct and indirect effects because the drainage is so large that detection of changes is not possible to determine with this size of project. It will be discussed in general for cumulative effects, as there have been some relevant studies that look at hydrologic function at that level (Grant 1989) and nutrients "Determining Nutrient and Carbon Loading in the Swan River, Montana" (Ellis et al. 1999). These studies will be discussed later in this section.

The Swan River Valley Bottom Area is outside of those watersheds but is within the project boundary. To ensure the hydrologic analysis covers the effects from the proposed management activities, it will be used as an individual analysis unit. This area is not a "watershed" because the water flow in the valley bottom is diffuse, running into wetlands, ephemeral draws and ponds. The valley bottom does contribute to the overall ground water for the Swan Valley.

TEMPORAL BOUNDS

The temporal bounds for potential effects on the hydrologic conditions in the project area are different for water quantity, water quality and channel stability as described below.

WATER QUANTITY

This analysis will focus on water quantity increases (yields) in the Glacier Creek and Upper Swan River Watersheds, and the Swan River Valley Bottom Area upon completion of the project, plus consideration of other reasonably foreseeable actions for cumulative effects. The water yield analysis will be expressed as average annual yield immediately after project implementation, and at 10, 25, and 50 years after the project is implemented. These points in the future provide an estimate for how the areas would recover given cumulative effects with the different alternatives. It was also used because it acknowledges the time frames for the modeled changes in water yield (volume of runoff) to return to background levels after forest management activities. This is linked to regrowth of vegetation and is directly correlated to curves that are used in forest growth and yield models developed here in Montana. The first 15 to 25 years is the period when there is a surge of growth of herbaceous plants and shrubs (Project File Exhibit M-3). The final stages of recovery are linked to re-growth rates of conifers with lack of total "recovery" limited to the areas left unoccupied by trees, such as compacted road beds or other areas removed from "reforestation" due to maintained pastures or residential development. This is figured into the calculations for past management (Project File Exhibit M-3).

WATER QUALITY

Sediment production derived from the Forest Soil Scientist's WEPP Modeling and on-the-ground road surveys done by the Atkins Study (Project File Exhibit M-0) will be used as the primary indicator of water quality for Glacier Creek, Upper Swan River, and Swan River Valley Bottom Area. Sediment delivery was considered immediately after project implementation.

CHANNEL STABILITY

Changes in channel stability or morphology (stream channel shape or form) can occur during one instance in time, or over decades. This analysis will consider changes to riparian areas, increases in water yield, and amount of BMP road work performed through implementation of the project and ten years after project implementation.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

SPATIAL ANALYSIS

The Flathead GIS was used to assemble information on past management, climate, and other resource data in the Glacier Loon Analysis Area. The GIS information for management includes past harvest, by harvest type and year, on all NFS lands. Management activities on Legacy lands was acquired from PCTC, then verified on 2011 National Agriculture Imagery Program (NAIP) aerial photos. Management on other private lands was digitized from the NAIP photos, with the harvest type and year of activity extrapolated from nearby areas where information is known.

WATER QUANTITY

All harvested areas were converted to "Equivalent Clearcut Areas" (ECA) as data needed for the ECA Model. Set values have been used for ECA calculations given the type of harvest. Conversion factors have had concurrence with each silviculturist at the onset of each project and used for past harvest based on a relationship between type of harvest and the percent of total canopy cleared. These ECAs were then "recovered" based on values currently used for forest growth and yield models for different types of habitats in Northwest Montana. The area cleared for roads is calculated based on the average width of a road's running surface, cut and fill slopes, and roadside clearing. A value of zero recovery is assigned to permanent road systems. A 200-year delay in recovery is assumed for homestead clearings, pastures, and yards, assuming they would not return to a forested condition for decades, if ever.

All water yield and ECA values were calculated with the use of an Excel spreadsheet created by Montana Department of Natural Resources and Conservation (DNRC), and calibrated with the coefficients used in other water yield models on the Flathead National Forest (Project File Exhibit M-10). This methodology used in the ECA Model has been the foundation for water yield analysis since its documentation in "Forest Hydrology – Hydrologic Effects of Vegetation, Part II (USDA Forest Service 1976). It is still a reliable tool and is currently being used as a surrogate for changes in water yield in many ongoing studies in British Columbia and Alberta Canada.

Peak Flows

Some attempts have been made to model peak flow changes in relation to forest management activities using aspect, slope, and other measurable parameters that could "synchronize or desynchronize" water runoff characteristics. Recent examples include R1WATSED and its predecessor R1-R4. But when compared to what is seen to be overall changes in climate weather patterns, and conversion of permeable land surfaces to hardened surfaces, the magnitude of effects of forest harvest on peak flows are relatively minor compared to other anthropologic management activities and weather patterns (Dunne et al. 1978). Therefore peak flow is dismissed from further analysis.

WATER QUALITY

The Soils Section of this EA discusses the amount of hill slope erosion projected to be produced by land management activities (harvest, skid trails, landings, and temporary roads) with the WEPP Model and erodibility of soils. The amount predicted to be eroded from each activity is then routed through a buffer given the distance to the closest body of water. The Soils Section evaluates the entire project area for overall soil quality. These predicted values will be reused for the Hydrology Analysis Areas described above to see how the modeled prediction could affect the water bodies of concern.

The permanent transportation system will be addressed in the Hydrology Section by number of stream crossings, and miles of roads by analysis area, with information provided by the Forest GIS shape files. Hydrology analysis will address the application of road BMPs, road decommissioning, and road surface treatments as improvement methods.

Values used for sediment produced at stream/road crossings will be estimated with the use of an on-the-ground sediment assessment of Glacier Creek Watershed conducted in 2010/2011 with field measurements culminating in the report "Swan Lake TMDL Planning Area Road Sediment Assessment Results" (Project File Exhibit M-9). This study measured potential sediment delivery to streams at each point a road crosses a stream in the Glacier Creek Watershed and other areas not included in the Glacier Loon Project Area.

This Glacier Creek field data will be extrapolated to estimate sediment values for the Upper Swan River Watershed and the Swan River Valley Bottom Area. Atkins (2012) is considered a good surrogate because these drainages are directly adjacent, on the same land type (glacier tills) and of relatively similar landforms. The predicted sediment values will then be compared to what is expected from drainages of similar size and land type given documented values in literature (Dunne et al. 1978).

CHANNEL STABILITY

Channel stability is an indicator of overall aquatic health. It physically reveals how a stream channel is functioning in relation to the amount of water and sediment it is carrying. The stability ratings are derived from field surveys that assess the condition of the upper slopes above the stream channel where large woody debris and potential landslides can influence stream dynamics; the lower channel indicates characteristics when bank full and lower channel areas that the stream uses during low flow conditions. Stability surveys are based on protocol outlined in "Stream Reach Inventory and Channel Stability Evaluation," commonly referred to as Pfankuck Ratings (Project File Exhibit M-8).

The "Stream Reach Inventory and Channel Stability Evaluation," was originated by a Hydrologist named Pfankuck from the Kootenai National Forest in the 1970s. It has been used to help track and document channel changes in relation to forest management and stream flows over time. This process is also defined in detail in "Hydrology Part II" (USDA 1973), as are links to predict channel changes resulting from water yield increases. The focus of these surveys considers rock or gravel size in the stream banks, potential recruitment of large woody debris, and stream bottom armoring. Changes between periodic surveys repeated at the same sites can be used to predict changes in channel condition and stability caused by variation in water yields and peak flows.

Fifteen individual conditions of a stream are assessed by this process. Several reflect the parent geology of the watershed, and the vegetation adjacent to a stream. Others focus on visible changes in stream channel conditions, such as increased fine material in pools. An "Excellent" rating, even in an unmanaged area will most likely occur only where streams carve their way through bedrock, in mature forests, that have had little or no disturbance in many years. In contrast, a "Poor" rating would be most likely to occur where channels are formed in fine sands or fine moveable gravels, the stream banks are covered with grasses or small shrubs that allow undercut banks to form and collapse, and there is little or no potential for large woody debris to be incorporated into the stream network. This system speaks directly to the hydrologic function of stream characteristics, and is not intended to be a

measure of fish habitat quality.

Channel Stability Surveys are most useful when used to document trends when repeated at the same point several times years apart. These trends are most useful for an assessment of potential effects of a management proposal when compared to modeled water yield values. The first series of surveys were conducted in the late 1970s on the Flathead Forest. They have been repeated across the forest as time and personnel became available. Within the Glacier Loon Project Area, 20 channel stability surveys have been conducted from 1976 to 2011, and these surveys have been reviewed in the evaluation of effects.

MEASUREMENT INDICATORS

Changes in water quantity, water quality, and the potential for changes in channel stability related to project implementation will be the main focus to analyze hydrologic impacts for the Glacier Loon Fuels Reduction and Forest Health Project. The following is a description of the primary measurement indicators that will be used to assess the risk of impacts to the streams and other water bodies in the Glacier Loon Area.

WATER QUANTITY (WATER YIELD)

The amount of water flowing from a “catchment” or true watershed is primarily influenced by the amount of precipitation received and the amount of water that runs off the land in the form of streams. The analysis areas in the Glacier Loon Area receive a large range in precipitation from less than 30 inches annually to over 100 inches annually. This range is related to the range of elevation and the influence of the mountains. The amount of water that runs off the hillsides is influenced by the porosity of the soils; how much moisture is contained in the soils from year to year; and the amount of vegetation cover present in the watershed. The vegetation uses water to grow at different rates depending on size and age. The vegetation also intercepts precipitation, allowing the water to evaporate from its leaf surfaces before it can reach the ground and soak in. Where the vegetation cover is changed through forest management or other activities that change the overall forest cover, the amount of water running out of the watersheds will change in quantity, and in some cases runoff timing can be affected.

The relationship between water quantity and changes in streams has been found to be influenced by:

- Forest harvesting for timber production; removal of smaller trees and brush to reduce the risk of large forest fires;
- Areas cleared to build roads; and
- Vegetative cover changes related to land converted to pastures, home sites and lawns.

A large portion of both the Glacier Creek and Upper Swan River Watersheds are located in the Mission Mountains Wilderness, with its myriad of lakes and wetlands. The rugged mountains and water bodies moderate the water quantity and timing of water that runs off for these areas, especially in the highest precipitation zones. The greatest area affected by the human-caused forest manipulations is in the lowest precipitation zones. However, it is the highest elevations that have the most influence on the water volumes in streams and rivers.

When analyzing any project proposal it is also important to consider the amount of forest vegetation that has been removed by road construction, roadside clearing, timber harvest, and/or fire. In general, removal of forest canopy by whatever means reduces interception and evapotranspiration. Loss of canopy can also change snow distribution, and melt patterns. Vegetation modifications can make more water available for surface runoff and stream flow. Hydrologic systems exhibit natural variability in flow and can accommodate some increase in water yield without damage to streams. Increases in the duration of higher (or peak) stream flows have the potential to cause channel adjustments, particularly bank erosion, widening, and subsequent in-stream sedimentation. This is why it is

important to assess the relative degree that water yield may be elevated above what might be considered a natural range.

The ECA Model is designed to address the effects of forest canopy removal on average annual water yield. This model primarily estimates the water delivered to the channel network, but does not estimate in-stream hydrologic or hydraulic processes. In 2002, DNRC developed an Excel worksheet labeled “Water Yield Analysis – ECA Method” for the Flathead Region (Project File Exhibit M-10). The worksheets are used to estimate increased water yield for watersheds that have experienced forest canopy removal through timber harvest, fire, and/or road construction. The procedure is documented in “Forest Hydrology, Hydrologic Effects of Vegetation Manipulation, Part II (USDA 1973). The procedure uses the ECA concept to estimate existing water yield, and how it may be affected by management activities. Data inputs include elevation, aspect, average annual precipitation, and roads. The model also estimates the degree of hydrologic recovery following forest disturbance. The rates of recovery are based on vegetation habitat types (USDA 1973) and growth and yield models for tree species as they regrow based on long term permanent plot data for this Region.

The ECA Model addresses average annual conditions and does not consider extreme or rare events such as high intensity rain storms or rain-on-snow events. The ECA Model relies on climatic mean conditions considered over long periods of time. The model is not intended to predict accurate runoff values, but to compare relative values between proposed actions and alternatives.

The primary concern about changes in water yield is how they may affect hydrologic systems like stream channel stability, aquatic habitat, and water quality. It is important to note that an ECA value is not always correlated with stream channel conditions. Schnackenberg et al. (1998) found no significant correlation between ECA and stream channel characteristics, which suggests that ECA is a poor surrogate for the changes in runoff and erosion that may affect stream channel conditions. By themselves, ECA values cannot fully describe overall watershed condition. At ECA values above 20 to 30 percent, it is important to assess the relative condition of stream channels, aquatic habitat, and water quality to determine if changes in water yield are affecting those resources. For this reason, it is important to determine ECA values, but consider that information in light of other watershed and stream conditions.

WATER QUALITY

SEDIMENT DELIVERY

The Soil Scientist used the WEPP Model in this analysis to assess potential erosion from areas where land management activities are proposed. This value is then reduced by the width of vegetative buffer before sediment would be delivered to a stream or wetland. The soils analysis focuses purely on vegetation management and temporary road construction. Water quality sediment estimates for permanent roads were derived from Atkins (2012), which considers the number of stream road crossings and the field measurements for each side of the stream when both sides were found to have potential contributions. The soils analysis describes the potential effects of the alternatives in terms of risk of changes in hill slope erosion and sediment delivery to streams from roads. Predicted erosion values may only be within 50 percent of the true value. Erosion rates are highly variable, and most models can predict only a single value. Research has shown that observed values vary widely for identical plots or the same plot from year to year (Elliot et al. 1995; Tysdal et al. 1999). In addition, observed erosion rates can be very different from those predicted by WEPP (Larsen et al. 2007). The model output used in this analysis is based on six different Return Period simulations of local climate (overall average, 1.5-year, 3-year, 6-year, 15-year, and 30-year return periods). As with the ECA and water yield values, the modeled sediment outputs used in the analysis are most useful to compare alternatives and particularly useful in contrasting the effects of proposed management activities.

BEST MANAGEMENT PRACTICES

The Streamside Management Zone (SMZ) Law came into effect March 15, 1991; it lists seven forest practices that are prohibited near streams and ephemeral draws. These include broadcast burning,

operation of ground-based logging equipment, the forest practice of clearcutting, construction of roads except to cross streams and wetlands, handling, storage, application or disposal of hazardous or toxic material, side-casting of road materials into streams, lakes, wetlands or watercourses, and deposit of logging slash in streams, lakes or other water bodies. These apply to all forested lands regardless of ownership.

The Montana BMPs were adopted as “voluntary preferred ways to manage forest land.” In April 2012, the USDA Forest Service adopted National Best Management Practices for Water Quality Management on National Forest System Lands (FS-990a). This technical guide turned these “voluntary” practices into requirements on Federal land.

To address these guidelines, the potential for road system impacts to reach waterways and wetlands will be analyzed given the amount of road miles proposed to have BMPs applied. This is thought to be an appropriate indicator because it was reported in the 2012 BMP audit (Project File Exhibit M-14) that the Flathead and Kootenai National Forests were found to be effective 99.3 percent of the time when BMPs were properly applied on glacial till soils, the primary soil type in the Glacier Loon Project Area.

In addition, the Inland Native Fish Strategy Selected Interim Direction has become the standard for management of riparian areas since it was originally adopted in 1995. The intent of this strategy is to lay out management guidelines to maintain “Riparian Goals” in Riparian Habitat Conservation Areas (RHCA) that protect water quality, stream channel integrity, sediment regime and other aquatic characteristics.

In most cases an RHCA is a buffer wide enough to encompass the intent of the SMZ regulations, so management with RHCAs will be used as an indicator for water quality protection. A measure to compare alternatives will include proposed activities within areas delineated as RHCAs by the District Fisheries Biologist.

ROAD DECOMMISSIONING

Recent studies (Project File Exhibit M-24) have found that different methods of reclaiming roads influence not only surface runoff but connectivity of water through the ground surface to the ground water below. Different methods of road reclamation are proposed through alternatives to the proposed action as are different forest management treatments. These differences are compared by alternatives.

RESOURCE ENHANCEMENT PROJECTS

Two resource enhancements are common to all action alternatives. The resource enhancement projects will be discussed separately as they relate to the watersheds analyzed.

CHANNEL STABILITY

As discussed above, channel stability is an indicator of overall aquatic health. It physically reveals how a stream channel is functioning in relation to the amount of water and sediment it is carrying. The stability ratings are derived from field surveys that assess the condition of the upper slopes above the stream channel where large woody debris and potential landslides can influence stream dynamics; the lower channel indicates characteristics when bank full and lower channel areas that the stream uses during low flow conditions. Stability surveys are based on protocol outlined in Stream Reach Inventory and Channel Stability Evaluation (Project File Exhibit K-5).

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

An in-depth description of the existing and historic condition of the geology, hydrology, and other

facets of hydrology in the Upper Swan Valley were described at length in the Upper Swan Valley Landscape Assessment (Project File Exhibit T-4).

Through the decades and centuries, the volume of water in the Swan Valley has changed vastly in response to climate variations. There have been decades of drought, resulting in abundant meadows and stream courses with only seasonally flowing water. When these drier times change into wetter times, meadows become ponds, there are higher more prolonged stream flows, higher water tables, and water sitting on the land surface for longer duration. The Swan River Valley and its tributaries have been in a constant state of change since the last time the glaciers receded.

Large fire events have also affected water retention and flow in localized areas. Wildfires have resulted in faster runoff and higher peak flows with lower retention of water on the landscape. These effects returned to a more average or “normal” runoff regime as fire areas revegetated in the decades after the fire event.

EXISTING CONDITION

WATER QUANTITY

Water quantity is a value that reflects the precipitation that falls on a catchment or watershed, converted to what runs off given soil permeability, overall geologic influences, and ECA. The ECA is a reflection of forest harvest, wildfire, clearings maintained for system roads or for homesteads, lawns and pastures. All managed areas have been modeled for re-growth of vegetation given the management date, forest habitat types, and area cleared for roads. Forests are regrown in the ECA Model based on localized growth and yield models for different tree species. Homesteads with pastures are modeled to recover in 200 years considering it will not return to a forested area within the current planning period, i.e., no return to forested areas.

The following table displays the natural water quantities flowing from the Glacier Loon Analysis Areas. The modeled water yield reflects the existing condition on all lands using the best available data as of the date of this analysis. **This includes recent harvest activities by The Nature Conservancy.**

TABLE 3- 53. NATURAL WATER QUANTITIES IN THE GLACIER LOON ANALYSIS AREA.			
WATERSHED	BASLINE TOTAL ANNUAL WATER RUNOFF (QUANTITY IN ACRE FEET)*	INCREASE WATER RUNOFF FROM EXISTING OPENINGS (QUANTITY IN ACRE FEET)*	PERCENT WATER RUNOFF INCREASE FOR EXISTING OPENINGS
Glacier Creek	81,727	4,686	5.9%
Upper Swan	85,745	773	0.9%
Swan River Valley Bottom	5,232	447	19.8%
*One acre foot is approximately 326,000 gallons of water. These numbers are generated with base layers from the Forest GIS Database and values extrapolated for the ECA Model. As indicated in the table above, the ECA Model runs indicate that the unmanaged amount of water runoff in the Glacier Creek Watershed is about 81,727 acre feet. When adjusted for openings created to build roads, wildfire, timber harvest, and openings on private land, the existing condition is calculated to be about 4,686 above baseline at 86,373 acre feet or about a 5.9 percent increase over what is calculated for the baseline undisturbed forested water runoff. It should be noted the Crazy Horse Fire is the primary cause of most water yield increase in the Glacier Creek Watershed.			

The following table provides information on the overall existing condition ECA for the three watersheds.

TABLE 3- 54. EXISTING CONDITIONS OF GLACIER LOON WATERSHEDS.

WATERSHED	TOTAL AREA (ACRES)*	TOTAL AREA WITH CHANGES TO FOREST CANOPY*	PERCENT AREA AFFECTED	TOTAL EQUIVALENT CLEARCUT AREA (ACRES) **	TOTAL EQUIVALENT CLEARCUT AREA (PERCENT)
Glacier Creek	35,805	20,825	58.2%	5,951	16.6%
Upper Swan	27,100	3,207	11.8%	1,034	3.8%
Swan River Valley Bottom	8,720	5,587	64.0%	4,172	47.8%
* These values represent the area that has had some change in forest canopy since the early 1950's. This includes logging, roads with their associated roadside clearing, forest fires such as Crazy Horse, harvest by The Nature Conservancy and homestead development. ** The Equivalent Clearcut Area is the percentage of forest canopy removed, assuming the area had 100% forest coverage before management. It also includes a recovery factor based on forest re-growth except for areas that have been permanently converted, such as roads and homesteads.					

It is important to remember most of the change in forest cover in Glacier Creek is attributable to the Crazy Horse Fire at about 10,870 acres. These burned areas will continue to revegetate through the coming decades.

Another consideration is the lands once owned by the PCTC: approximately 746 acres in the Swan River Valley Area, 3,144 in Glacier Creek Watershed, and 1,211 acres in the Upper Swan River Watershed. Until the recent acquisition of these lands through the Legacy acquisition, the primary method of harvest was regeneration harvest (clearcut or seed tree), 1 square mile (section) at a time. It is believed that this was done for economic reasons, since it is most efficient to keep equipment in one area until the area is treated. There were many occasions where ground-based equipment was used for forest management in riparian areas before the enactment of the SMZ Act in 1991. Some residual evidence of these activities remains on the ground.

Management on private lands has also changed the landscape. Hundreds of acres have been converted from either forested habitats or wet meadows to support livestock. Where these areas are maintained as cleared areas the vegetative recovery is considered a conversion to permanent openings in the ECA Model. The same would be true for areas converted to lawns and gardens. These interpretations are not displayed separately in the table above but can be found in the ECA calculations (Project File Exhibit K-7).

WATER QUALITY

SEDIMENT DELIVERY

Glacier Creek Watershed

In order to estimate the natural sediment transport capability of Glacier Creek, two models were consulted. The first was Dunne and Leopold (1978) publication, *Water in Environmental Planning*. This body of work has been the foundation of most present day analysis of sediment and hydrologic functions. The table on page 680 of this publication was used to compare drainage areas in the Glacier Loon Project Area to values found with similar sizes and geologies. Glacier Creek drains about 56 square miles of land. According to Dunne and Leopold (1978), about 510 tons of sediment would be expected to be delivered annually from drainages of similar glacier till. The second model is derived from Montana Department of Environmental Quality (2004) calculation that the Swan River naturally transports about 4,600 tons annually. Glacier Creek is about 8.5 percent of the watershed, so proportionally this would mean that Glacier Creek could naturally transport about 390 tons of sediment. Thus the natural range is assumed to be between 390-510 tons of sediment annually.

Past activities that have contributed fine sediment to streams and wet areas include road construction and maintenance, forest harvest in streamside areas, and the 2014 Red Butte Fish barrier.

In the Glacier Creek Drainage over 100 miles of road are recorded as constructed. This equates to a current road density of about 1.8 miles per square mile in the entire Glacier Creek Drainage. There

are about 29.7 square miles of land in the Mission Mountains Wilderness, so when only the area outside of wilderness is considered, there is a road density of about 3.3 miles of road for the area with about 75 stream crossings. This includes roads on all ownerships. These road values also include all roads considered “historic” in the Flathead Forest Road Database.

In 2010 and 2011, an on-the-ground road sediment assessment was conducted to measure how much fine soil could be routed to any stream found crossing roads in the Glacier Creek Watershed (Atkins 2012). Field surveys on all unpaved roads were conducted at over 75 road/stream intersections on all ownerships in the Glacier Creek Watershed that could be accessed by the crews. The field measurements were input into the WEPP Model to estimate the total annual sediment load at each site. Some sites were identified as contributing from both sides of a road crossing by the field crews and values of sediment able to reach the stream were doubled. Other crossings were considered to be able to contribute on just one side. **A map showing the WEPP survey results is available in Project File Exhibit M-15.**

Estimated sediment from these measurements was approximately 3,500 pounds (or about 1.8 tons) for the Glacier Creek Drainage. (This assumes 1 cubic yard of sediment equals 1 ton of sediment as per information provided by Shawn Boelman, Jim Yarborough, Forest Engineers; personal communications). **This is less than 1% of the stream's natural sediment transport and thus assumed to have a very minimal impact.** In general, roads in the Glacier Creek Watershed were in excellent condition, with BMPs in place at most crossings. Only one site was singled out as in need of attention. This was NFS Road #561F, which on review turned out to be the place where a logjam had forced the water out of the established channel upstream from an old set of native timber bridge abutments. The water intercepted the old road bed after flowing overland for about 100 yards and then scoured a new channel. This situation is not felt to be reflective of sediment produced from system road crossings, so it was removed from the data when the data was used as a surrogate for other areas. These photos were taken in the fall of 2011 at the site (NFS Road #561F).



Figure 3- 10 NFS Road #561F



Figure 3- 11 NFS Road #561F.

Historic forest harvest practices included regeneration harvest immediately adjacent to streams and this presumably generated sediment to Glacier Creek. This practice was discontinued with the 1988 Montana Streamside Management Zone act and no recent harvests (included The Nature

Conservancy) have done regeneration harvest beside streams. This has allowed stream banks to stabilize to natural conditions and the past timber harvest no longer are sediment sources.

Analysis conducted for the Red Butte Fish barrier estimated that project would generate a one-time contribution of approximately 11 tons of sediment. This work was completed in 2014 and no longer contributes sediment to Glacier Creek watershed.

Upper Swan River Watershed

Past anthropogenic sediment sources in the Upper Swan River watershed include forest road construction and historic timber harvest. This watershed was not included in the Atkins on-the-ground assessment that included the road network of Glacier Creek. However, the Glacier Creek data was used to simulate the existing condition the Upper Swan River Watershed. This Atkins data fits well because the Glacier Creek Watershed is immediately adjacent to the Upper Swan Watershed, and there are similar soils and land form conditions.

The Glacier Creek data was adjusted to estimate the Upper Swan existing condition by eliminating the top 4 measurements including the washout at NFS Road #561F and about half of the zero value measurements for the averaging process. (It was felt that eliminating the zero values was valid because several of the field data point locations did not coincide with any known road location when they were overlaid with the stream layer available GIS road layers.)

With the Atkins sediment field survey values adjusted as described, the measurements range from 0 to about 150 pounds of sediment at the remaining stream crossings. Review of the data showed some of crossings reflected sediment contributions from both sides of the road and others contribute from just one side. It appeared that about half of the crossings were contributing from both sides. These adjustments result in an average of 38 pounds per year of sediment leaving the roadside buffers and reaching streams at each entry point (Atkins 2012). The Atkins on-the-ground WEPP Study estimated a total annual sediment loading caused by road crossings of about 3500 pounds for 100 crossings or 35 pounds per crossing. The 38 pounds per entry point after adjusting for extreme data points is still close to the study average.

Forty road/stream intersections were identified in the Upper Swan River Watershed using the Forest Road GIS layer and the stream layer. It was assumed there are a similar number of road/stream intersections that have contributions from both sides of the stream as the case in Glacier Creek data. With these assumptions, there would be about 53 potential sediment contribution sources in the Upper Swan River Watershed. Multiplying 38 pounds of sediment by 53 potential data points, the data suggests that about 2,015 pounds of sediment could be impacting streams due to the current road system, or about one ton annually.

A GIS delineation of the Upper Swan River Watershed estimates the size to be about 60 square miles. The natural sediment load would be about 490 tons of sediment annually according to the graph in Dunne and Leopold's publication, *Water in Environmental Planning* (1978). According to the surrogate values derived from the Atkins on-the-ground surveys, the road network in the Upper Swan River Watershed contributes approximately 1.0 ton per year. Considering this information, the existing road network adds relatively little to the predicted sediment loads.

Lindbergh Lake Water Quality sediment was identified as a concern of landowners along the shoreline in late 1980s. In 1989, an evaluation of water quality was prepared for the Lindbergh Lake Homeowners Association by Ken Knudsen in reaction to PCTCs harvest on portions of the west face of Lindbergh Lake. Knudsen found documentation from the University of Montana comparing the clarity of Lindbergh Lake with other neighboring lakes in the Swan/Clearwater drainages in 1975. These measurements were taken with a Secchi Disk, which is a qualitative value as it does not single out sediment from other particulates that affect clarity. The study found Lindbergh Lake to have the highest clarity (Project File Exhibit K-12).

Knudsen repeatedly sampled clarity from 1989 through 1993. He found the worst clarity was in 1991, which was the first sampling season after the PCTC logging operation, but also the highest level of runoff in the watershed during the 4 years of study, thus confounding the effort to study harvest effects.

Another study was conducted by the Flathead Biological Station in 1998 funded by PCTC when they were considering subdividing their property along the lake. The Biological Station found the highest measured levels of sediment coincided with the year of highest snow pack and runoff. This was a year with no logging in the watershed. This was similar to Knudsen's study of clarity in that time of least clarity coincided with not only logging, but also the highest precipitation year of the study.

The conclusion of both Knudsen's report and the analysis by the Flathead Biological Station was that water quality of Lindbergh Lake would most likely stay high due to the fact that a large portion of the drainage supplying the lake is designated Wilderness. It is also important to note that the large volume of the water flowing through Lindbergh Lake is sufficient to replace the entire lake water about twice a year.

Another facet of the lake's water quality is related to development along the southeast side and landowners who use the water directly from the lake. Aged septic systems and the high likelihood of nutrients draining into the lake are a concern. Studies for the Flathead Lake TMDL (Project File Exhibit K-13) show nutrient "hot spots" in lakeshore waters near developed areas; a high potential for cross-contamination. Knudson 1989 (Project File Exhibit M-12) found signs of some bacterial contamination along the shoreline both in front of the home sites and along undeveloped areas, and suggested those using the water as a drinking source should have it tested for coliform bacteria.

SWAN VALLEY RIVER BOTTOM AREA

This area is characterized by ephemeral drainages, ponds and hummocky topography. The flat grade causes sediment to settle out quickly in floodplains and wet meadows that readily revegetate. The area is not a true catchment, so the area would not have hydrologic connectivity of surface flow as is the case for Glacier Creek and Upper Swan River Watersheds. It is not likely that sediment would be routed to the Swan River due to the nature of the geology. It can be noted that the Soils WEPP Modeling suggests no sediment was expected to reach any wet area in any proposed action alternative in analysis area.

BEST MANAGEMENT PRACTICES (BMP's)

Best Management Practices involve various strategies, such as installing rolling dips, clearing ditches, and using right sized culverts when culverts need to be replaced for any reason. There is no single source of information on what roads have had BMPs applied in the past, but it can be assumed that any road used as a haul route for timber sales activities has had road drainage improvements and surface hardening when possible since 1991 when the SMZ regulations were passed as law. One caveat that needs to be remembered about BMPs is they are only functional as long as they are both properly installed and regularly maintained. Intense rain events can overwhelm even the best designed drainage features.

In addition to BMPs installed for timber sales, other efforts have focused on reducing sediment from roads. An example is the Technical Advisory Group formed in response to the concerns about Swan Lake and the Total Maximum Daily Load (TMDL) Report for the Lake in 2004. In 2010, this collaborative group sought to evaluate recent road improvements to determine whether the work had been effective at the Swan River Watershed scale. The top 70 most erosive sites identified in the 2004 Report were monitored using a similar but improved survey method as the one used for the TMDL Study. The results indicated a reduction of erosion from 539 tons per year to 184 tons per year (66 percent decrease). It appears that recent BMP efforts have met the State of Montana Department of Environmental Quality's (DEQ) objective to restore Swan Lake water quality (Project File Exhibit M-9). Several of the main system roads in the Glacier Loon Analysis Area have had drainage improvements within the past few years. These roads include the main route in the Upper Swan River Watershed, NFS Road #79.

NUTRIENTS

Sediment has been found to be the primary source of nutrients in forested environments. These

nutrients are not necessarily readily available, but are attached to the soil particles that make up the sediment carried by streams. There are several sources of nutrients entering the waters in the Glacier Loon Project Area that could add to background nutrient levels. Atmospheric inputs account for most of the nutrients entering the nutrient cycle, usually during a precipitation event in the form of dissolved gases, aerosols, and solid particulate matter (Environmental Protection Agency 1980). Depositional dry fall (deposition of solid particles from the atmosphere during non-precipitation events) and aerosols could occur during precipitation, washing particles from the atmosphere and the forest ecosystem.

Another source is the result of intense wildfire (Spencer et al. 2003). A study of the Flathead Basin was conducted in the 1990s to determine the primary sources of nitrogen and phosphorus entering Flathead Lake (Stanford 1994). During the 1888 Red Bench Fire, a 5 to 60 fold above background level of phosphorus and nitrogen resulted from aerial deposition of smoke and ash (Spencer et al. 1991). Post fire effects were also documented in the food web in macro-invertebrates and fish. Nutrient levels gradually returned to background levels within several weeks after the fire, but were re-elevated to some degree after spring runoff and storms.

STREAMSIDE MANAGEMENT ZONES - RIPARIAN HABITAT CONSERVATION AREAS

Historic timber harvest activity often included streamside harvest and ground-based logging systems. These activities have been found to contribute sedimentation to streams and other bodies of water (Klamath Resource Information System, www.krisweb.com). As discussed above, the SMZ law established by the Montana legislature prohibits seven forest management acts (although it does allow selective harvest). In addition to these standards, the Forest Service retains larger buffers adjacent to streams in compliance with the 1996 INFISH Standard. These activities have been found to be highly effective at protecting water quality and associated aquatic habitat.

ROAD DECOMMISSIONING

There are many levels of road decommissioning; each level is dependent on the resource intended to benefit from removing the travelway from its level of use. The amount of work to change the travelway also depends on the long-term vision for what level of access would be needed for management given the intent of the management of the area. A few roads built by PCTC on the west face of Lindbergh Lake (NFS Roads #10731, #10732, and #10733) in the early 1950s had work done on them in 2009 to put them into level one maintenance. This included removing culverts at stream crossings and some other drainage improvements on the travel surface so they would be more or less storm proof, and, hopefully, avoid potential washouts. This action probably generated only a small amount of disturbance; and it is estimated that the project had no measurable sedimentation to Lindbergh Lake (personal communication with Craig Kendall, Forest Hydrologist).

BENEFICIAL USES

The State of Montana has classified all the streams in the Glacier Loon Analysis Area as B-1. Waters classified as B-1 are to be maintained as suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply. These are considered their beneficial uses. Specific changes from naturally-occurring values of certain water quality characteristics, such as turbidity and temperature, are allowed under State Water Quality Standards. Growth and propagation of a salmonid fishery and associated aquatic life are also included as beneficial uses for area these streams.

No stream in the project area is listed on Montana 303(d) TMDL list or is considered in anyway impaired.

CHANNEL STABILITY (MORPHOLOGY)

The analysis area contains a wide variety of stream channels from steep boulder-controlled channels in the headwaters, to low gradient, alluvial channels with active floodplains. It is important to understand the concept of dynamic equilibrium to assess stream health in light of watershed

processes. Streams in dynamic equilibrium usually have a balance between stream power (energy) and sediment. Stream power is a function of discharge and channel gradient. Changes in either sediment availability and/or stream power can cause streams to adjust and sometimes result in adverse effects on aquatic habitat and water quality. In forested watersheds, water yield is sometimes a concern because additional stream flow (beyond the normal range of variability) can increase stream power and cause channel erosion and/or adjustments. By the same token, changes in sediment availability and transport can cause channels to adjust in various ways. In addition, added sediment can degrade water quality and particularly aquatic habitat. Therefore, it is important to assess the relative condition of stream channels in and downstream of the project area, especially if upland watershed conditions suggest that there could be channel impacts.

Pfankuck surveys were conducted along about 10 reaches of streams in the Glacier Loon Analysis Area in the summers of 2005 and 2006, and the fall of 2011. Several of the stream reaches had also been surveyed in 1976. Therefore, comparisons may be made for longer-term trends. These changes are an important factor when predicting a stream's ability to withstand increases in water or sediment without undergoing major changes in channel size or form. This transition is important because the current shape of a stream channel is a reflection of the amount of water it is receiving. When water volume increases, its erosive force can scour stream banks to make room for more water. Eroded material is in the form of fine suspended sediment, rock or gravel, which is then deposited as bars downstream.

The following is the current Channel Stability Rating for streams in the Glacier Loon Area and an interpretation of the primary factor contributing to that rating.

TABLE 3- 55 CHANNEL STABILITY RATINGS.			
WATERSHED	HISTORIC PFANKUCK RATING	CURRENT PFANKUCK RATING	INTERPRETATION OF RATING AND STREAM OBSERVATIONS
Glacier Creek	Fair	Good/Poor	Since the fire in the Crazy Horse Area, many stream sections have shown large changes in bedload movement and shifts in stream bottom gravels. In at least one incidence, the stream channel was blocked by snags that burned in the fire and fell into the stream. It is likely these changes will continue in reaches downstream from the fire area for many years.
Upper Swan River	--	Variable	Several of the intermittent stream channels on the north side of Lindbergh Lake were documented as down cutting through the sections that were formerly managed by Plum Creek Timber Company. Channel widening and mass wasting led to removal of undersized culverts and roads being put into "storage" several years ago to minimize the amount of erosion in this area.
Swan River Valley Bottom Area	-	-	*
* There are few scoured or otherwise defined channels that would qualify for rating through this methodology. The channel shapes are changed more so by local influences such as beaver than by changes in water yield increases.			

At the current level of water flow and management it is unlikely that changes in channel stability would occur related to induced water yield increases. There is ongoing in-channel erosion flowing from the Crazy Horse Wildfire Area that will stabilize over time.

As the streams flow east from the Mission Mountains the ground flattens compared to the area where the Crazy Horse Fire burned. Historically, streams with lower gradients have naturally evolved slowly from one type to another given current trends in climate and weather. Because the streams in the valley bottoms of the Glacier Loon Area were formed by glaciers they are basically "U" shaped with broad areas for the streams to migrate from side to side and form pot holes and wetlands like "Glacier Slough". Literature is readily available for those interested in the mechanic of fluvial morphology.

ENVIRONMENTAL CONSEQUENCES

All alternatives were compared to the existing condition, (Alternative A or the No Action Alternative), for the direct and indirect effects for the all management activities. These values were then combined with all other past, present, and foreseeable actions within the analysis area to address the cumulative effects. See the Cumulative Effects Worksheet (Project File Exhibit M-2) for additional cumulative effects information.

Because road systems can produce undesirable consequence to hydrologic resources it was felt that providing information on road management, by alternative would be a good way to provide a framework for the environmental consequences. The following tables summarize road BMP work, temporary roads and road decommissioning proposed in the alternatives for the Glacier Loon Project Area, and by major watershed. These tables are referred to throughout the effects analysis discussed below.

TABLE 3- 56 GLACIER LOON PROJECT AREA ROAD MANAGEMENT MILES.			
	ALTERNATIVE		
	B	C	D
Total National Forest System and Other Jurisdiction Road Miles in the Project Area	140.3	140.3	140.3
Total National Forest System and Other Jurisdiction Road Miles in the Project Area after Road Decommissioning	136.2	131.9	131.9
Haul Routes (BMPs applied)	37.7	34.7	29.1
Temporary Road Construction – New Ground Disturbance	9.2	5.4	4.4
Temporary Road Construction on Historic Road Template	2.3	2.0	1.4
Total Temporary Roads for the Project	11.5	7.4	5.8
Total Roads Proposed for Decommissioning (miles)	4.1	8.4	8.4
Miles of Passive Road Decommissioning – Abandonment, No Ground Disturbance	2.1	2.1	2.1
Miles of Active Road Decommissioning – Berms, Barriers, etc.	2.0	2.4	2.4
Miles of Road Decommissioning by Recontouring	0	3.9	3.9

ALTERNATIVE A – NO ACTION DIRECT AND INDIRECT EFFECTS

Alternative A provides a baseline to evaluate the effects of the proposed action alternative throughout the Glacier Loon Analysis Area. The effects on the hydrologic resource will be discussed as water quantity and water quality that could affect the conditions of stream channels through in-channel scour or channel stability. These are discussed by how they would change over time, and cumulatively at the point the streams join the Swan River and flow towards Swan Lake.

WATER QUANTITY

With Alternative A, the No Action Alternative, none of the proposed forest management activities would occur in the Glacier Loon Analysis Area at this time. With no vegetation management, there would be no changes in water quantity caused from human activities at this time on NFS lands. However, the purpose and need of the proposal would not be met. With no fuel reduction activities, the size, intensity, and spread of wildfires would likely increase with potential effects to water quantity as described below. (Also see the Existing Condition discussion above for a description of the current situation.) This is because by not reducing fuel levels, it is likely ingrowth of shade-tolerant trees would continue to increase, thereby increasing the risk of a severe wildfire. This in turn could increase the risk of a negative effect to water quantity by increasing overland flow due to the lack of use of water by forest vegetation. Based on the information in the Fire and Fuels Section of this EA, it appears that existing ladder fuels and fuel loading in the analysis area has increased over historic conditions, at least in part due to the effective fire suppression since the 1940s.

Sediment Delivery

As stated above the No Action Alternative means none of the proposed forest management actions would occur in the Glacier Loon Analysis Area at this time. This would mean there would be no activities specifically designed to improve water quality through sediment reduction, primarily from projects such as installation of BMPs on haul routes. (See numbers of miles proposed to have drainage improvement in the tables below.) The Purpose and Need of the proposal would not be met.

With no fuel reduction activities, the size, intensity and spread of wildfires would likely increase with potential effects to water quality as described above for the Crazy Horse Fire. (See the Existing Condition discussion on related logjams and effects to channels above and in the Fisheries discussion on PIBO Survey Results.) Based on the information in the Fire and Fuels Section of this EA, it appears that existing ladder fuels and fuel loading in the analysis area has increased over historic conditions in this area, at least in part due to the effective active fire suppression since the 1940s. As fuels increase so does the potential for more intense fire and burn through the duff layer of the forest. This exposes mineral soils to erosion and removes the potential for the duff to trap sediment before it enters streams.

Best Management Practices

This alternative would not accomplish projects that improve road drainage through BMPs on forest roads used for haul routes because there would be no harvest (please refer to the tables at the beginning of this section.) Although many miles have recently received BMPs through grant money and recent timber sales in the area, there is always an opportunity to maintain them after winter runoff. This helps keep drainage features functional. Hot spots would continue to be addressed as identified and funding is available.

Road Decommissioning

There would be no active decommissioning of road segments with the Alternative A. The hydrologic benefits, such as improvement of hillside water flow and infiltration of water into the ground water, would not be improved through active road decommissioning. With the No Action Alternative there would continue to be some amount of disruption of runoff patterns.

Streamside Management Zones - Riparian Habitat Conservation Areas

No activities would occur within SMZs or RHCAs under Alternative A. This has potentially both positive and negative effects. Where the riparian areas are resilient and healthy streamside area conditions exist, conditions would be expected to continue. However, where vegetative treatment could improve the health of overstocked and decadent stands by reducing stem density and reducing fuels the potential for stand replacing wildfire would remain or increase over time. Stand-replacing wildfire would negatively impact RHCAs through channel instability, erosion and sedimentation for several years until vegetative recovery.

Resource Enhancement Projects

None of the Resource Enhancement Projects would occur with the No Action Alternative. In the case of the proposal to plant shrubs on an old skid trail, which currently have scoured into a stream channel, there would be no immediate opportunity to stop sediment from being carried into a Howellia pond. The replacement of the pipe on NFS Road #9552 between Bunyan and Meadow Lake would not occur at this time; the long-term benefits of correcting the misaligned pipe would not occur. This includes reducing sediment inputs at the site during spring runoff or storm events.

As described in the Existing Condition for the Water Resource, most roads on the west face of Lindbergh Lake received on-the-ground work to improve water runoff in 2009. This included work on NFS roads #10731, #10732, and #10733. In Alternative A, no additional work would occur. This would keep sections already revegetated from being re-exposed to erosion during weather events.

Beneficial Uses

All water bodies in the Glacier Loon Project Area currently meet water quality standards and,

therefore, meet the intent for Designated Beneficial Uses. No action would suggest the current trend would continue. As with all other measures of hydrology for the No Action Alternative, the Purpose and Need would not be met, so there would be potential for increased risk of catastrophic fire. This could result in unintended and temporary deviations from desired water quality standards.

CHANNEL STABILITY (MORPHOLOGY)

The general health of the forested areas proposed to be treated would not change through planned management activities at this time. The Purposed and Need of reducing fuels and improving forest health would not be met. Since the current condition of the channels is considered fair to good channel stability, there could be a slight chance of improved conditions through recovery in some reaches. It is noted in the Fisheries Section that there has been some decline at long term sites monitored by PIBO surveys (See Fisheries PIBO discussion). There would be some increased risk of catastrophic fire, the result of which could be negative to channel stability (Project File Exhibit M-5).

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

Alternative B proposes the most management activities and would represent the most potential change to the hydrology of the area. Alternative C was designed to address the visual changes along Lindbergh Lake and public concerns about potential effects on water quality for surface water and wetlands. Public comments were received regarding how the proposed road construction and regeneration harvest would affect the wetlands, streams, and RHCAs within Section 12, just northeast of Lindbergh Lake. In response to this concern, Alternative C was developed and it eliminated all temporary roads that cross RHCAs.

Alternative D was designed to address issues associated with wildlife cover and security.

WATER QUANTITY

As previously stated, the ECA Model uses the baseline condition as a fully forested or closed canopy condition within the watershed to compare the natural condition to the existing condition and potential changes from the proposed activities. It is acknowledged that this is only an assumption used for modeling purposes because in fact, this condition would not truly represent the historic conditions in this part of the Swan Valley. Frequent low-intensity fires kept stands open, thereby allowing snow to accumulate in the openings. Other areas, such as rock outcrops in the upper basins, would never support a mature tree due to shallow soils. Nevertheless, these predictions are useful in assessing potential change to the runoff regime in the three major watersheds of the analysis area.

The analysis for the Hydrologic Resources focused on changes in annual water quantities that flow from the two major watersheds and the Swan River Valley Bottom Area in the Glacier Loon Analysis Area. All action alternatives were modeled and are compared in the table below.

TABLE 3- 57 WATER QUANTITIES RESULTING FROM ACTION ALTERNATIVES.					
WATERSHED	ANNUAL WATER YIELD	NO ACTION WATER YIELD INCREASE*	ALTERNATIVE B PROPOSED ACTION WATER YIELD INCREASE	ALTERNATIVE C WATER YIELD INCREASE	ALTERNATIVE D WATER YIELD INCREASE
	ACRE FEET				
Glacier Creek	81,727	5.9%	6.0%	6.0%	5.9%
Upper Swan River	85,745	0.9%	1.2%	1.1%	1.1%
Swan River Valley Bottom Area	5,232	19.8%	21.4%	21.0%	20.8%
* Includes reasonably foreseeable cumulative effect of activities in the drainages. One acre foot equals 42,560 acre feet of water					

The table of the modeled harvest results indicates there is little difference in percent of annual water yield increase in stream flows due to the proposed harvest and associated road building between the No Action Alternative and the action alternatives. It is predicted that there would be a 0.1 percent

increase in annual water yield stream flows in the Glacier Creek Watershed resulting from Alternative B. An increase in water yield of 0.1 percent equates to 81.7 acre feet increase in annual stream flow. Water yield could increase a maximum of 0.3 percent in the Upper Swan Watershed in Alternative B. An increase in water yield of 0.3 percent equates to 257.2 acre feet per year increase in stream flow. Neither of these values would be detectable over the natural range of variability (see below). The highest increase in water yield is a 1.6 percent change or 83.7 acre feet within the Swan River Valley Bottom. This is not a true catchment. This is an area with short stream sections that may or may not connect to the Swan River. All surface water is directly affected by fluctuations in groundwater. This could result in a raising or subsiding of the Swan River water level or upwelling of water that infiltrates somewhere upslope and feeds the different subsurface pools of water, otherwise known as aquifers.

To put the change of water quantities into perspective, streams gauged by the USGS were reviewed. The closest uncontrolled gauging station to the Glacier Loon Project is the Middle Fork of the Flathead River at West Glacier. There are about 70 years of flow data at this site, and although it is much larger in scale, it is similar to the watersheds in the Glacier Loon Project Area in that much of its drainage area is in Wilderness, and changes in vegetation are dominated by fire. The increase in water yield modeled for Glacier Loon is far below the annual variability over a 70-year period of the closest uncontrolled gauged river station. The water yield increase from the alternatives would likely be undetectable on an annual basis.

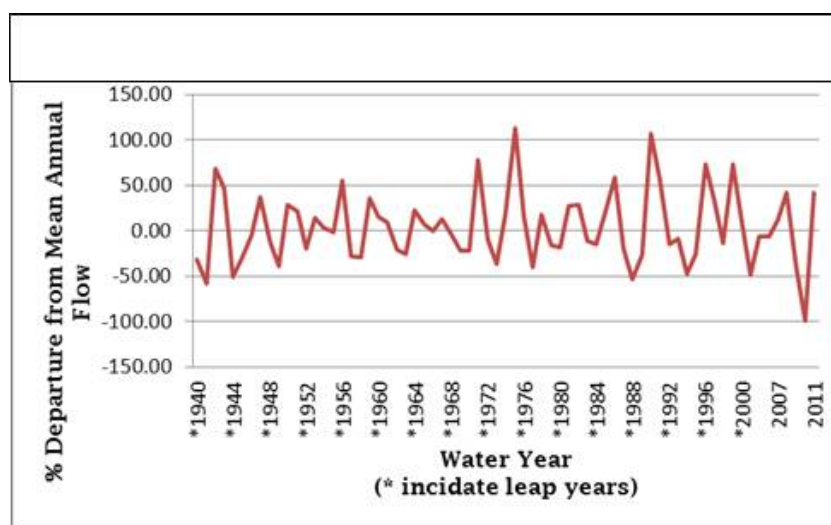


Figure 3- 12 Percent Departure from Mean Annual Flow by Water Year.

GLACIER CREEK WATERSHED

The following table summarizes BMP work, road decommissioning, and temporary road work proposed in the Glacier Creek Watershed.

TABLE 3- 58 GLACIER CREEK WATERSHED ROAD MANAGEMENT MILES.			
	ALTERNATIVE		
	B	C	D
Total Existing National Forest System and Other Jurisdiction Road Miles in the Watershed Area	100.1	100.1	100.1
Total National Forest System and Other Jurisdiction Road Miles in the Watershed Area after System Road Decommissioning	99.1	99.1	99.1
Haul Routes (BMPs applied)	14.0	13.7	12.4
Temporary Road Construction – New Ground Disturbance	4.1	3.4	2.6

TABLE 3- 58 GLACIER CREEK WATERSHED ROAD MANAGEMENT MILES.			
	ALTERNATIVE		
	B	C	D
Temporary Road Construction on Historic Road Template	2.3	1.9	1.4
Total Temporary Roads for the Project	6.4	5.3	4.0
Total Roads Proposed for Decommissioning (miles)	1.0	1.0	1.0
Miles of Passive Road Decommissioning – Abandonment, No Ground Disturbance	0.2	0.2	0.2
Miles of Active Road Decommissioning – Berms, Barriers, etc.	0.8	0.8	0.8
Miles of Road Decommissioning by Recontouring	0	0	0

ALTERNATIVE B DIRECT AND INDIRECT EFFECTS

WATER QUALITY

Sediment Delivery

The highest potential for changes in water quality comes from exposure of mineral soil from road systems constructed to access the timber and transportation occurring on the haul routes. Alternative B has several aspects proposed that could generate a small amount of sedimentation in the Glacier Creek Watershed. Alternative B includes 6.4 miles of temporary road construction within the Glacier Creek Watershed. Most of these temporary roads would be located on upland terrain and would not be located near any water bodies. Modeling by the Soils Scientist indicates that no sediment is likely to reach water bodies due to the amount of distance that runoff would run through vegetated buffer zones. Only one temporary road may have impact to sedimentation according to the WEPP Modeling process. Temporary Road #12A (access to Units 60, 62, and 214) is located on a template of an old historic road built in the early 1980s. The culvert across the intermittent stream is still in place, although it is poorly aligned and would be likely to fail sometime in the future. In Alternative B, the culvert would be used, and then removed after use as a part of temporary road restoration. Design Criteria (Table 2- 16) for removing the culvert includes implementation during the dry period to minimize channel disturbance. The project could create a small amount of sediment, which could transport downstream to a wetland. This would not be measureable given the estimated 510 tons of natural background sediment that could be expected to be delivered annually from drainages of similar size and glacier tills (Project File Exhibit M-17).

Winter harvest is required to meet the Region 1 Soil Quality Standards and/or protect sensitive soils in the following units for Alternative B in the Glacier Creek Watershed; Units 2, 5, 10, 11, 16, and 59.

Winter logging requires that there be enough snow to prevent muddy water from mixing into the snow where equipment operates. This would require about 10 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. The action of compacting the snow to make it passable would likely have short-term effects on the melting action of water on the surface. If winter logging practices are followed, there should be little chance of soil transport to stream courses.

Best Management Practices

Within the array of the action alternatives, Alternative B would have the most roads used as haul routes. This translates to 14.0 miles of BMP drainage improvements. Although, as described earlier, the road network is largely in good condition, the project would touch up existing BMP work done through other recent activities and add drainage as needed. Given the widely dispersed work and the small amount of work needed, it is concluded that the amount of sedimentation exposed for runoff from the sites would be small and not discernible from background levels.

Streamside Management Zones and Riparian Habitat Conservation Areas

No harvest activity is proposed within any SMZs or **RHCAs of the Glacier Creek watershed**. As a result, the commercial and pre-commercial vegetation management proposed would not create sedimentation within these areas. Within the Glacier Creek Watershed, no harvest activity would take place within 300 feet of fish-bearing streams, 150 feet of perennial streams, 50 feet of intermittent streams, and 50 to 150 feet of wetlands (varies by wetland size). There would also be **restrictions to** activities in ephemeral draws in accordance with the SMZ Law and Montana BMPs that are now a requirement on all Federal lands. The 2012 BMP Audit states:

"The Montana Department of Natural Resources and Conservation, Forestry Division, has evaluated forest practices for BMP implementation and effectiveness every 2 years since 1990... The Forestry Division has evaluated timber harvest sites of Federal, State and private lands, over all ownerships, BMP implementation has improved from 78 percent meets or exceeds criteria in 1990 to 97 percent in 2010. Similarly, BMP effectiveness has also improved, from 80 percent rated as providing 'adequate protection' in 1990 to 98 percent in 2010."

Road Decommissioning

Alternative B would decommission approximately 1.0 mile of road in four locations in the Glacier Creek Watershed; they are as follows: NFS roads #10247, #561G, #561F, and #11648A. Decommissioning NFS Road #561F could generate a small amount of erosion during implementation where it crosses a small intermittent stream. A small amount of sediment could also be eroded from exposed soils as annual plants often do not have time to sprout the year of implementation unless there is sufficient fall rain. The following spring there is likely to be no sediment produced detectable from background sediment levels. The other three roads (NFS roads #10247, #561G, and #11648A) planned for decommissioning are not near streams and would have little potential for the activity to cause sedimentation to water bodies.

Resource Enhancements

One Resource Enhancement Project (Resource Enhancement Project #1 shown on Map 2-1) is proposed to re-establish vegetation on an historic road (unmapped, with no number) or skid trail that was discovered about 0.25 miles from the end of NFS Road #9591Y. This travelway is located in the bottom of a small draw and now collects enough water to scour a stream channel that runs down the middle of the draw bottom. Although the amount of water is small and does not appear to cause much erosion, it would be likely to affect the groundwater by flowing on the surface before it connects with the wetland. The wetland is an occupied *Howellia* pond whose habitat should be protected. This project would plant approximately 400 shrubs and seedlings on about 250 feet of the valley bottom to diffuse water flow so it can go back into the ground.

Beneficial Uses

Alternative B would not affect the designated Beneficial Uses of the water. This is due to the inclusion of all BMPs for all activities: temporary road construction, harvest of timber, prescribed burns, and restoration activities in accordance with National direction.

CHANNEL STABILITY (MORPHOLOGY)

The main activities that could change channel stability are the total area of land with vegetation changes and any increased water in streams due to connection of roads. Any new or temporary stream crossing would conform to current Best Management Practices to minimize or eliminate additional water being added to stream courses. Stream crossings would be properly sized and aligned.

As described earlier in this section, the change in the amount of water in this and all action alternatives is so small it would not be detectable when comparing variability of flow from year to year. For this reason there is no evidence there would be a change in channel stability or channel morphology due to the action alternatives.

ALTERNATIVES C AND D DIRECT AND INDIRECT EFFECTS

WATER QUALITY

Sediment Delivery

Alternatives C and D have similar potential for impacts to the Glacier Creek Watershed. These alternatives would contribute only a very small amount of sediment to Glacier Creek. Transportation needed to implement Alternative C would build approximately 5.3 miles of temporary roads. Alternative D would build 4.0 miles. According to the WEPP Model, both alternatives have one temporary road that could generate a small but immeasurable amount of sediment (personal communication with Project Soils Scientist). This sediment is predicted to come from temporary Road #12A where it crosses a small channel between two wetlands to access Units 60, 62, and 214 in Alternative C. The road is a historic road with a culvert already in place and, thus, there would be no sedimentation to the channel by using the road. After harvest is complete, the culvert would be removed and the channel restored since the road would be reclaimed. This road is not required in Alternative D, but Design Criteria (Table 2- 16) for this alternative would include removal of the culvert. This is considered more advantageous to the Hydrologic Resource, and specifically water quality, than leaving the old road along with the potential for the culvert to wash out at some point in the future. The predicted sediment would come when the culvert is removed, then routed to a wetland about 100 yards downstream.

As mentioned with Alternative B, winter harvest is required to meet the Region 1 Soil Quality Standards and/or protect sensitive soils in the following units for Alternative C in the Glacier Creek Watershed: Units 2, 5, 10, 11, and 16. In Alternative D, Units 2, 5, 10, 17, 20, and 22 would require winter mechanical operations.

Best Management Practices

Both alternatives vary in the total length of haul route miles of BMPs that would be applied (See Table 3- 58). Alternative C would apply approximately 13.7 miles of BMPs within the Glacier Creek Watershed, while Alternative D would install 12.4 miles (Given there are currently 100 miles of road in the Glacier Creek Watershed according to the table above, this means 12 to 14 percent of the total road network would receive BMPs). Installing improved drainage features would temporarily generate a small amount of sediment when ditches are cleared and road surfaces reshaped. Ultimately, the BMPs would reduce the small amount of erosion that occurs annually on area road systems.

Streamside Management Zones and Riparian Habitat Conservation Areas

No harvest activity is proposed within any SMZs or RHCAs of the Glacier Creek watershed. As a result, the commercial and pre-commercial vegetation management proposed would not create sedimentation within these areas. The alternatives would retain unharvested RHCA buffers beside streams that would prevent any overland erosion from reaching the streams and include appropriate management activity regulations according the SMZ law by limiting machinery operation within draws and other activities described in the BMP documentation.

Road Decommissioning

Alternatives C and D propose the same road decommissioning as Alternative B – Proposed Action. Restoration of NFS Road #561F would create some sedimentation during project implementation by removing a culvert on a small intermittent drainage, but it is doubtful the sediment would reach any main water course. Identified as the largest known sediment point-source in the Glacier Creek Watershed in Atkins (2012), this site does not connect with the main body of Kraft Creek, a tributary of Glacier Creek. It is hoped that any reshaping of this area would occur in a time frame that allows the area to revegetate quickly. No other road decommissioning project is anticipated to transport sediment through buffer zones (personal communication with Project Soil Scientist).

Resource Enhancements

One Resource Enhancement Project (Resource Enhancement Project #1 on Maps 2-3 and 2-5) is proposed to re-establish vegetation on an historic road (unmapped, with no number) or skid trail that was discovered about 0.25 miles from the end of NFS Road #9591Y. This travelway is located in the bottom of a small draw and now collects enough water to scour a stream channel that runs down the middle of the draw bottom. Although the amount of water is small and does not appear to cause much erosion, it is likely to be affecting the groundwater by flowing on the surface before it connects with the wetland. The wetland is an occupied Howellia pond whose habitat should be protected. This project would plant approximately 400 shrubs and seedlings on about 250 feet of the valley bottom to diffuse water flow so it can go back into the ground.

Beneficial Uses

Alternatives C and D would not affect the designated Beneficial Uses of the water. This is due to the inclusion of BMPs in all activities: temporary road construction, harvest of timber, prescribed burns, and restoration activities in accordance with National direction. See discussion for Alternative B above.

CHANNEL STABILITY (MORPHOLOGY)

Alternative B has more temporary roads than either Alternative C or D, both on historic templates and newly constructed. Therefore, Alternatives C and D are expected to have less potential to affect channel morphology. Any point where these roads cross stream systems could have some minor effect on channel morphology. Any new or temporary stream crossing would conform to appropriate road permit designs, and all BMPs to minimize or eliminate impacts.

As described earlier in this section, the change in the amount of water in all action alternatives is so small it would not be detectable when comparing variability flow from year to year. For this reason, there is no evidence there would be a change in channel stability or channel morphology.

UPPER SWAN RIVER WATERSHED

The following table summarizes BMP work, road decommissioning, and temporary road work proposed in the Upper Swan Watershed.

TABLE 3- 59 UPPER SWAN WATERSHED ROAD MANAGEMENT MILES.			
	ALTERNATIVE		
	B	C	D
Total Existing National Forest System and Other Jurisdiction Road Miles in the Watershed Area	40.4	40.4	40.4
Total National Forest System and Other Jurisdiction Road Miles in the Watershed Area after System Road Decommissioning	39.3	35.0	35.0
Haul Routes (BMPs applied)	17.1	14.4	12.4
Temporary Road Construction – New Ground Disturbance	2.6	1.3	0.8
Temporary Road Construction on Historic Road Template	0	0	0
Total Temporary Roads for the Project	2.6	1.3	0.8
Total Roads Proposed for Decommissioning (miles)	1.1	5.4	5.4
Miles of Passive Road Decommissioning – Abandonment, No Ground Disturbance	0.6	0.6	0.6
Miles of Active Road Decommissioning – Berms, Barriers, etc.	0.5	0.9	0.9
Miles of Road Decommissioning by Recontouring	0	3.9	3.9

ALTERNATIVE B – PROPOSED ACTION DIRECT AND INDIRECT EFFECTS

WATER QUALITY

Sediment Delivery

The Proposed Action is likely to generate a short-term, small amount of sedimentation into Lindbergh Lake according to the Soil Scientists WEPP Modeling. The model predicts management activity on the west face of Lindbergh Lake is likely to generate 19 pounds of sediment on an annual basis until the disturbed area becomes revegetated. The standard seed mix used on disturbed sites germinates and becomes established in 2 years, which is intended to be faster than natural, so sedimentation is anticipated to be near 0 in about 5 years (Personal communication, Forest Biologist). This amount of sediment would be undetectable beyond background levels that are predicted to be 490 tons of sediment annually according to the graph in Dunne and Leopold's publication of "Water in Environmental Planning" (Dunne et al. 1978) (Project File Exhibit M-17).

The largest source of sedimentation would be from construction of Temporary Road #22B (access to Units 84 and 85) and, to a lesser extent, Road #15C (access to Units 67 and 69). These roads would cross two intermittent streams that flow directly to Lindbergh Lake. Since no culverts exist in the area now, new stream crossings would need to be installed. This would disturb the stream bed and adjacent ground. The culvert could remain in the stream for a few years depending on the contractor's harvest schedule. It would then be removed and the road put back into storage. Both installation and removal of the culverts would generate some fine sediments, but it is likely to be undetectable when combined with background levels. To minimize impacts, Design Criteria (Table 2-16) would require dry channel conditions during in-channel work, but some sedimentation would be inevitable the following spring when water scours the streams again. Temporary Road #22B crosses a high-gradient stream that flows directly into Lindbergh Lake and thus, all sedimentation from this stream crossing would transport to the lake. Temporary Road #15C crosses a stream that flows into a small wetland first, and some (or all) of the sedimentation would deposit in the wetland with less reaching the lake.

Alternative B would reuse NFS Road #10732 and Road #10734 with an extension across **an unnamed stream** on the slope facing Lindbergh Lake. These roads provide access to Units 82 to 87. There is anecdotal evidence that the construction of this road and the associated logging in the 1990s could have impacted the water quality in Lindbergh Lake. This is backed in part by the study done by Knudsen, though the study could not eliminate the possibility that the change in water quality coincided with a year of elevated runoff. Modeling of this and all other road activities indicates that very little sediment is likely to travel through buffer zones and reach any body of water, and if it does it would not be measurable or separable from what would be expected to occur through natural processes (personal communication with Derek Milner, Soil Scientist). It should also be remembered that the total volume of water in Lindbergh Lake is replaced almost twice a year. Several public commenters wondered if the buffer by Lindbergh Lake should be increased, but if the goal is to prevent sediment, this would not be necessary. A 150-foot buffer by the lake would preclude any sediment from harvest activity from reaching the lake.

There is no activity requiring winter operations for Upper Swan River Watershed in Alternative B.

Best Management Practices

Additional BMP work would be applied on all haul routes as well as touch up of those implemented in the past few years on NFS roads #9552 and #79. Those roads run along the slope break west face of Lindbergh Lake and have already had some BMPs installed in the past few years through 319 Grants. Primary goals for the 319 Grant Program are:

1. Protect the quality of clean water; and restore water quality in water bodies whose beneficial uses are impaired by non-point source pollution; and
2. Whose water quality does not meet state standards.

Additional drainage features and touching up of existing drain dips would help minimize or eliminate connection of water running from the transportation system to area streams.

Streamside Management Zones and Riparian Habitat Conservation Areas

Alternative B includes only one unit with a limited amount of commercial thinning in a RHCA. Unit 64 is within the 300 foot RHCA of Swan River but the thinning is located on an upland bluff across the road from the river. This action has no potential for any sediment reaching the Swan River (Project File N-9). All other units in the Upper Swan Watershed have no harvest activity within any SMZ or RHCA. This greatly reduces the potential for any surface erosion caused by harvest to reach waterbodies, although as stated above, an estimated 19 pounds of sediment could reach Lindbergh Lake due to their steep aspect.

Road Decommissioning

There are approximately 1.1 miles of NFS roads designated for decommissioning with Alternative B in the Upper Swan River Watershed. These include NFS Roads #79B, #10731, and #10730. These road segments are basically already undrivable, but with action they would be put into the historic status in the Forest Road Database, which reduces the likelihood that they would be reused in the future.

Resource Enhancements

One Resource Enhancement Project (Resource Enhancement #2 shown on Map 2-2) is proposed in the Upper Swan River Watershed with Alternative B, as funding becomes available. The road crossing (Road #9552) between Meadow Lake and Bunyan Lake was found to be an undesirable fish migration barrier. If funding is available, the current culvert would be replaced with either a bridge or a crossing that facilitates fish movement between the lakes. Any potential sediment generated by these activities would be minimized with appropriate Design Criteria (Table 2- 16) and would be short term. The final project is planned to reduce existing erosion problems at the site and would be beneficial to fish. Alternative B would ultimately slightly reduce the effect of sedimentation from the road network due to the replacement of the culvert on Road #9552 and road surface recontouring.

Beneficial Uses

Alternative B would not affect the Beneficial Uses designated for this or any other area in the Glacier Loon Project Area.

CHANNEL STABILITY (MORPHOLOGY)

The main activities that could change channel stability are the total area of land with vegetation changes and any increased water in streams due to connection of roads. Any new or temporary stream crossing would conform to current BMPs to minimize or eliminate additional water being added to stream courses. Stream crossings would be properly sized and aligned.

As described earlier in this section, the change in the amount of water in this and all action alternatives is so small it would not be detectable when comparing variability of flow from year to year. For this reason there is no evidence there would be a change in channel stability or channel morphology caused by increased stream flow due to the action alternatives.

ALTERNATIVES C AND D DIRECT AND INDIRECT EFFECTS

WATER QUALITY

Sediment Delivery

One of the main differences between Alternative B and the other action alternatives is Alternatives C and D do not include harvest along the west face of Lindbergh Lake, so any sediment related to that harvest and reconstruction of NFS roads #10732, #10733, and #10734 would not occur.

Construction of Temporary Road #22B (access to Units 84 and 85) and Road #15C (access to Units 67 and 69) would not occur. These roads would not cross two intermittent streams that flow directly to Lindbergh Lake. No new stream crossing would be installed and no disturbance of the stream bed and adjacent ground would occur. There would be no crossing of the high-gradient stream that flows directly into Lindbergh Lake, no sedimentation from this stream crossing would transport to the lake. No temporary roads proposed would cross any stream channels and would not generate sediment. This would mean that 2.6 miles of temporary roads to be used for Alternative B would be reduced to 1.3 miles for Alternative C and 0.8 miles for Alternative D. This reduction in roads from Alternative C to Alternative D is mainly related to units dropped for wildlife concerns.

There is no activity requiring winter operations for Upper Swan River Watershed in Alternatives C and D.

Best Management Practices

Both alternatives vary in the total length of haul routes, which is a reflection of the miles of BMPs that would be applied by alternative (See Table 3- 59). Alternative C would apply approximately 14.4 miles of BMPs within the Upper Swan River Watershed, while Alternative D would install 12.4 miles. (Given there is currently 40.4 miles of road in the Upper Swan River Watershed according to the table above, this means 31 to 42 percent of the total road network would receive BMP's through Alternatives C and D). Installing improved drainage features would temporarily generate a small amount of sediment when ditches are cleared and road surfaces re-shaped. Ultimately, the BMPs would reduce the small amount of erosion that occurs annually on area road systems.

Streamside Management Zones and Riparian Habitat Conservation Areas

Alternative C includes Unit 64 with the same limited amount of commercial thinning with the RHCA as Alternative B (it is deferred altogether in Alternative D). As described earlier, this action has no potential for sediment to reach Swan River.

Road Decommissioning

The Alternatives C and D include obliteration and recontouring of 0.9 miles of NFS Road #9575 and 0.4 miles of NFS Road #9573. National Forest System Roads #10732, #10733, and #10734 (Lindbergh Lake) would be fully recontoured. These activities would install water bars to help water move off of road surfaces, thereby reducing erosion. Decommissioning NFS Road #10730 would involve constructing water bars to halt the gullies on the road, but this road is also far from stream channels. Likewise decommissioning of NFS Roads #10731 and #79B would have no impact since the roads are already naturally grown in and need no active restoration. Recontouring of these NFS Roads would improve the hydrologic function of these sites in the long term. Modeling (Project File Exhibit M-22) results displayed in the Soils Section found that sediment would not be detectable.

Resource Enhancements

One Resource Enhancement Project is proposed in the Upper Swan River Watershed with Alternatives C and D. The road crossing (NFS Road #9552) between Meadow Lake and Bunyan Lake was found to be an undesirable fish migration barrier. If funding is available the current culvert would be replaced with either a bridge or a crossing that facilitates fish movement between the lakes. Any potential sediment generated by these activities would be minimized with appropriate Design Criteria (Table 2- 16) and would be short term. The final project is planned to reduce existing erosion problems at the site and would be beneficial to fish. Alternatives C and D would ultimately slightly reduce the effect of sedimentation from the road network due to the replacement of the culvert on Road #9552 and road surface recontouring.

Beneficial Uses

Alternatives C and D would not detrimentally affect the Beneficial Uses designated for this or any other area in the Glacier Loon Project Area.

CHANNEL STABILITY (MORPHOLOGY)

The main activities that could change channel stability are the total area of land with vegetation changes and any increased water in streams due to connection of roads. Any new or temporary stream crossing would conform to current BMPs to minimize or eliminate additional water being added to stream courses. Stream crossings would be properly sized and aligned.

As described earlier in this section, the change in the amount of water in this and all action alternatives would be so small it would not be detectable when comparing variability of flow from year to year. For this reason, there is no evidence there would be a change in channel stability or channel morphology caused by increased water flow due to the action alternatives.

SWAN RIVER VALLEY BOTTOM AREA

The following table summarizes BMP work, road decommissioning, and temporary road work in the Swan River Valley Bottom Area.

TABLE 3- 60. SWAN VALLEY RIVER BOTTOM AREA ROAD MANAGEMENT MILES.			
	ALTERNATIVE		
	B	C	D
Total National Forest System and Other Jurisdiction Road Miles in the Watershed Area	41.9	41.9	41.9
Total National Forest System and Other Jurisdiction Road Miles in the Watershed Area after System Road Decommissioning	39.8	39.8	39.8
Haul Routes (BMPs applied)	6.6	6.6	4.3
Temporary Road Construction – New Ground Disturbance	2.5	0.8	1.0
Temporary Road Construction on Historic Road Template	0	0	0
Total Temporary Roads for the Project	2.5	0.8	1.0
Total Roads Proposed for Decommissioning (miles)	2.1	2.1	2.1
Miles of Passive Road Decommissioning – Abandonment, No Ground Disturbance	1.9	1.9	1.9
Miles of Active Road Decommissioning – Berms, Barriers, etc.	0.2	0.2	0.2
Miles of Road Decommissioning by Recontouring	0	0	0

ALTERNATIVE B DIRECT AND INDIRECT EFFECTS

WATER QUALITY

Sediment Delivery

The WEPP output models indicate there are no units in Alternative B considered likely to generate sediment that would leave the units, travel through buffer zones and reach any water bodies in the Swan River Valley Area. This prediction is mainly attributable to the flat undulating ground in this analysis area.

Alternative B proposes to construct temporary roads #24A and 36C. Several new stream crossings would generate a small amount of sedimentation during culvert installation and again during culvert removal. Meanwhile, implementation of road BMPs should minimize or eliminate any transport of sediment to the Swan River.

Unit 34 is the only place where winter harvest would be required to meet the Region 1 Soil Quality Standards and/or protect sensitive soils. Winter logging requires that there be enough snow to prevent muddy water from mixing into the snow where equipment operates. This would require about 10 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. The action of compacting the snow to make it passable would likely have short term effects on the melting action of water on the surface. If winter logging practices are followed, there should be little chance of soil transport to stream courses.

Best Management Practices

Additional BMP work would be applied on all haul routes, as well as touch up of those implemented in the past few years. Additional drainage features and touching up of existing drain dips would help minimize or eliminate connection of water running from the transportation system to area streams. Sediment generated from BMP work too small to detect due to undulating landscape and low gradient water courses.

Streamside Management Zones and Riparian Habitat Conservation Areas:

Existing roads isolate scattered small slivers of designated RHCAs that are included in **five** proposed treatment units (Units 19, 24, 57, 61, and 205). The existing roads separate these slivers hydrologically from the main bodies of the designated riparian areas as these slivers are located uphill of the existing roads. The District Fisheries Biologist examined these units and verified that there is no potential for erosion from the harvest activity to reach any of the wetlands (Project File N-9).

Road Decommissioning

Alternative B proposes to decommission NFS Roads #9579 (0.785 miles), #10566 (0.08 miles), #10568 (0.300 miles), #79Y (0.750 miles), and #79Z (0.150 miles) using a mix of active and passive techniques. This work would include taking advantage of existing road vegetation and installing water bars and other water management work to prevent erosion and sediment transport. Road decommissioning should benefit water resources over the long term by reducing the potential impact of roads on water quality. In the short term, decommissioning work has the potential to impact water quality due to soil disturbance. However, if BMPs are implemented during decommissioning, the potential should be minimized.

Resource Enhancements

There are no resource enhancements projects proposed in this valley bottom area.

Beneficial Uses

Alternative B would not impact the Beneficial Uses designated for this or any other area in the Glacier Loon Project Area.

CHANNEL STABILITY (MORPHOLOGY)

Another road, NFS Road #10567, accessing Units 206, 207, and 208, would have a culvert removed on a small tributary of the Swan River in the valley bottom after the road is used for yarding and access for thinning. Removal of the culvert would improve the channel morphology in this location because the pipe is less than bank full width. This is an old road with a prism that is basically reclaiming itself. In Alternative B, these roads would be put into the "Historic" status in the Forest road database, which reduces the likelihood that they would be reused in the future.

ALTERNATIVES C AND D DIRECT AND INDIRECT EFFECTS

WATER QUALITY

Sediment Delivery

The WEPP output models indicates there are no units in Alternatives C and D considered likely to generate sediment that would leave the units, travel through buffer zones and reach any water bodies in Swan River Valley Bottom Area. This prediction is mainly attributable to the flat undulating ground in this analysis area.

Alternative C does not propose construction of temporary roads that need new stream crossings. Temporary Roads #36C and #24A are not included in Alternative C, so the two unnamed tributaries to Swan River would not experience any sedimentation. However, Alternative C does include BMP work on the haul route of NFS Road #10567. As described earlier, this road has an unstable road cut and two undersized culverts that would need to be addressed by BMPs. During project implementation, a small amount of sediment would be transported to the Swan River, although it would be too small for normal detection. In the long run, this activity would reduce potential erosion that would have taken place if the culverts washed out.

Alternative D, however, proposes to construct Temporary Road #24A just like Alternative B. This new stream crossing would generate a small amount of sedimentation during culvert installation and again during culvert removal. Meanwhile, Alternative D does not include any commercial harvest units on NFS Road #10567 and, therefore, it would not be improved to BMP standards. Thus, Alternative D does not include any short-term sedimentation associated with replacing culverts and stabilizing a road slump. While this avoids any short-term sedimentation, there is a risk that the old culverts could wash out in the future. It is impossible to forecast just when this would happen; and given the low gradient characteristic of the stream, it may or may not happen within the 25-year analysis timeframe.

Unit 34 is also included in Alternatives C and D as requiring winter harvest. As with Alternative B, this unit would require winter harvest to meet the Region 1 Soil Quality Standards.

Best Management Practices

Additional BMP work would be applied on all haul routes, as well as touch up of those implemented in the past few years. Additional drainage features and touching up of existing drain dips would help minimize or eliminate connection of water running from the transportation system to area streams.

Streamside Management Zones and Riparian Habitat Conservation Areas

Alternative C and D include limited amount of harvest activity within RHCAs of units 19, 24, 57, 61 and 205. As described earlier, these actions have no potential for erosion to reach any wetlands.

Road Decommissioning

There are approximately 2.1 miles of roads designated for decommissioning in Alternatives C and D in the Swan River Valley Bottom Area. This primarily includes NFS Road #79Y that accesses Units 38, 39, and Unit 40. This is an old road with a prism that is basically reclaiming its self. Another road, NFS Road #10567, accessing Units 206, 207, and 208 would have a culvert removed on a small tributary of the Swan River in the valley bottom. This work would occur after the road is used for yarding and access for thinning. Removal of the culvert would improve the channel morphology in this location because the pipe is less than bank full width. In Alternatives C and D, the decommissioned roads would be put into the "Historic" status in the Forest road database which reduces the likelihood that they would be reused in the future.

Resource Enhancements

There are no resource enhancements projects proposed in this valley bottom area.

Beneficial Uses

Alternatives C and D would not negatively impact the Beneficial Uses designated for this or any other area in the Glacier Loon Project Area. With either Alternative C or D there would be less annual change in water quality than with Alternative B.

CHANNEL STABILITY (MORPHOLOGY)

Because Alternative B has the most temporary roads, both on historic templates and newly constructed, the other alternatives are expect to have less potential to affect channel morphology. Any point where these roads cross stream systems could have some minor effect on channel morphology. Any new or temporary stream crossing would conform to appropriate road permit designs, and all BMPs to minimize or eliminate impacts.

As described earlier in this section, the change in the amount of water in all action alternatives would be so small it would not be detectable when comparing variability flow from year to year. For this reason, there is no evidence there would be a change in channel stability or channel morphology due to increased stream flow.

ALL WATERSHEDS

ALTERNATIVES A – NO ACTION CUMULATIVE EFFECTS

PAST AND PRESENT ACTIONS

Analysis of Alternative A indicates that there is little change in the major components of the hydrologic resource anticipated when considered with known present and past activities. Vegetative recovery would continue uninterrupted by management. Along with this predicted “no change” would be an increased risk for larger wildfires. (See the Vegetation and Fuels Sections of this EA for these predictions.) The extent of water yield change due to wildfire is dependent on the elevation / precipitation zone a fire occurs, the size and the overall amount of vegetation killed, and the precipitation zone in which the fire occurs.

The potential for change in water quality from sedimentation also has the potential to increase with the No Action Alternative. This is because with no action there is a reduced likelihood of opportunities to refresh drainage features on roads because they would not be used to haul harvested products. Along with increased sediment from roads is the increase potential of erosion from burned areas such as was seen along steep banks of Kraft Creek after the Crazy Horse Fire.

Increased water and erosion with the increased risk of fire leads to a higher potential of channel erosion and reduced stability. This was observed on Kraft Creek (see photos above) after the Crazy Horse Fire.

FORESEEABLE ACTIONS

Despite no proposed action on NFS lands in Alternative A, other land management actions are foreseeable. The Beaver Creek Landscape Restoration Project includes a prescribed fire in the Upper Swan analysis area, along with approximately 141 acres of vegetation management. However, the Beaver Creek EA determined this action would have no impact to water yields and a one-time pulse of sediment that, even with the worst-case scenario, is within natural variation. Meanwhile older harvest units would continue to grow and have diminishing impacts to water yields, as displayed on Table 3- 57. Considering the current and past changes in vegetation, it has been determined that all foreseeable actions should not change stream flow levels to a point that would result in stream bank instability or impairment of water quality.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

The Cumulative Effects Worksheet (Project File Exhibit M-2) considers and describes in detail proposed activities in addition to the past, current, and reasonably foreseeable activities listed in Table 3- 1 and Table 3- 2 of this document. Please refer to this worksheet for more information on the evaluation of these past, present, and foreseeable activities within the Glacier Loon Cumulative Effects Analysis Area.

PAST AND PRESENT ACTIONS

Modeling, along with on-the-ground reviews, indicate there would be no adverse cumulative effects from water yield increases, water quality from sediment delivered to water bodies, or stream channel

morphology from past activities within the Glacier Loon Area. This conclusion is reached due to the small annual water yield increases modeled with the Existing Condition, especially when compared to natural variability described earlier. Past and present actions have likewise not impacted water quality, as detailed in the review of Existing Condition of sediment and nutrients. Furthermore, available data indicates that channel stability is in good condition.

Additional consideration was given to whether past, present, and reasonably foreseeable actions would have a cumulative effect not only on the analysis watersheds, but on the Swan River, as well. This concern can best be addressed by two studies that have been conducted on the Swan River. In the past 15 years, both were initiated to determine if land management activities are having an effect on the river.

In 1989, an aerial photo analysis was conducted on the Swan River's geomorphology, or channel shape. This was done by comparing changes between three sets of photos; 1934, 1966, and 1985 (Grant 1989). It was concluded that "(T)he kinds of changes observed during the period 1934-1985 are consistent with the type of behavior one would expect for a channel of this gradient and discharge."

The Swan River flows at a very low gradient (less than 1 percent slope) through unconsolidated glacial till material that is easily erodible. Noticeable changes in gravel bars are seen annually as peak flows scour the river banks and deposit the recruited material in the lowest gradient areas. Because of its gradient and annual discharge, it is on the threshold between where one would expect a meandering, single-channel system, and where one would expect to find a braided stream with many bars and channels. These channel types are most likely to be changed by extreme flood events such as the one experienced in 1964. The study goes on to conclude: "Increased delivery of water from harvested units is unlikely as a mechanism for generating cumulative effects because: 1) snowpack melting results in only negligible increases in runoff from harvested units versus unharvested areas; 2) the drainage network connecting valley floor units with the main channel is poorly developed; and 3) there exists ample opportunity for storage and detention of runoff in the numerous lakes, ponds, and marshes along the valley floor." The study goes on to point out that the glaciated landforms effectively buffer the movement of both water and sediment from the adjacent hill slopes," thereby reducing the sensitivity of the channel to hillslope-induced changes in regime."

The other study, completed in 1999 by Flathead Lake Biological Station researchers, focused on water quality primarily in form of nutrients, represented by the levels of sediment in grab samples taken along the course of the river. In this study, the Swan River catchment was broken into five segments. The sampling locations were placed along the river where the flows could be measured through most of the year, and water quality samples could be taken on a consistent basis. Of the locations, three are spatially located below the point where the Swan River passes along the Glacier Loon Analysis Area.

As mentioned previously, the 1999 study confirmed that nutrients and total suspended sediment is extremely variable from site to site, from season to season, and from year to year. And that, even when the best statistical analysis techniques are used to link land management level to water quality components, Ellis states that it is "not surprising that we observed no statistically significant relations between human landscape disturbance and water quality." The reason for this lack of linkage was related to:

- The mixing and dilution of nutrients and sediment through the course of the river as tributaries entered the river,
- The large amount and types of areas capable of storing nutrients and sediments such as the extensive floodplains and side channels, and
- "The chaotic timing of the movement of materials from storage at a range of scales in response to often episodic events."

Therefore, any downstream cumulative effects on the Swan River is dismissed and focus remains on Glacier, Upper Swan and Valley Bottom watershed analysis areas. The following discussion reviews several past and present actions for their contribution to cumulative effects. It is not an exhaustive list

and other minor actions are described in Project File M-2.

Forest Service Timber Harvest

Historic timber harvests often modified riparian areas and this likely contributed sediment and also reduced stream channel stability. However with the advent of the 1988 Montana SMZ law (and subsequent RHCA buffers in 1995), the overall condition of riparian vegetation has greatly improved. Riparian shrub vegetation is very resilient, although full recovery of streamside trees will take longer. Stream banks no longer erode, channels are stable and water yields are not outside of normal variability. Analysis for the most recent Forest Service project in the analysis areas, called Hemlock Elk, determined the project would have “no measurable effect to water quality in the streams” and “all beneficial uses would be protected” (Project File Section AA).

Wildfire, Fire Suppression and Post-Fire Salvage

There is no evidence that fire suppression has negatively impacted water quality. Wildfires periodically burned these analysis areas. The 2003 Crazy Horse wildfire burned 11,000 acres of the Glacier and Swan Valley Bottom watershed and the 2008 Lindbergh wildfire burned 44 acres of Upper Swan watershed. Both of these fires contributed substantial sediment and temporarily increased water yields and then have subsided and no longer have an impact, which is expected with natural variation. The 2004 post-fire salvage had no impact (Project File Section AA).

The Nature Conservancy Timber Harvest on Legacy Lands

The Nature Conservancy has implemented several timber harvest projects in recent years on lands that are now within the National Forest system. One project consisted of 173 acres of overstory removal in T20N, R17W, sec 13 in the Swan Valley Bottom watershed, which was acquired by the Forest Service in 2013 with Land and Water Conservation Funds. The other projects were part of the PCTC Fiber Supply Agreement on Legacy Lands, which terminated in 2016 (Project File Section AA). These projects were called Fredswood, Mac-n-Cheese, and Pickpocket Harvest and they were located in Glacier Creek watershed and Swan Valley Bottom watershed. These projects were 409 acres total of overstory removals and 8 acres of commercial thinning. All work was conducted in upland areas and not within SMZ. No new roads were constructed. Furthermore, this work was conducted in concert with the State BMPS, which have been found to be over 90 percent effective in protecting water quality in recent audits. Therefore, these Nature Conservancy Timber Harvests would not have had any measurable effect to water quantity or quality.

Red Butte Fish Barrier

Analysis conducted for the Red Butte Fish barrier estimated that project would generate a one-time contribution of approximately 11 tons of sediment. This work was completed in 2014 and no longer contributes sediment to Glacier Creek watershed.

REASONABLY FORESEEABLE ACTIONS

There are several reasonably foreseeable actions that could impact hydrology resources of Glacier Creek, Upper Swan and Valley Bottom analysis areas, described below.

Restoration Work on Legacy Lands

The recent acquisition of Legacy Lands from PCTC to the Forest Service could over the long term have a positive impact on water quality as a result of restoration work. These lands are in the process of being treated for noxious weeds, revegetated with native plants, and actively treated to restore natural water flow patterns.

Beaver Creek Landscape Restoration Project

The Beaver Creek Landscape Restoration Project seeks to reduce the effects of uncharacteristic wildfire through a number of treatments within the Upper Swan River Analysis area used for this project. The Beaver Creek Project includes a 1,104 acre prescribed burn in the headwaters of Lindbergh Lake (within the wilderness) and also approximately 141 acres of commercial and pre-commercial harvest near the south side of Swan River and east side of Lindbergh Lake (Beaver

Creek Draft Decision 2016). The Beaver Creek EA determined that these actions consists of only 4.5% of the watershed and are too small to impact water yields. The cumulative effect of the Beaver Creek Project and the Glacier Loon Project are still “little to no effect on water yields or peak flows” (Project File Section AA). The EA also determined no potential for sediment from the vegetation management but small amount was possible from the prescribed burn if the spring runoff after the burn was at least a 6 year flood event. This worst-case scenario is a one-time pulse of sediment entering Lindbergh Lake but it is well within normal sediment loads after a flood event. Water quality metrics of Lindbergh Lake (such as Secchi disc depth, chrolophyll a and dissolved oxygen) would be unchanged (Project File Section AA).

Windfall Creek restoration

Several culverts and a portion of NFS Road #9590 are authorized for removal as watershed restoration under the Hemlock Elk Project (Project File Section AA). This project is located in upper Windfall Creek, which is a tributary of the Glacier Creek Watershed. This restoration work could occur in the next few years. Sediment control specifications would be included in the restoration work. A small amount of sediment could be generated during restoration work. However, there would be a long-term benefit due to reducing the contribution of road fill erosion during high flows.

Private Land Transactions and Development

According to Missoula and Lake County Subdivision Regulations, land may be found unsuitable for subdivision due to flooding, landslides, steep slopes in excess of 25 percent, high potential for wildfire, high water table, and other features that may cause environmental degradation. Land also located within the 100-year flood frequency or land deemed subject to flooding shall not be subdivided for building or residential purposes. Limitations on home site development are defined by the county regulations in which the property resides.

Lindbergh Lake Wetland Restoration

A 3 acre wetland adjacent to the Lindbergh Lake campground was ditched and drained approximately 70 years ago. A reasonably foreseeable project is to restore the historic meandering stream channel in this wetland to allow natural water recharge of this wetland. This action helps recover natural hydrologic processes in that particular wetland but has a trivial impact to the overall Upper Swan watershed water quantity or quality.

Overall, cumulative effects of the Glacier Loon Project activities themselves are extremely limited and, as described in the effects analysis, even these limited affects rapidly subside within 15 years due to vegetative recovery. Land ownership changes and associated development are speculative, but it is not likely that effects from changes in the ownership pattern would combine with the limited affects from the project to produce a measurable effect on the water quality of the Swan River within the period of recovery from project. Further, the impact of the land ownership changes is, in many cases, moving the lands from industrial use to less impactful practices. Overall it is not expected that the landownership changes in the Swan Valley would combine with the project affects to adversely impact water quality.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change to the MA for a portion of the Glacier Loon Project Area along Lindberg Lake, including the highly visible portions of the project area from the lakeshore to the slope break totaling approximately 221 acres. The proposal would change 213 acres from MA 15, which consists of timberlands where timber management with roads is economical and feasible as currently assigned, to MA 5, which consists of roaded timberlands in areas of high scenic value. The other 8 acres would be changed from MA 15C, timberlands with emphasis on white-tailed deer summer range, to MA 5.

Timber harvest would occur only when designed to improve or retain the scenic qualities of that area. Timber harvest designed as such would typically be less frequent, at a lower intensity with less of a

potential impact to water resources. The effects of this change are included in the direct and indirect effects section for Alternatives C and D. These alternatives propose elimination of vegetation management and additional road decommissioning associated with the proposed management area change.

REGULATORY FRAMEWORK AND CONSISTENCY

Water resources management in the Glacier Loon Area is regulated by the Federal Water Pollution Control Act, the EPA's Anti-degradation Policy, Montana Water Quality Standards, Montana State BMPs, and the SMZ Act.

Water quality standards (Section 303(c)) established in Montana for the Clean Water Act classify all waters in this area to be B-1. This means that the waters are suitable for drinking, culinary, and food preparation 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. There are many registered water rights for Consumptive Use (households and stock watering) in the lower portions of the project area.

The predominant non-consumptive use of the streams' water in this area is the propagation of cold-water fisheries and other aquatic life. The water quality parameters of primary concern to the fisheries are fine sediment and changes in temperature. These, along with dissolved oxygen, nutrients, dissolved solids, and many other variables, have been measured at a variety of locations across the Forest.

Federal agency compliance with pollution control is addressed through Section 313 of the Clean Water Act, EO 12580 (January 23, 1987), National Nonpoint Source Policy (December 12, 1984), USDA Nonpoint Source Water Quality Policy (December 5, 1986) and the EPA in their guidance "Nonpoint Source Controls and Water Quality Standards" (August 19, 1987). In order to comply with State and local nonpoint pollution controls, the Forest Service would apply BMPs to all possible nonpoint sources that may be due to management activities addressed in this Environmental Analysis. Best Management Practices are the primary mechanism to achieve water quality standards (EPA 1987).

Best Management Practices include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. Best Management Practices 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). Although there has been a recent court case stating that there may be a need to apply for a Non-point source pollution permit for every logging road, or those that potentially could route sediment to "waters of the United States" President Obama signed a 1 year waiver to this injunction that makes the issue mute for the Glacier Loon Project. In any case all necessary permits would be obtained prior to project implementation; these are listed below.

- **Montana Streamside Protection Act (SPA 124 Permit)** - Any project including the construction of new facilities or the modification, operation, and maintenance of an existing facility that may affect the natural existing shape and form of any stream or its banks or tributaries (Montana Department of Fish, Wildlife, and Parks).
- **Montana Streamside Protection Act (SPA 124 Permit)** – Any activity that will result in the discharge or placement of dredged or fill material into waters of the United States, including wetlands (U.S Army Corp of Engineers).
- **Short-term Water Quality Standard for Turbidity (318 Authorization)** – Any activity in any state water that will cause unavoidable short term violations of water quality standards. "State water" includes any body of water, irrigation system, or drainage

system, either surface or underground, including wetlands, except for irrigation water where the water is used up within the irrigation system and the water is not returned to other state water (DEQ).

- **Storm water Discharge General Permits** – Any person, agency, or entity, either public or private, proposing a construction, industrial, mining, or other defined activity that has a discharge of storm water into surface waters. Under the authority of the Montana Water Quality Act, permit authorization is typically obtained under a Montana Pollutant Discharge Elimination System (MPDES) "General Permit" (DEQ).

New FSM direction was released in April 2012 for BMPs for all activities on Federal lands. Within Volume One Best Management Practices for all activities on Federally-managed lands are listed. Volume Two will cover National BMP Monitoring, and Volume Three will include revised national direction. This means that what was once considered voluntary in Montana is now National direction to be applied on all Flathead National Forest lands managed for timber sales. It should be noted that this document also outlines BMPs not only for timber sales activities but all activities that occur on NFS Lands.

Wetlands are protected under EO 11990. This Act directs Federal agencies to "minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." Effects on the maintenance of natural systems, flora, fauna, habitat diversity, and hydrologic utility are to be considered when evaluating a proposed project that could potentially affect a wetland. The Montana SMZ Act (1991) directs wetlands adjacent to stream channels to be included within SMZ boundaries.

All action alternatives are consistent with the water quality goals, objectives, and standards described above and outlined in the Flathead Forest Plan, as amended. This consistency is met primarily by application of BMPs in timber harvest areas and roads associated with vegetation removal.

FISHERIES

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA. This section has been updated to include updated information about bull trout and cutthroat trout populations and meltwater ledian stonefly, a species that was identified by the USFWS in 2016 as a proposed threatened species. The updated information relative to bull trout and bull trout critical habitat was included in the 2015 Bull Trout and Bull Trout Critical Habitat BA submitted to USFWS with a determination of effects to bull trout as “may effect, not likely to adversely affect”. This updated analysis also reflects that the completion of harvest activities on Legacy Lands, the genetic rescue of the Herrick Run cutthroat trout population and the construction of a desirable fish barrier on Red Butte Creek. This section also considers the potential cumulative effects of a Beaver Creek Project and other small reasonably foreseeable project.

INTRODUCTION

Aquatic species, such as trout, suckers, mayflies and stoneflies, depend on good water and diverse habitat conditions to survive. In order to characterize the needs of many diverse aquatic species, the Forest Service relies on the use of management indicator species (MIS). Analyzing impacts to these particular species are considered adequate surrogates for all others. The Flathead Forest Plan has identified westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and bull trout (*Salvelinus confluentus*) as MIS since they are native to the forest and sensitive to habitat degradation. Thus, while this analysis focuses on native trout habitat parameters, it serves as an adequate surrogate for all aquatic species.

ANALYSIS AREA

SPATIAL BOUNDS

There are four fisheries analysis areas for this project (Map 3-3). Some are “nested” inside the others. Fish may not be able to move between them, but water flows unimpeded and thus the smaller nested one can impact the larger one.

GLACIER CREEK ANALYSIS AREA

Many aspects of the proposed action are located in the south half of this watershed. Since fish are able to move freely around the watershed, all tributaries are included in the analysis area (Windfall, Kraft, Hemlock, Red Butte, Frenchy, Glacier, Stoner Lake outflow, and Loon Lake outflow). The downstream limit is the confluence of Glacier Creek with the Swan River. The upstream limits are the highest locations where fish exist.

HERRICK RUN ANALYSIS AREA

This watershed may have been historically fishless due to the very high gradient in lower Herrick Run. Currently, a cutthroat trout population exists in a portion of Herrick Run with lower gradient, plus Meadow and Bunyan Lakes. The downstream limit of this analysis area is the very high gradient area just above Lindbergh Lake. The upstream limit is the inlet stream of Meadow Lake, the highest

elevation for this population. Herrick Run is nested within the larger Lindbergh Lake analysis area.

LINDBERGH LAKE ANALYSIS AREA

The proposed action includes activity within the watershed of Lindbergh Lake, outside of Herrick Run. Fish in Lindbergh Lake are not truly isolated and can move downstream into the Swan River Valley if they chose. However, many species in the lake utilize the deep, oligotrophic (cold, unproductive) habitat offered by the lake and would be unlikely to swim into the relatively warm river outlet. Thus any potential habitat changes to Lindbergh Lake would mostly impact fish in the lake, more so than downstream. The downstream limit of this analysis area is the outlet of Lindbergh Lake. The upstream limit is the upper extent that spawning fish from Lindbergh Lake can travel, namely at Gray Wolf Lake and a waterfall below Crystal Lake.

SWAN RIVER VALLEY ANALYSIS AREA

All of the above analysis areas ultimately discharge to the Swan River. In addition, the Glacier Loon Project has activities in several small, unnamed watersheds that enter the river directly plus also activities near the river itself. Therefore this analysis area encompasses both potential direct impacts and cumulative impacts from other analysis areas. The downstream limit is the Bigfork Hydroelectric Dam which isolates the Swan River Valley. The upstream limit is the upper limits of every tributary that fish can access.

TEMPORAL BOUNDS

The timeframe for this analysis is 25 years after completion of the project. The majority of impacts from the project, such as temporary roads and culvert replacements, would have impacts for only a few years and then return to background conditions. However, decommissioning forest roads has a very subtle, long-term impact to channels. The rate of change to stream channels depends on random events such as floods and wildfires. Twenty five years was selected as a reasonable timeframe.

INFORMATION SOURCES

Information for this analysis has been gathered from a variety of sources. Fish habitat evaluations within the analysis area have been conducted by the Forest Service since 1980. Fish population inventories have been gathered by the Forest Service and Montana Department of Fish, Wildlife & Parks (MDFW&P) since 1972. All raw data is stored at the Swan Lake Ranger District Office and is incorporated by reference. In addition to this, peer-reviewed scientific literature has been used as the primary source of information regarding the life histories and habitat requirements of the aquatic organisms and the effect of natural and human-caused disturbances upon those organisms.

Habitat surveys were initially conducted in 1980, but these older surveys are minimally used in this analysis. In these older surveys, technicians visually examined the entire stream and then ascribed a single numeric value for pools, percent gravels, etc. This methodology is not repeatable or verifiable and, therefore, only used to divide streams into reaches. Beginning in 1992, fish habitat surveys evolved to two general types of data collection. Some habitat surveys are designed as inventories. Inventories sequentially measure every foot of the stream and then compile the results within a given stream reach, usually bounded by changes in gradient. Inventories followed protocols defined by Overton et al. (1997). Inventories have an advantage in that they examine the entire stream and do not risk mischaracterizing a stream. However, because inventories do not have a fixed sampling location, they are less valuable for monitoring trends.

Other habitat surveys are specifically designed to monitor conditions. Within a Designated Monitoring Reach (DMR), efforts focus on quantifying microhabitat features in smaller representative areas with carefully defined habitat measurements to avoid observer bias (Roper et al. 2003). Some of the oldest DMR locations in this project area were established in 1999. Protocol evolved gradually until it

was finally written down in 2006 (USDA Forest Service 2006a). This analysis considered the gradual change in protocol and concluded that the original surveys are compatible to more recent surveys. The weaknesses of monitoring surveys are that a single survey without repeat has little value. Also monitoring just short representative areas may not fully typify the rest of the stream.

The majority of fish population data available has been collected by electrofishing. Electrofishing offers superior ability for crews to identify and accurately measure each fish. Techniques are virtually unchanged since the earliest available data (1972), thus allowing repeat monitoring. The weakness of electrofishing is that it does not effectively capture all fish, since some individuals drift out of sight or escape the area prior to sampling. Cryptic, bottom-dwelling species, such as bull trout and sculpins, especially tend to be underrepresented. Electrofishing is only done in summertime low-flow conditions in a small, representative area (often 328 feet [100 meters] in length). This analysis assumes that available electrofishing data does an adequate job in characterizing species relative abundance distribution during low flows on gravel bed streams.

Snorkeling surveys have also been conducted when searching for bull trout or working in large channels like Glacier Creek. Because fish are not captured for closer inspection or marked, snorkeling limitations are that it cannot offer a population estimate, it may misidentify fish, and it can only estimate fish sizes. An assumption is made that snorkeling surveys do an adequate job of identifying species distribution, but also recognizes that they do not prove species absence and may not fully characterize the population.

MEASUREMENT INDICATORS

This analysis focuses on four measurement indicators:

1. Sedimentation,
2. Fish Habitat Complexity,
3. Fish Migration Barriers, and
4. Native Fish Population.

The analysis does not focus on other fish habitat attributes such as water temperature, large woody debris or stream bank condition because the Proposed Action has no potential impact to them. Project File Exhibit N-10 has further information on why other habitat attributes were not used as measurement indicators.

SEDIMENTATION

Sedimentation into trout streams is considered a key concern and the most frequently cited type of pollutant in streams of the Pacific Northwest (Bauer et al. 2001). In discussions about local fisheries habitat, sedimentation is narrowly focused on the amount of silt, sand, clay and small gravels less than 0.25 inches (6.35 mm). This is based on local research (Weaver et al. 1991) and commonly referred to as “fine sediments.”

The amount of fine sediment in a stream can profoundly affect the quality of fish habitat. Bull trout and cutthroat trout lay eggs in between gravels and, if these eggs are covered with fine sediments, they suffocate. Furthermore the majority of native aquatic insect species depend on cobble and gravel substrates that are not embedded or stuffed with fine sediments. In extreme cases, where fine sediments are very excessive, and can fill in pools and bury logs that fish need for cover and rest.

Though fine sediment is an important parameter, there are no regulatory standards and no consensus on how to quantify the effects (Bauer et al. 2001). The challenge comes from the extremely dynamic nature of substrate conditions as it can vary naturally from stream to stream, riffle to riffle and year to year (Everest et al. 1987). Due to the complexity of stream habitat, there is no one simple value that can describe the entire stream. A portion of the stream along a steep mountainside

would tend to have less sedimentation than a slow-moving beaver pond area. Therefore, fish habitat is divided into a series of reaches (a length of stream) bounded by a change in channel morphology or gradient. Reach delineation is based on on-the-ground habitat inventories and since geology changes slowly over eons, the initial inventory is assumed to still correctly segment the stream. If the stream has not been inventoried, reach delineations are based on the District Fisheries Biologist's interpretation of GIS modeling of stream gradient and sinuosity (Project File Exhibit N-9).

This analysis uses information provided from "pebble counts," which measures the average diameter of substrate at evenly spaced intervals in a section of the stream. Pebble counts were used chiefly because it is the most widely available data in the analysis area and is a reasonably effective method to monitor sedimentation in gravel or cobble streams such as found in the analysis area (Bunte et al. 2001). Pebbles measured are assigned to various size categories (e.g., 0 to 0.2 inches [0-6 mm], 0.2 to 0.3 inches [6 to 8 mm], 0.3 to 0.5 inches [8 to 12 mm], etc). The "percentage of fine sediment" refers to the percentage of all particles that are less than 0.25 inches [6.35 mm]. However, Archer et al. (2004) found that fine sediments vary so much between observers and stream heterogeneity, that it would take far more samples than typical agency budgets can afford in order to have confidence in change. Therefore, percentage of fine sediments is presented, but no interpretation of trends is possible.

A better monitoring technique is evaluation of "D50," the median category of all the pebbles measured (i.e., 50 percent of pebbles are equal to or smaller than the category). A stream with a large D50 has relatively little fine sediments. An increasing D50 trend means the substrate is coarsening (thus has less fine sediments). This measurement has less observer bias and less seasonal variability.

There are no Inland Native Fish Strategy standards for sedimentation. The Forest Plan does note that certain, specific bull trout streams should not exceed 35 percent fine sediment as found from "coring" protocols. None of the bull trout streams listed in the Forest Plan are found in the analysis area nor is coring protocol data available.

FISH HABITAT COMPLEXITY

Fish Habitat Complexity is critically important to aquatic resources. The ability of a stream to support native trout depends on ample features, such as: pools for year-round dwelling space, shallow riffles for growing insects, side channels for juvenile fish rearing, undercut stream banks for fish hiding and woody debris for hiding cover and insect colonization. Conversely, a stream with simple, uniform habitat has a much lower carrying capacity. Habitat complexity also serves a vital role in providing resiliency in stressful conditions, such as increased temperatures and reduced summer flows.

There are many ways to describe habitat complexity. Factors such as the amount and size of woody debris, stream bank shape and stability, channel width and pool frequency are some of the variables that contribute to habitat complexity. However, this analysis will solely use the residual depth of pool habitat to characterize habitat complexity. The residual depth of pools is simply the maximum depth minus the pool crest depth; and therefore, it is not sensitive to flow levels on the date of inventory. The first 10 pools encountered in the DMR are averaged for a single value. This variable was selected because it is considered the most sensitive to watershed changes (Bauer et al. 2001), and it also is one of the more repeatable, quantifiable monitoring techniques (Archer et al. 2004). Thus while woody debris and stream banks are certainly important to fish habitat, this project would have extremely little activity that could impact them and therefore it is meaningless to review.

FISH MIGRATION BARRIERS

Fish Migration Barriers are factors that can block natural movements of fish, either traveling upstream or downstream. Stream-dwelling fish need to be able to move about their entire lives in order to escape harsh winter conditions, seek out optimal food and cover and seek out spawning habitat. Barriers to fish migration can include man-made items, such as poorly designed road culverts or natural features such as waterfalls. Barriers to migration are characterized by the length of habitat that is blocked.

NATIVE FISH POPULATIONS

Native Fish Population are discussions about how a given fish population reacts to changes. Fish populations are impacted by habitat conditions, habitat quantity, invasive species, recreational harvest and abiotic factors, such as floods, drought or climate change. These factors are complex, interdependent, and very challenging to forecast over time. Therefore, rather than describing an absolute population response (such as numbers of fish increase from 250 to 260 adults), Fisheries Biologists characterize a change in population “viability.” Viability is an estimate of whether the population will persist for at least 100 years. A population that is expected to have improved viability means that change is substantial enough to have more fish than at present, without having to articulate the exact change.

AFFECTED ENVIRONMENT

GLACIER CREEK ANALYSIS AREA

SEDIMENTATION

Within the Glacier Creek Analysis Area, there are 15 stream reaches that have pebble count data. To date, 11 of these have been replicated at the exact location and protocol. Table 3- 61 below provides the data results. The general impression is much of the Glacier Creek Analysis Area trended towards smaller D50 size (increased fines) in 2004. Those that have been monitored since have largely returned to initial condition. Archer et al. (2004) calculated that at least 16 locations are needed to detect 50 percent change in D50 with probability of Type 1 or Type II error at 0.1. In other words, any change less than 50 percent could be natural heterogeneity or observer error. The Glacier Creek Analysis Area has just 11 locations with varying upward or downward trends measured during different years. If all are average equally, the trend is about 9 percent change towards coarser materials and fewer fines. Thus, no statistical confidence is possible with this data, but it does appear that there is a spike in fine sediments in 2004 followed by a return to previous condition. During the period monitored, there is no evidence the Glacier Creek Analysis Area is experiencing increased sedimentation.

STREAM REACH	YEAR	NO. OF LOCATIONS SAMPLED	PERCENT OF FINE SEDIMENT	D50 (MM)	POSSIBLE TREND
Glacier 4	2003	1	7.4	48-64	50% coarser; less fines
	2004	1	7.5	96-128	
Glacier 5	1999	1	30.5	24-32	Highly variable, perhaps 65% coarser
	2003	1	10.5	96-128	
	2010	1	20.0	64-96	
	2015	1	8.4	96-128	
Glacier 12	1999	1	8.4	64-96	Highly variable, perhaps 50% coarser
	2008	1	12.1	192-256	
	2011	1	6.4	128-192	
	2016	1	11.3	96-128	
Glacier 13	1999	1	5.9	96-128	
Kraft 1	2004	2	17.6	48-64	
Kraft 2	2004	3	26.4	48-64	
Kraft 3	2004	1	15.4	32-48	
Kraft 4	2003	1	NR	64-96	

TABLE 3- 61. SYNOPSIS OF ALL AVAILABLE PEBBLE COUNT DATA IN GLACIER CREEK ANALYSIS AREA. REACHES WITH MULTIPLE PEBBLE COUNTS ARE AVERAGED TO ONE VALUE. REACHES WITH JUST A SINGLE ROW LISTED HAVE NOT HAD REPEAT MONITORING EFFORT YET.

STREAM REACH	YEAR	NO. OF LOCATIONS SAMPLED	PERCENT OF FINE SEDIMENT	D50 (MM)	POSSIBLE TREND
	2008	1	NR	96-128	50% Coarser, less fines
Kraft 5	2003	1	7.3	96-128	Unchanged
	2004	1	17.2	96-128	
	2011	1	24.4	96-128	
Kraft 6	2003	1	11.3	64-96	Variable. Increase in fines then returned to previous condition
	2004	5	28.6	12-16	
	2006	1	21.2	48-64	
	2011	1	7	64-96	
	2016	1	16	32-48	
Kraft 7	2003	1	3.2	128-192	Increase in fines and returning to previous condition
	2004	2	17.4	128-192	
	2010	1	22	48-64	
	2015	1	11.3	64-96	
Kraft 8	2003	1	6.2	192-256	30% Increase in fines
	2004	1	22.5	128-192	
Hemlock	2003	1	7.3	96-128	30% Increase in fines
	2004	1	19.2	64-96	
Red Butte	2003	1	17.6	96-128	50% Increase in fines
	2004	1	22.5	48-64	
Crazy Horse	2003	1	NR	96-128	Variable. No change
	2008	1	NR	192-256	
	2013	1	NR	96-128	

FISH HABITAT COMPLEXITY

There are nine DMRs in the Glacier Creek Analysis Area and seven of them have replicated at least once. According to Archer et al. (2004), these seven monitoring samples are enough to detect 50 percent change with $p < 0.1$ of Type I or II error. In other words, there is statistical confidence if the reaches change by more than 50 percent. Any smaller changes could just be natural heterogeneity and not significant.

Table 3- 62 below presents the available data from the Glacier Creek Analysis Area. Most have changed little and when all 7 DMRs are averaged together the net change is 11 percent shallower. This is not a significant change.

TABLE 3- 62. SYNOPSIS OF ALL AVAILABLE DATA FOR RESIDUAL DEPTH OF POOLS IN THE GLACIER CREEK ANALYSIS AREA.

STREAM REACH	YEAR	NO. OF LOCATIONS SAMPLED	RESIDUAL DEPTH OF POOLS	POSSIBLE TREND
Glacier 4	2003	1	0.84m	4 deeper
	2004	1	0.87m	
Glacier 5	1999	1	0.59m	50% shallower
	2003	1	0.57m	
	2004	1	0.57m	
	2010	1	0.53m	
	2015	1	.30	
Glacier 12	1999	1	1.28m	33% shallower
	2008	1	0.59m	
	2011	1	0.51m	
	2016	1	0.84m	
Glacier 13	1999	1	0.99m	

TABLE 3- 62. SYNOPSIS OF ALL AVAILABLE DATA FOR RESIDUAL DEPTH OF POOLS IN THE GLACIER CREEK ANALYSIS AREA.				
STREAM REACH	YEAR	NO. OF LOCATIONS SAMPLED	RESIDUAL DEPTH OF POOLS	POSSIBLE TREND
Kraft 4	2003	1	0.30m	17% shallower
	2008	1	0.25m	
Kraft 6	2003	1	0.32m	Variable. No trend
	2004	1	0.16m	
	2011	1	0.22m	
	2014	1	0.34m	
Kraft 7	2010	1	0.34m	33% shallower
	2015	1	0.23m	
Red Butte	2003	1	0.29m	15% deeper
	2004	1	0.34m	
Crazy Horse	2003	1	0.31m	4% deeper
	2008	1	0.32m	

FISH MIGRATION BARRIERS

There are two known human-caused migration barrier in the Glacier Creek Analysis Area . One is at a culvert on NFS Road #9590 which is unintentionally blocking approximately 0.25 miles (300 meters) of fish habitat in upper Windfall Creek. The 2008 Hemlock Elk DN authorized the removal or replacement of this culvert to provide fish passage. This action is reasonably foreseeable although funding is not secure. Non-native brook trout (*Salvelinus fontinalis*) are the only fish species found in Windfall Creek, and the culvert is blocking some of their rearing habitat. There are no fish upstream of the culvert barrier. Judging from the current high density of brook trout in Windfall Creek, the loss of this rearing habitat has had little effect to the population.

The other barrier was intentionally designed to block non-native brook trout from invading Red Butte Creek. As described further below, Red Butte Creek hosts a remnant native fish population but was regarded as highly vulnerable to an invasion of brook trout. A free-standing cement barrier was installed in 2014 on lower Red Butte Creek, very close to its confluence with Kraft Creek. This structure requires no maintenance and appears to be highly effective in blocking brook trout from entering Red Butte Creek.

NATIVE FISH POPULATION

The Glacier Creek Watershed contains **three** populations of cutthroat trout which differ greatly in conservation value. The first population is located in **Red Butte Creek**. The cutthroat trout of Red Butte Creek are 100% genetically pure and since the stream was never stocked, the fish are considered endemic to the Swan River valley. This makes the Red Butte population to be of very high conservation value. Gardner et al (2012) identified that Red Butte Creek was at risk of invasion by both brook trout and hybrid cutthroat x rainbow trout, and urged immediate conservation measures. This led to the decision to construct a barrier near the terminus of Red Butte to isolate the cutthroat trout from any non-native fish invasion. The barrier was installed in 2014 and no further actions are reasonably foreseeable.



Photo 1. Westslope Cutthroat Trout from Red Butte Creek, a tributary of Kraft Creek. This population is 100% genetically pure and endemic to the watershed (8/2011).

The second cutthroat trout population is located in Kraft, Hemlock, and Frenchy Creek Tributaries. For simplicity, this population will be just called "Kraft Creek Population." Note that Red Butte Creek previously was a part of the Kraft Creek population but was severed from it by the installation of the fish barrier. At one time, the Kraft Creek Population was considered to have great conservation value by a collaborative group called the Swan Native Fish Committee. A 2010 report by this committee noted that only 18 remnant populations of cutthroat trout remain in the Swan River Valley and at the time the Kraft Creek population (which included Red Butte) was the largest and probably the most important "conservation population" in the valley (Project File Exhibit N-4).

Prior to 2011, the Kraft Creek Population had been sampled 26 times at various locations and years, giving a fairly robust understanding of the population (Project File Exhibit N-5). In addition to the above inventories, a temporary weir was installed at Middle Kraft Creek (habitat reach 5) in the spring of 2004 in order to understand what, if any, use Kraft Creek gets from migratory spawning cutthroat trout. From this information, the District Fisheries Biologist learned that most of Kraft Creek's cutthroat trout were resident fish and do not migrate to the Swan River. Only about a dozen cutthroat trout attempt to migrate into Kraft Creek yearly. However, 28 percent of these migratory fish were, in fact, cutthroat x rainbow trout hybrids. The weir also discovered that about a dozen rainbow trout (*Oncorhynchus mykiss*) also migrate annually into Kraft Creek. Data indicated the early stages of hybridization. The cutthroat trout in Middle Kraft Creek were about 95 percent pure and those further upstream in Red Butte and Upper Kraft were 100 percent westslope cutthroat trout.

Unfortunately, the genetic samples taken in 2011 found a sharp decline in purity since the 2003-2004 samples. Only 19 percent of the fish captured in Middle Kraft Creek were pure Westslope cutthroat trout; the rest were hybrids. These fish had varying amounts of rainbow trout alleles (one of two or more versions of a gene). This is evidence of multiple generations of hybrid fish backcrossing with either pure cutthroat trout or pure rainbow trout parents. Overall purity had dropped from 95 percent to 88 percent pure in just seven years. Upper Kraft Creek had also declined to 99 pure. The 2011 tests used more powerful diagnostics than any prior work (i.e., more locations for detecting nonnative alleles); and therefore, the comparisons from earlier samples may not be quite equal. 2011 and 2012 sampling also found considerable increase in the numbers and distribution of brook trout. Clearly the conservation value of Kraft Creek population had deteriorated since 2004.

The **third** cutthroat trout population is in Upper Glacier Creek in reaches 7 to 13 (above the Glacier

Sloughs) and also headwater lakes of Glacier Lake, Lacey Lake, and Turquoise Lake. The cutthroat trout of the Glacier Creek Watershed are almost certainly hybridized *Oncorhynchus* species and no longer truly westslope cutthroat trout. Three headwater lakes (Heart Lake, Island Lake, and Crescent Lake) are stocked by MDFW&P with nonnative golden trout (*Oncorhynchus aguabonita*). There is nothing to prevent these fish from drifting downstream and hybridizing with native westslope cutthroat trout, and this scenario has been documented in many other watersheds. Furthermore, Lower Glacier Creek has numerous non-native rainbow trout. There is nothing to prevent the rainbow trout from hybridizing with native westslope cutthroat trout. Therefore, the *Oncorhynchus* complex in Glacier Creek are managed to provide a recreational fishery and presumed to no longer function as a native fishery.

The current distribution of bull trout in the Glacier Creek Analysis Area is uncertain. A 1972 inventory captured several small-sized bull trout upstream of Glacier Slough, close to the Mission Mountains Wilderness boundary. A few more bull trout were also captured in 1982; no further population inventories have taken place in that area. A single bull trout redd (spawning nest) was found in Upper Glacier Creek in 1983. However, redd counts in 1982, 1995, and 2003 did not find any. Given the relatively warm water in Glacier Creek (in spite of the name), and the very shallow habitat immediately upstream of Glacier Sloughs, Biologists assume that large-body migratory bull trout do not use Glacier Creek for spawning and rearing. The stream is not designated as critical habitat. It seems possible the bull trout in upper Glacier Creek function as a resident population. This is unusual for the Swan River Valley and further research is needed before that can be confirmed.

Some small size bull trout have also been periodically observed in Lower Kraft Creek, **several miles downstream of the Red Butte fish barrier**. Kraft Creek does not have the cold groundwater that migratory bull trout typically seek. Redd counts in 1995, 2003 and 2004 did not find any redds. Kraft Creek is not designated critical habitat. It is assumed that the bull trout found in lower Kraft Creek are juvenile fish from another system that move into there for foraging. Bull trout are known to disperse widely for foraging and essentially every stream in the Swan River Valley has occasional observations of bull trout.

Lower Glacier Creek and Lower Kraft Creek contain native mountain whitefish (*Prosopium williamsoni*), an undetermined sucker species (*Catostomus* sp.), and slimy sculpins (*Cottus cognatus*). Tailed frogs (*Ascaphus truei*) are found throughout the analysis area and seem especially abundant in Red Butte Creek.

The many small streams that flow from Loon Lake and Stoner Lake and other wetlands were probably historically fishless. Today, they contain non-native brook stickleback (*Culaea inconstans*). The stickleback has invaded many wetlands in this analysis area.

HERRICK RUN ANALYSIS AREA

SEDIMENTATION

The Herrick Run Analysis Area has a single DMR which has only been sampled once to date. In 2008, the survey found 32.1 percent fine sediment and the D50 was 0.6 to 0.9 (16 to 24 mm). No monitoring has taken place yet and trend is unknown.

FISH HABITAT COMPLEXITY

The Herrick Run DMR found the residual depth of pools was 1.1 feet (0.34 m) in 2008. No monitoring has taken place yet and the trend is unknown.

FISH MIGRATION BARRIERS

The culvert on NFS Road #9552 in the Meadow Lake outlet stream appears to be a partial barrier to

upstream fish migration. The culvert is undersized and has developed about one foot-high waterfall on the outlet. Juvenile cutthroat trout are probably blocked from reaching Meadow Lake, but larger-size cutthroat trout should be able to pass. This culvert has not been formally surveyed to verify it is a barrier, but the District Fisheries Biologist assumes it is a partial barrier based on her experience in other Flathead National Forest streams. The culvert blocks approximately 0.2 miles of habitat, but the consequence is unclear. Cutthroat trout exist in both Bunyan Lake downstream and Meadow Lake upstream. The loss of some rearing habitat upstream of Bunyan Lake may be the cause of a perceived population decline in Bunyan Lake. On the other hand, it may be inconsequential altogether and the decline is simply due to overfishing. Since cutthroat trout are the only species found in this analysis area, there is no beneficial purpose to the barrier (i.e., it does not block invasive species).

NATIVE FISH POPULATION

The Herrick Run Analysis Area only contains westslope cutthroat trout and tailed frogs. It is unlikely that the trout are endemic to Herrick Run due to a very high gradient area near Lindbergh Lake which would have discouraged colonization. Lamar (2008) mentions that Bunyan Lake was first stocked with cutthroat trout in 1931 but MDFW&P records are less certain. Most likely the trout in Herrick Run today are descendants from fish stock of the lake. The Herrick Run population, which includes Bunyan and Meadow Lakes, is one of the 18 “conservation populations” identified by the Swan Native Fish Committee. The high gradient area seems to deter any non-native species of Lindbergh Lake from colonizing Herrick Run.

In 2011, the Swan Native Fish Committee collected 34 fish in Herrick Run and determined they were 99.9 percent genetically pure westslope cutthroat trout. One individual had one Yellowstone cutthroat trout allele out of 114 alleles tested. Gardner et al (2012) regard this population as having high conservation value. However Herrick Run is one of the smallest populations and is believed to have only 154 age 1+ fish dwelling in the stream. The population is restricted in the wintertime to a low gradient area that is only about 0.25 miles long, and the rest of the stream is too steep. The genetic sampling revealed the population has ten times less allelic heterozygosity (diversity) than all other populations sampled in 2011. This means Herrick Run had some kind of “bottleneck” in the past and is vulnerable to inbreeding. Inbreeding can lead to reduced fitness, reduced disease resistance, and may ultimately cause extirpation. Gardner et al. (2012) urge relocating a limited number of pure cutthroat trout from elsewhere into the Herrick Run population so to give fresh infusion of genetic diversity. This was implemented in 2013-2014 by a joint effort from Montana Fish, Wildlife and Parks and University of Montana. Research on the effectiveness of this work has been conducted but results are not known at the time of this writing.

LINDBERGH LAKE ANALYSIS AREA

SEDIMENTATION

The Lindbergh Lake Analysis Area has a single DMR. A 2008 survey found the stream has 11 percent fine sediment and D50 was 5.0 to 7.5 feet (128-192 mm). No monitoring has taken place yet and the trend is unknown.

FISH HABITAT COMPLEXITY

The 2008 survey found the residual depth of pools is 22.4 inches (0.57 m). No monitoring has taken place and the trend is unknown.

FISH MIGRATION BARRIERS

There are no human-caused migration barriers in the Lindbergh Lake Analysis Area.

NATIVE FISH POPULATION

Historically, Lindbergh Lake contained many cutthroat trout, but they are less abundant today. The lake is dominated by nonnative species. In the river between Crystal Lake and Lindbergh Lake, surveys have found nonnative rainbow trout and brook trout are abundant, while native mountain whitefish, cutthroat trout and Northern pikeminnow are uncommon. Crystal Lake contains cutthroat trout (possibly endemic) and stocked rainbow trout. Further upstream is High Park Lake, which has been stocked with hybrid *Oncorhynchus* species.

Gray Wolf Lake, however, has been stocked with only westslope cutthroat trout. The 4.6 miles of Swan River between Gray Wolf Lake and the Crystal Lake outlet appears to have only cutthroat trout. Sampling is difficult in this area, but a 2011 effort estimates the population may have 2,300 age 1+ fish. Genetic samples found the fish were 99.8 percent pure. Two out of 34 individuals sampled had slight contamination with Yellowstone cutthroat trout alleles. This population is one of the 18 “conservation populations” and has high conservation value (Gardner et al 2012). There is no natural barrier that will protect this population from invasion of non-native species.

Lindbergh Lake contains bull trout. The bull trout are traditionally considered to be “disjunct” from the rest of the Swan River Valley because of the relatively warm water conditions in the Lindbergh Lake outlet. The bull trout spawn in the river between Lindbergh Lake and Crystal Lake. The natural high gradient of this river restricts bull trout to only a small patch of suitable spawning habitat, roughly 0.1 miles long. Both the lake and the inlet river are designated as critical habitat for bull trout.

Redd counts are conducted intermittently for this population and have ranged from 5 to 26 redds, with the most recent survey (2016) finding 7 redds. There is no apparent upward or downward trend. The low numbers of redds are somewhat puzzling given the relatively large bull trout population in the lake. How does the population sustain itself on so few redds? A recent study on bull trout in Swan Lake suggests the possibility that some Lindbergh Lake bull trout may be migrating downstream to spawn and mix with Swan Lake stocks (DeHaan et al. 2011). The traditional assumption that Lindbergh Lake is functionally isolated may be wrong. The recent invasion of non-native lake trout into Lindbergh Lake also underscores that the lake may not be as isolated as previously thought.

SWAN RIVER VALLEY ANALYSIS AREA

SEDIMENTATION

This analysis area is very large and the existing condition is best summarized from a 2004 report that addressed water quality condition in the Swan Lake Watershed (Montana Department of Water Quality 2004). The report found Swan Lake may be impaired by increased particulate organic carbon and decreased dissolved oxygen at the bottom of the lake. Both may be symptoms of increased sediment transported by the Swan River. The report speculated the primary pollutants came from timber harvest and private land development. Since the 2004 report, additional monitoring in the lake has found no upward or downward trend (unpublished data available from the Swan Ecosystem Center).

FISH HABITAT COMPLEXITY

The overall condition of residual pool depth was summarized in a 2015 report of all DMRs of the Swan River Valley (Gardner 2016). This report evaluated 34 stream reaches with data on residual

depth of pools. The report found no significant statistic difference from streams in unmanaged, unroaded areas and those in managed landscapes. There was no significant statistic difference in the rate of change between the two groups.

FISH MIGRATION BARRIERS

The District Fisheries Biologist is aware of 14 human-caused migration barriers still remaining in the Swan River Valley (beyond those already described within Glacier and Herrick Run Analysis Areas). This information is based on a 2002 inventory that sampled about 50 percent of road culverts in the Swan Valley plus additional barriers that have been discovered since. There may be additional barriers that are not yet known. The 14 known barriers include four barriers on Highway 83, which are partially blocking Cooney, Perry, Rumble, and Cilly Creeks. There are two privately-owned water diversions that are barriers to fish, one at Rumble Creek and the other at Sixmile Creek. There are six undersized culverts on forest roads that have created full or partial barriers. These are located on Stopher Creek, Owl Creek, Yew Creek, Rumble Creek, Beaver Lake outlet, and "Frozen Creek" (tributary to Cold Creek). The DNRC has also intentionally modified 1 culvert on Whitetail Creek to create a barrier. An intentional, free-standing barrier exists on Smith Creek. These 14 barriers, plus the barriers on Windfall Creek, Red Butte and Herrick Run, total to approximately 32 miles of blocked fish habitat. This is approximately 6 percent of all riverine fish habitat in the Swan River Valley.

Sometimes a fish migration barrier is desirable if it blocks non-native species. Five of the 14 barriers are considered beneficial for that reason, namely the barriers on Smith, Sixmile, Yew, "Frozen," and Whitetail Creeks. The barriers on Cooney and Owl may or may not be desirable and further information is needed. The remaining barriers have no beneficial use.

NATIVE FISH POPULATION

The Swan River Valley has many aquatic species. Bull trout and westslope cutthroat trout are considered MIS in that they best represent the health of all other aquatic species. Bull trout are protected by ESA and critical habitat is designated along the length of the Swan River, from Lindbergh Lake to Swan Lake.

The bull trout of the Swan River Valley consist of one core population (USDI 2014b). Bull trout spawn in 12 tributary streams distributed along the length of the Swan River Valley. The juvenile fish rear in the tributaries for 2 or 3 years and then migrate to Swan Lake to mature. Until recently bull trout had maintained a strong, stable population in the Swan River Valley (Montana Bull Trout Scientific Group 1996a). A limited recreational fishery in Swan Lake was permitted until 2012. However, redd count monitoring in the 12 tributary streams has observed a downward trend. This decline is uniform in all tributaries. Thus, the apparent cause is the new establishment of non-native lake trout in Swan Lake. It is unlikely the cause is habitat loss in any stream since all spawning tributaries are trending equally. Suppression of lake trout began in 2009. From 2011 to 2016 (most recent data available) bull trout redds counts have stabilized, suggesting the project has prevented further bull trout losses.

Cutthroat trout were once very widespread and occupied almost every tributary. The population may have consisted of multiple resident populations in tributaries plus, perhaps, some migratory fluvial fish that reared in the Swan River. They were not present in high-elevation mountain lakes. In recent years, the distribution of cutthroat trout in tributaries has sharply declined. This is likely due to a combination of impacts from non-native rainbow trout, non-native brook trout, habitat loss, and recreational harvest. Since 2011 the Swan Native Fish Committee (a collaborative group) has inventoried and monitored tributaries with "conservation populations" of cutthroat trout. The collaborative regularly updates their understanding of cutthroat trout distribution and their most recent report indicates that there are 22 remnant populations of sufficient size and genetic purity to have conservation value (Swan Native Fish Committee 2014). These were largely in headwater streams, and they represent approximately 20 percent of the historic range (USDA Forest Service et al. 2010). Meanwhile high mountain lakes, which were previously fishless, have been periodically stocked with cutthroat trout, so the total distribution of cutthroat trout has shifted from low elevations to high elevations.

On October 4, 2016 the U.S. Fish and Wildlife Service announced the meltwater lednian stonefly (*Lednia tumana*) was proposed as a threatened species under the Endangered Species Act. This stonefly is found at outlets to certain glaciers and has not been documented anywhere in the Swan River Valley. Because this species is absent in all analysis areas, it is not reviewed further.

ENVIRONMENTAL CONSEQUENCES

GLACIER CREEK ANALYSIS AREA

ALTERNATIVE A – NO ACTION ALTERNATIVE DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

This alternative has no activity and, thus, no direct or indirect effect. Past, current, and reasonably foreseeable actions on all lands within the analysis area were evaluated when considering the cumulative effects to Fisheries associated with the No Action Alternative. These activities are discussed in the Existing Condition Section and provide the baseline Fisheries conditions. Given that, the following discussion will focus on the current and reasonably foreseeable activities on all lands, in combination with the effects of the No Action Alternative on NFS lands. See the Cumulative Effects Worksheet (Project File Exhibit N-11) for additional cumulative effects information.

SEDIMENTATION

Past activities that could have contributed to fine sediment deposition include road construction and old timber harvest, especially those that harvested next to a stream. This analysis area has approximately 100.1 miles of roads across all public and private lands. The total road density is 1.80 miles per square mile. The cumulative amount of sedimentation from initial road construction was probably substantial.

Most of the road construction and harvest in this analysis area was done decades before the oldest quantifiable habitat survey. Therefore, it is uncertain how this changed fish habitat from historical condition. The roads and historic timber harvest are now part of the baseline condition. It is unknown if whether the streams still hold sediments from this legacy impact or if they have long since transported it downstream and returned to historical conditions.

It is noteworthy that many of the stream reaches have been trending towards coarser substrate (less fine sediment) since 2004. The most probable cause of this change is due to the 2003 Crazy Horse Wildfire. Wildfires are well known to trigger very large amounts of erosion for a few years as streams adjust to barren hillsides, increased runoff, and unstable stream banks. Since the Crazy Horse Fire burned 31 percent of the Glacier Creek Watershed, it is logical to assume the streams reacted to the fire. But as vegetation returned and the stream banks stabilized, the amount of erosion sharply declines to background levels. This seems to explain why, since 2004, many stream reaches appear to have less fine sediments.

In more recent years, vegetation management and post-fire salvage contributed only a small amount of sedimentation to the Glacier Creek watershed. Recent projects have not needed additional roads and have deferred vegetation management in riparian areas, thereby minimizing sedimentation from upland areas reaching streams. The EA for the 2004 Crazy Horse post-fire salvage of timber (along with associated road BMPs, culvert upgrades, etc.) concluded that project would only contribute only a small, unmeasurable amount of sedimentation (Project File Section AA). Likewise the EA for the 2008 Hemlock Elk Project determined the project would contribute a small amount of sedimentation during culvert replacements associated with the project, but not the actual vegetation management itself (Project File Section AA). Between 2010 and 2014, the Nature Conservancy implemented three projects on Legacy Lands known as Fredswood, Mac-n-Cheese and Pickpocket Harvests. These projects consisted of approximately 409 acres of overstory removal and 8 acres of commercial

thinning. Because the project needed no roads and deferred any work in riparian areas, they likely had negligible impact, if any, to sedimentation in Glacier Creek.

The only other recent past event was the construction of the fish barrier on Red Butte Creek. This activity could have contributed a small amount of sediment during project implementation, but not substantial enough to be measured.

The only on-going cumulative effect of sedimentation is the continued existence of the forest road network in Glacier Creek. Yet a 2010-2011 Glacier Creek inventory found relatively little chronic erosion taking place. This survey reviewed 75 road/stream intersections (all ownerships) in the Glacier Creek Watershed. Surveyors used the Water Erosion Prediction Protocol (WEPP) (Elliot et al. 1999) that calculated how much annual tonnage could travel from the road prism to a stream with average weather conditions. As is typical across the landscape, most locations had virtually no erosion, and just a few locations contributed the majority of sediment. The greatest sediment point source found was a section of Road #561F located in Kraft Creek's floodplain that recently washed out (photograph in Hydrology Section). This location contributes about 375 pounds annually. The total annual erosion from all existing roads is 3,518 pounds (1.7 tons). The District Hydrologist estimates Glacier Creek naturally transports about 510 tons of sediment annually (See Hydrology Section). Therefore, a road network that contributes 1.7 tons is viewed as a minor effect that is far below detection in fish habitat. It appears that the 2004 post-salvage BMP work has been effective. A map showing the WEPP Survey Results is available in Project File Exhibit N-7.

The other present and reasonably foreseeable events in this analysis area include noxious weed spraying, special use permits, and the Glacier Meadows Subdivision development. None of these activities would contribute sediment to fish habitat. There is one known culvert, which could be a future sediment source. This culvert is located where an abandoned, unmapped road crosses an intermittent channel (Temporary Road #12A on the Proposed Action). The culvert was poorly installed in early 1980s, and the stream almost breached the road in the prolonged 2011 runoff. It is likely the culvert would wash out within the analysis timeframe, releasing about 1 cubic yard of sediment. This is roughly equal to all chronic erosion on the other 100.1 miles of road in the watershed. Shortly downstream of the culvert is a wetland that would capture and store all the sediment. The potential failure of the culvert is undesirable, but it would not actually impact fish habitat. All in all, Alternative A would mean that the streams of Glacier Creek Analysis Area would continue to have very little fine sediment deposition.

FISH HABITAT COMPLEXITY

Fish habitat complexity can be negatively impacted by actions that compact the soil, interfere with groundwater movement, and more quickly route precipitation to streams. Several studies have found the cumulative effect of private land development such as houses and paved driveways can degrade fish habitat complexity (Stanfield et al. 2006; Wang et al. 1997). The studies vary by protocols and geographic area, but generally a threshold of concern is when 5 to 10 percent of landscape is impermeable. Aerial photographs suggest that impermeable development is only 0.01 percent of Glacier Creek Watershed and thus has not had a cumulative effect.

Forest roads can also interfere groundwater movement even they are more permeable than paved roads. A single road by itself has minor effects, but cumulatively, they can alter downstream fish habitat complexity. The roads collect runoff in ditches and transport them quickly into streams, consequently subjecting the stream to elevated peak flows. This in turn can move woody debris and bedload, weakened stream banks and de-stabilize pools. Over time, the pools become shallower. As stated before, approximately 100.1 miles of roads exist in the Glacier Creek Analysis Area.

Despite the network of forest roads, available data suggests essentially no change in residual depth of pools in all but one reach. The lack of change means that, at least since 1999 (the earliest data available), the Glacier Creek Watershed has accommodated the existing road network. It may or may not be within historic range. Regardless, the stream has stabilized and fish habitat complexity is not trending downward. Even the 2003 Crazy Horse Wildfire has not resulted in unstable, reduced pool habitat.

There are no present or reasonably foreseeable activities that would impact fish habitat complexity. The proposed Glacier Meadows Subdivision is far too small in scale to affect permeability. There are no new roads proposed or road decommissioning proposed. Fish habitat complexity is anticipated to remain unchanged in the No Action Alternative.

FISH MIGRATION BARRIERS

Previously, **there were several** forest roads with barriers to fish migration but most have been remedied, and there is only one known **culvert** barrier left. The culvert on NFS Road #9590 is blocking approximately 0.25 miles of upper Windfall Creek. The 2008 Hemlock Elk Decision Notice authorized the removal or replacement of this culvert to provide fish passage. This action is reasonably foreseeable although funding is not secure. Providing fish passage to brook trout has not been a high priority for traditional agency funding. **There is also an intentional barrier on Red Butte Creek that is a free-standing cement structure. This barrier is considered desirable for the conservation of cutthroat trout in Red Butte Creek.** There are no other present or reasonably foreseeable activities that would impact fish migration barriers.

NATIVE FISH POPULATION

Past actions of stocking brook trout, rainbow trout, and Yellowstone cutthroat trout in this watershed have had a profound impact to native westslope cutthroat trout. These fish were initially stocked in the 1930s to 1940s to enhance recreational fishing. They are no longer stocked but are now wild, self-sustaining populations. Golden trout are still routinely stocked by MDFW&P to provide a recreational fishery. As a result of these past and current actions, the Glacier Creek cutthroat trout population is hybridized. These fish have little conservation value. There are no present or reasonably foreseeable activities to recover the cutthroat trout in Glacier Creek. It is reasonable to assume that the population would continue to backcross (e.g., all progeny of hybrids are hybrids), and the proportion of pure individuals would continue to decline. There would be little chance of pure westslope cutthroat trout from the Swan River migrating into Glacier Creek, re-founding the population, and pushing out the hybrids. The headwater lakes would probably remain at status quo and MDFW&P would continue to stock them with various *Oncorhynchus* species. The average angler would probably continue to harvest *Oncorhynchus* in the lakes and be unaware of the change in Glacier Creek's fish population.

The prognosis for the Kraft Creek population is also poor. There are no present or reasonably foreseeable actions that would address the nonnative species. It is certain that hybridization would continue to spread upstream throughout the entire watershed. Hybridization typically occurs in a lineal pattern with the lower part of the stream (nearest the source of rainbow trout) becoming hybridized first (Bennett et al. 2009; Vasemägi et al. 2010). Monitoring results in Middle and Upper Kraft Creek confirm the pattern. The hybrids captured in Middle Kraft are beyond first-generation. In other words, relatively few rainbow trout are spawning in Kraft Creek, but their hybrid progeny continue to backcross and blend rainbow trout alleles with cutthroat trout alleles. Due to the complexity of mating selection, fecundity (the ability to reproduce), and other factors, it is not possible to say just exactly how fast the hybrid swarm would invade Upper Kraft or Hemlock Creek. The question is not "if" but "when."

Curiously, recent evidence suggests that hybrid *Oncorhynchus* trout have reduced "fitness" than pure westslope cutthroat trout. While the first generation hybrid does well, the subsequent backcrosses produce fewer offspring (Muhlfeld et al. 2009). This could mean that over time Kraft Creek would have fewer *Oncorhynchus* individuals altogether. The long-term evolutionary fate of a hybridized *Oncorhynchus* population is uncertain (Muhlfeld et al. 2009). The fish could fail to survive a future catastrophic event (fire, flood, etc.) that westslope cutthroat trout previously tolerated (G. Luikart, University of Montana Conservation Geneticist, personal communication, 12/2012).

Non-native brook trout would also continue to negatively impact Kraft Creek cutthroat trout. Brook trout have been present in low numbers in the Kraft Creek Analysis Area since at least 1983 (the oldest survey on file). But the more recent surveys have noticed a shift in species composition in Middle Kraft, Upper Kraft, and Hemlock Creek. Brook trout are now equally abundant with cutthroat trout..

The increase in brook trout number suggests the species is now successfully colonizing Kraft Creek. Brook trout tend to colonize better in warmer streams (Dunham et al. 2002). The Kraft Creek Watershed had a significant wildfire in 2004, burning much of the riparian vegetation and allowing solar radiation to warm the stream. This could be the factor that has triggered the change. But, this is not certain since monitoring conducted in the Bitterroot Drainage after 2003 wildfires did not see a species shift (Sestrich 2005). Given this uncertainty, it is reasonable to conclude brook trout will continue to **invade** Middle Kraft, Upper Kraft, and Hemlock, but **the actual timeframe until they dominate is unknown**.

Thus, the Kraft Creek population has three threats: continued spread of hybridization, reduced fitness due to hybridization, and continued dominance by brook trout. Given the rapid decline observed just since 2004, it is the professional opinion of the District Fisheries Biologist that cutthroat trout in Kraft Creek will decline so rapidly they will no longer be viable at the end of the analysis timeframe.

Conversely the prognosis for the Red Butte Creek population is brighter. The free-standing cement barrier will block any invasion of brook trout or hybrid trout. The isolated cutthroat trout population above the barrier is considered large enough to be viable and this genetically pure population should remain unchanged in the analysis timeframe.

The future of bull trout in the Glacier Creek Analysis Area is uncertain. The dynamics of *Oncorhynchus* and brook trout matter little to bull trout since they prey equally well on both species. But the recent introduction and population expansion of non-native lake trout in Swan Lake is a complication. The bull trout in Lower Kraft Creek could dwindle in the next few years. Bull trout have declined in all spawning streams in the Swan River Valley since 2007, presumably due to predation and competition with lake trout. Kraft Creek would be no different. Kraft Creek seems to provide rearing habitat for juvenile bull trout; and if bull trout numbers decline, they would decline in Kraft Creek, too. At the time of this writing, it is reasonably foreseeable that government agencies would continue to suppress lake trout, and eventually bull trout numbers would stabilize. It is uncertain if bull trout would recover fully to previous levels but they certainly should increase beyond current condition. Meanwhile, the bull trout of Upper Glacier Creek should persist at steady numbers. If the bull trout are truly resident fish, they do not migrate to Swan Lake and would be unaffected by conditions in that lake.

The other native species in the Glacier Creek Watershed would be unaffected by any past, present or reasonably foreseeable activities. Mountain whitefish, suckers and slimy sculpins would persist due to unchanged habitat conditions and are unaffected by dynamics of nonnative brook trout, rainbow trout or lake trout. Tailed frogs would also persist due to unchanged habitat.

HERRICK RUN ANALYSIS AREA

ALTERNATIVE A – NO ACTION ALTERNATIVE DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

The headwaters of Herrick Run were roaded and harvested by PCTC in the 1980s. Similar to Glacier and Kraft Creek, this activity undoubtedly generated some sedimentation to the stream, but it is unknown if the impacts are still felt or if long since flushed downstream. No trend data is available.

The existing condition of Herrick Run roads are likely contributing a small amount of chronic erosion. The primary access road, NFS Road #79, was previously causing chronic erosion, but work was completed in 2009 to greatly reduce the problem. The existing condition of forest road network (including lands previously owned by PCTC) has not been fully inventoried, but the District Fisheries Biologist examined about a third of the roads to date. Most have very little active erosion. One fairly substantial point source of sediment is at the culvert between Bunyan and Meadow Lakes (NFS Road #9552). Another challenging road is NFS Road #79W on Legacy Land. This road is immediately

adjacent to Herrick Run for about 0.1 mile. It is not actively eroding now, but there is nothing to prevent the stream from washing out the road at some time in the future. If this happens, it could erode many tons and would likely have a measurable impact on fish habitat downstream. There is no way to predict if and when such an event would happen. National Forest System Roads #9573 and #9575, which are in the extreme headwaters of Herrick Run, were built long ago to low standards and have many ruts and rills. These roads are eroding, but it is assumed that little or no erosion is delivered to Herrick Run because of the distance the roads are from mapped stream channels.

There are no reasonably foreseeable actions in this analysis area. Based upon past experience, erosion point sources on open roads (such as NFS Road #9552) do not heal and usually would get worse over time **without repair**. Therefore, considering the continuation of a small point source and the possibility of a substantial road wash out, it appears that Herrick Run's sedimentation could increase over time.

FISH HABITAT COMPLEXITY

The only potential impact to fish habitat complexity in this analysis area has been an indirect impact from forest roads. Past road construction has resulted in 3.51 miles of road per square mile (primarily a legacy of PCTC past ownership). The cumulative effect of this action could have been increased peak flows, which in turn could have simplified fish habitat. Lacking any trend data, it is uncertain how much Herrick Run was actually impacted by past road construction. There are no present or reasonably foreseeable actions that would alter the density of roads in this watershed. Therefore, fish habitat complexity would likely remain at status quo.

FISH MIGRATION BARRIERS

Past road construction had created two fish barriers, one on Herrick Run itself at NFS Road #79 and the other on NFS Road #9552 on the stream between Meadow and Bunyan Lakes. The culvert on NFS Road #79 was replaced with a fish-friendly culvert in 2009, and now provides full access to spawning habitat upstream. The culvert between Meadow Lake and Bunyan Lake remains in place and blocks 0.2 miles. Under Alternative A, there are no reasonably foreseeable plans to replace or remove the culvert. Over time the outlet drop would continue to get taller and taller, and the culvert would eventually become a complete barrier to all upstream fish passage. The exact moment when this would happen is unknown, but it could happen within the analysis timeframe. This would block a majority of the spawning habitat for fish in Bunyan Lake. The consequences of this are uncertain. Loss of spawning habitat would certainly reduce reproductive success from wild-spawning fish, but the lake is periodically stocked by MDFW&P.

NATIVE FISH POPULATION

Herrick Run contains one of the **22** cutthroat trout "conservation populations" in the Swan River Valley. It is naturally isolated and protected from non-native species. However, this population is very small and only has a limited amount of spawning and rearing habitat available. The isolation in a small area makes Herrick Run cutthroat trout vulnerable to fires, floods or other natural disturbances that normally do not threaten a population. The small population size also has resulted in reduced allelic heterozygosity and the population is experiencing genetic depression ("inbreeding"). **From 2013-2014, small numbers of cutthroat trout from a genetically pure population in the South Fork Flathead River were introduced into Herrick Run to combat inbreeding. This is intended to improve genetic fitness and viability of the Herrick Run population but the efficacy of this project is yet unknown at the time of writing.** Another threat is that fish habitat may slightly deteriorate due to cumulative effects of sedimentation from Legacy Land roads and the culvert barrier on NFS Road #9552. These indirect effects would not by themselves have much harm to a healthy population, but Herrick Run is especially vulnerable. Therefore the combination of a small population **that is vulnerable** to disturbance events, plus a limited amount of habitat that is further reduced by past land management, means the Herrick Run population **may or may not** persist to the end of the analysis timeframe. **The long term future of this small "conservation population" is indeed uncertain.**

LINDBERGH LAKE ANALYSIS AREA

ALTERNATIVE A – NO ACTION ALTERNATIVE DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

The past management activity in this analysis area includes private land development along the southeastern part of the lake that has been underway for decades. There have been various small fires and management activities in the watershed. One event was a 1953 wildfire along the west shore that then prompted PCTC to build roads and salvage timber. The other was in 1989 when PCTC built an extensive road network and harvested their lands in the nested Herrick Run Watershed. A wildfire in 2008 also resulted in a small amount of sedimentation into the lake, far below detectable levels. A few of the 1950's era roads built by PCTC (NFS Roads #10731, #10732 and #10733) had their culverts removed in 2009 to avoid potential washouts. This action probably generated only a small amount of disturbance and had no measurable sedimentation to Lindbergh Lake. **There have been no other recent timber harvests by the Forest Service, PCTC or The Nature Conservancy.** Concern about past timber harvest and private land development led to two independent studies on Lindbergh Lake's water quality, described below.

The lake's water clarity, total phosphorus, nitrate nitrogen and dissolved oxygen levels were studied from 1989 to 1993 to monitor response from the 1989 harvest in Herrick Run. These measures were selected as indirect methods to evaluate if there was substantial sedimentation entering the lake. The report found no change in nitrogen, a slight loss of water clarity in 1990, a slight increase of total phosphorus in 1991, and a slight decrease of dissolved oxygen in 1992. No statistical analysis was presented, and all returned to baseline conditions by 1993. The author concluded Lindbergh Lake has "exceptionally good water quality" and has "largely recovered" from the timber harvest (Knudson 1994). Additional lake sampling was conducted in 1996-1997 by separate authors. These authors did not use the same techniques as earlier, but they found roughly similar results and concluded Lindbergh Lake was oligotrophic (Ellis et al. 1998). Oligotrophic lakes tend to have excellent water quality. Therefore, based on these findings, it appears that sedimentation **has not cumulatively resulted in an adverse impact to fish habitat.**

There are two reasonably foreseeable project in this analysis area. First, the Beaver Creek Landscape Restoration Project proposes a prescribed burn in the headwaters and 141 acres of commercial or pre-commercial thinning uphill from the lake. As described in the Beaver Creek EA, this project has the potential to generate some sediment to the inlet river, depending on size of the runoff the first spring after the fire. Modeling averaging from a variety of runoff situations computed the net amount of sediment is likely to be too small to detect. No effect is anticipated from the vegetation management. Therefore, fish habitat in both Lindbergh Lake and the inlet river are anticipated to remain high quality and fully capable of supporting native fish, including bull trout (Project File Section AA).

The second project is a restoration project for a 3 acre wetland located near Lindbergh Lake campground. This project would eliminate a ditch and restore the natural, meandering, intermittent stream channel in the wetland. This action would not generate any sediment to Lindbergh Lake.

FISH HABITAT COMPLEXITY

Other than the lake itself, all fish habitat is within the Mission Mountains Wilderness. There are no past, present, or reasonably foreseeable activities that could change fish habitat complexity.

FISH MIGRATION BARRIERS

There are no known human-caused migration barriers and no reasonably foreseeable activities that would create one.

NATIVE FISH POPULATION

As described earlier, past stocking of rainbow trout, hybrid *Oncorhynchus* species, and brook trout has greatly reduced the historic range of cutthroat trout in this analysis area. However a population still persists in the 4.6 miles of Swan River between the Gray Wolf Lake and Crystal Lake outlet. This fish are 99.8 percent pure and they are considered one of the 22 “conservation populations” in the Swan River Valley. The long-term future of this population is uncertain. There is nothing to prevent rainbow trout and hybrid *Oncorhynchus* from colonizing the area, just as they have done in many other streams in the Swan River Valley. And yet, for some reason, the non-native fish have not been successful to date in the Upper Swan River. There are no present or reasonably foreseeable activities to halt or reverse the spread of non-native species in the Lindbergh Lake Area. Therefore, it is uncertain if the “conservation population” will persist unaided or if they will succumb to invasion by non-native fish.

Bull trout in Lindbergh Lake have a poor prognosis. Although there are no past, present, or future impacts to bull trout spawning habitat, the recent invasion of non-native lake trout in Lindbergh Lake is of great concern. Lake trout have a clear track record of devastating native bull trout. The only thing that might complicate the lake trout invasion is the absence of *Mysis* shrimp in Lindbergh Lake (a non-native shrimp that has greatly benefitted lake trout production in other lakes). Biologists are uncertain if lake trout have yet successfully spawned and reared in Lindbergh Lake, or if they are just emigrants from Swan Lake. Thus, once again, the speed at which lake trout would dominate bull trout is uncertain. There are no present or reasonably foreseeable activities to suppress or eradicate lake trout in Lindbergh Lake.

SWAN RIVER VALLEY ANALYSIS AREA

ALTERNATIVE A – NO ACTION ALTERNATIVE DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

As described earlier, there has been concern that the cumulative effect of past road construction and timber harvest could have increased sedimentation into the Swan River. This, in turn, could have increased the sedimentation rate into Swan Lake; and since nutrients are tied to sediments, it could have accelerated primary productivity in the lake. Increased primary productivity could be the cause of low dissolved oxygen levels at the bottom of the lake (Montana Department of Water Quality 2004). Due to scarcity of historical data, DEQ is not confident of how much departure this is from normal, but recommended that land managers reduce erosion. To achieve water quality restoration, DEQ recommended that chronic erosion from roads be reduced by 40 percent, plus future timber harvest should leave adequate streamside vegetation.

Since the 2004 Report, a collaboration of land managers has sought to reduce erosion from roads by applying BMPs. Best Management Practices involve various strategies, such as installing rolling dips, clearing ditches, and replacing undersized culverts. Land managers have focused their work especially in the Cold, Beaver, Lower Glacier, and Herrick Run Drainages and anywhere timber harvest or timber salvage took place. In 2011, the collaboration sought to evaluate if this work had been effective at the Swan River Watershed scale. The top 70 most erosive sites identified in the 2004 Report were monitored using the same technique as before. The results indicated a reduction of erosion from 539 tons per year to 184 tons per year (66 percent decrease). It appears that recent BMP efforts have met DEQ’s objective to restore Swan Lake water quality (Project File Exhibit N-7).

Historic timber harvest activity often included streamside harvest, and this contributed sedimentation. The 1989 Streamside Management Zone Law (SMZ) established by the Montana legislature prohibited clearcut practices by the streamside (although it does still allow some selective harvest). Generally, the Forest Service has left even larger buffers beside streams due to the 1996 Inland

Native Fish Strategy (some projects had slight variances). On Federal, state, and private lands, the amount of erosion into streambeds has undoubtedly lessened since the 1980s.

Recently completed timber harvest projects have included Sixmile, Hemlock Elk, Summit Salvage and multiple projects by The Nature Conservancy and all of these have retained riparian buffers and reduced road erosion. The reasonably foreseeable vegetation management projects of Beaver Creek and Cold Jim, (Flathead National Forest) and Cilly Cliffs (Swan River State Forest) all incorporate riparian buffers and adhere to SMZ law and also further reduce road erosion. The Chilly James project consists of road BMP, road decommissioning and other actions designed to reduce chronic or potential erosion into Cold and Jim Creeks. Meanwhile, monitoring on Swan Lake has found no upward or downward change in water quality since the initial 2004 Report. Thus it is concluded that the cumulative effects of past, present, and reasonably foreseeable projects appear to have diminishing impact to sedimentation in fish habitat.

FISH HABITAT COMPLEXITY

As described earlier, there is no evidence that past land management has reduced fish habitat complexity at the scale of the Swan River Watershed. Therefore, it is reasonable to assume that any present and future land management of similar nature (timber harvest, forest roads) would have no impact. The greatest threat to a widespread loss of fish habitat complexity would be if forested lands were converted to impermeable landscapes of buildings, parking lots, and paved roads. Even though some development has taken place and more is reasonably foreseeable, it is far below the threshold of concern when 5 to 10 percent of the landscape is impermeable.

FISH MIGRATION BARRIERS

Past road construction and private land water diversions have created many complete or partial barriers to fish migration. By 2002, data indicated that human-caused barriers blocked about 12 percent of all available habitat. From 2002 to the present, the Forest Service had corrected 22 undesirable barriers using a variety of funding sources. A total of 16 barriers remain, some on NFS lands and others on private lands, and these block about 6 percent of fish habitat. Several barriers are beneficial to conserving native fish. It is reasonably foreseeable that one of the remaining barriers would be replaced, namely the culvert on NFS Road #9590 on Windfall Creek. There are no plans to replace the other barriers at this time. Alternative A - No Action would mean that about 6 percent of fish habitat would remain blocked. .

NATIVE FISH POPULATION

Historic introductions of nonnative rainbow trout, golden trout, Yellowstone cutthroat trout, and brook trout have greatly impacted cutthroat trout, and currently they only occupy 20 percent of their former range in the Swan River Valley. There are 22 populations remaining that are considered large enough and genetically pure enough for conservation value. It is reasonably foreseeable that one population, the "Sunset Creek" population would have a new barrier constructed in order to block invasive brook trout. This action is evaluated in the Beaver Creek Landscape Restoration Project and determined beneficial (Project File Section AA). There are no other reasonably foreseeable actions beyond that. . As described earlier, it is likely that the Kraft Creek population would disappear in the analysis timeframe, and possibly the Herrick Run and Upper Swan River populations as well. Other "conservation populations" outside of the Glacier Loon Project Area may also decrease. Some populations are too small in numbers and/or partially invaded by nonnative fish, and these are likely to lose further ground. The District Fisheries Biologist speculates that roughly half of the "conservation populations" would be lost within the analysis timeframe.

Bull trout numbers have recently declined, primarily due to nonnative lake trout establishment in Swan Lake. Lake trout suppression began in 2009 and has been very successful to date (Project File Exhibit N-6). It is reasonably foreseeable that lake trout suppression would continue, although the exact plan is not known at the time of this writing. Even with lake trout suppression, bull trout are likely to decline in abundance for another 4 to 5 years. This is because lake trout interactions from 2006 to 2009 (prior to suppression), and the long period before juvenile bull trout mortality can be detected by missing redds. But during the rest of the analysis timeframe, the District Fisheries

Biologist does anticipate bull trout numbers would stabilize and recover to some degree.

GLACIER CREEK ANALYSIS AREA

ALTERNATIVE B – THE PROPOSED ACTION

DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

Alternative B has several aspects to the project which could generate a small amount of sedimentation in the Glacier Creek Analysis Area. This alternative includes 6.4 miles of temporary road construction within this analysis area. Most of these temporary roads would be located on upland terrain and would not be located near any water bodies, so they would not be able to generate erosion. Only one temporary road would have any impact to sedimentation. Temporary Road #12A (access to Units 60, 62, and 214) is located on a template of an old historic road built in the early 1980s. The culvert across the intermittent stream is still in place, although it is poorly aligned and would eventually wash out. In Alternative B, the culvert would be used, and then removed afterwards, since the road is only a temporary road. Design Criteria (Table 2- 16) of only removing the culvert during the dry period would minimize channel disturbance. The project would create a small amount of sediment, which would transport downstream to a wetland. No sediment would reach any fish habitat.

Alternative B also includes implementation of 14.0 miles of BMPs on haul routes. This is approximately 24 percent of the total road network in Glacier Creek and 14 percent of the total chronic erosion found in the 2010-2011 road inventories with WEPP protocols. Although, as described earlier, the road network is largely in good condition, haul routes would have additional BMP work done on them as needed. Activities include tasks, such as clearing overgrown ditches, replacing rusted ditch relief pipes, and re-shaping worn down rolling drain dips. These actions would mobilize soil, and some erosion towards streams would be possible if precipitation occurs before the road compacts again. Given the widely dispersed work and the small amount of work needed, it is concluded that the amount of sedimentation would be small and not measurable. Ultimately, BMPs on haul routes would reduce chronic erosion. A recent study at nearby Elk Creek and Beaver Creek found BMPs installed in 2009-2010 reduced erosion by 60 percent on average (Atkins 2012). The reduction would have been much more impressive except for one particular location failed to show much improvement and skewed the average. Still, 60 percent average reduction is valuable information and means that Alternative B would curtail about 298 pounds of erosion.

This alternative would decommission four roads in the analysis area that total 1.0 miles. The decommissioning of one particular road, NFS Road #561F, would generate a small amount of erosion. Decommissioning this road would involve removing a culvert on an intermittent stream and reshaping the scoured portion. A small amount of sediment would be mobilized the following spring before vegetation is re-established. Ultimately, the decommissioning of the road would greatly reduce chronic erosion. This location had the single largest point source of erosion (375 pounds) found in the 2010-2011 road inventories. Decommissioning this one road would have greater benefit than 14 miles of proposed BMP work. The decommissioning of the other roads (NFS Roads #10247, #561G, #11648A) are not near streams and have no potential for the activity to cause sedimentation to fish habitat.

All other aspects of Alternative B are benign and would not generate any sedimentation to fish habitat. (Castro et al. 1995) summarize that logging roads, not the harvest itself, are primarily responsible for sediment entering streams. The unharvested riparian buffers are the essential Design Criteria. Within the Glacier Creek Analysis Area, no harvest activity would take place within 300 feet of fish-bearing streams, 150 feet of perennial streams, 50 feet of intermittent streams, 50 to 150 feet of wetlands (varies by wetland size). **Occupied and unoccupied howellia ponds (see threatened and endangered plants section) would require a 300 foot buffer.** These buffers were designed from

studies in the erodible soils of the Pacific Northwest (USDA 1995c). Considering the relatively less erodibility of Swan Valley geology (Sugden et al. 2007), they should be sufficient to trap any overland sediments before they reach a stream channel. Monitoring of post-fire salvage in the 2004 Crazy Horse Project confirmed that debris and roughness on the ground sufficiently captured erosion from harvest units before it reached a stream (Gardner 2004). Some harvest units would be restricted to winter activity only but this has no consequence to sedimentation into fish habitat. One public comment identified a sensitive tributary to Glacier Creek and the District Fisheries Biologist examined this and confirmed that a 50-foot no-harvest buffer would adequately protect the channel. The single Resource Enhancement (Resource Enhancement #1 shown on Map 2-1) in this analysis area would involve restoration of a small ephemeral stream near Unit 200. Planting shrubs would be laudable for restoring the stream, but it only flows into a wetland devoid of fish, thus it has no direct benefit to fisheries.

In consideration of past, present, and reasonably foreseeable activities (described in Alternative A), it is concluded that this alternative would not substantially contribute to any cumulative effect to the Glacier Creek Analysis Area. There is no evidence of any sedimentation concern in the watershed now or in the reasonably foreseeable future.

FISH HABITAT COMPLEXITY

Habitat complexity can be altered if a watershed experiences a change in its flow regime. A watershed that suddenly loses its vegetation canopy or has an excessive road network would respond by increased peak flows, which in turn simplify habitat. As reviewed in the Hydrology Section, the total amount of harvest in the Glacier Creek Analysis Area would not reach a threshold of concern. The total amount of road would temporarily increase from 1.80 to 1.93 miles per square mile due to construction of temporary roads. Following harvest, the temporary roads would be removed. A total of 1.0 miles of existing roads would be decommissioned, as well. This means the road density would ultimately decrease to 1.78 miles per square mile. The net impact of harvest, temporary roads, and road decommissioning would be too small in scale to effect fish habitat complexity.

As disclosed in Alternative A – No Action, there are no known impacts to fish habitat complexity in light of past, present, and reasonably foreseeable activities. This alternative does not contribute any cumulative effect to fish habitat complexity.

FISH MIGRATION BARRIERS

This alternative does not add or remove any fish migration barriers in the Glacier Creek Analysis Area. As disclosed in Alternative A – No Action, the only known **culvert** barrier is at NFS Road #9590 at Windfall Creek. It is reasonably foreseeable this barrier would be removed within the analysis timeframe. **The intentional, free-standing barrier on Red Butte Creek would remain.**

NATIVE FISH POPULATION

Alternative B would have essentially the same impact to native fish as Alternative A - No Action. The only anticipated impact from this alternative is a very small amount of sedimentation from road BMP work and decommissioning of NFS Road #561F. Ultimately these actions would reduce the small amount of on-going sediment that comes from the existing road network. But even the short-term sediment and long-term restoration have very minor effects and would not result in measurable change to fish habitat. All other aspects of the alternative, including temporary road construction, timber harvest, other road decommissioning and resource enhancements would have no impact to fish habitat.

Ultimately the real impact to native fish is the consequences of non-native species. Just like the Alternative A – No Action, the prognosis for **some cutthroat trout populations** in the Glacier Creek Analysis Area is poor. Non-native brook trout **and hybrid *Oncorhynchus*** would further dominate Middle Kraft, Upper Kraft and Hemlock Creek. Within the analysis timeframe, it is likely that the Kraft Creek “conservation population” would be lost. Likewise, there are no restoration plans for Upper Glacier Creek. **However the valuable population at Red Butte Creek is expected to remain viable.** This alternative does not impact the cutthroat trout in any way. It does not speed up or slow down the

devastating role of non-native species.

Bull trout are also strongly impacted by non-native species. As described earlier, the primary impact to bull trout in the Glacier Creek Analysis Area has been from non-native lake trout downstream in Swan Lake. It is reasonably foreseeable that bull trout numbers would recover a bit in the future. This alternative has no impact to bull trout habitat and does not add or substrate to cumulative effects.

HERRICK RUN ANALYSIS AREA

ALTERNATIVE B – THE PROPOSED ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

Alternative B has a few activities that would result in minor, short-term sedimentation to the Herrick Run Analysis Area. The replacement of the culvert on NFS Road #9552 above Bunyan Lake would generate a small amount of sediment during project implementation. Although the stream has mostly cobble substrate in the area, finer materials currently lie underneath the culvert. As the old culvert is removed, they would be mobilized and likely transport to Bunyan Lake. Two Design Criteria are proposed to minimize disturbance (Table 2- 16). First, the channel would be de-watered during construction. Second, either two straw bales or commercial netting called “Sedimat” would be installed downstream of the diversion to trap most of the sediments. These would later be removed and, thereby, minimize the impact (Foltz et al. 2007). The total amount of sedimentation would be too small to detect and would have no measurable impact to biota in the lake. All sediment would settle in the lake; none would reach Lindbergh Lake. Sedimentation would cease as soon as the new culvert is embedded in the stream channel. In the long term, replacing the culvert on NFS Road #9552 would reduce the chronic erosion that is currently taking place. Additional BMP work is also expected on the rest of NFS Road #9552 and Road #79 but this would not likely have measurable effects to Herrick Run since the roads are largely in good shape at this time.

There is no potential sedimentation from timber harvest of Units 92 and 94 since RHCA buffers would adequately trap any overland erosion. Likewise, there would be no potential sedimentation from the construction of Temporary Road #22C, since it is not near a stream channel.

Therefore, this alternative does help reduce some of cumulative effect of past road construction in the Herrick Run Analysis Area. Chronic sedimentation from the culvert on NFS Road #9552 would cease. However this alternative would not alter NFS Road #79W, which is not a chronic sediment source at this time but a potential source in the future.

FISH HABITAT COMPLEXITY

Alternative B - Proposed Action does not add or remove any roads in the Herrick Run Analysis Area. There are no temporary roads proposed in this analysis area. Because the road density would remain the same, fish habitat complexity would remain at status quo.

FISH MIGRATION BARRIER

Alternative B - Proposed Action removes the only remaining barrier to fish migration (Resource Enhancement #2). The replacement of the culvert on NFS Road #9552 between Bunyan and Meadow Lake would allow full access to cutthroat trout to move upstream. This should improve cutthroat trout spawning success, but it would be uncertain how meaningful this is because MDFW&P periodically stocks the lakes. At any rate, providing fish passage would cause no harm since cutthroat trout are the only species present.

NATIVE FISH POPULATION

Alternative B - Proposed Action would have a minor beneficial impact to cutthroat trout in the Herrick

Run Analysis Area. This small population is faced with vulnerability to disturbance and limited habitat capability. The replacement of the culvert on NFS Road #9552 may help improve spawning success for fish in Bunyan Lake and it would curtail the on-going point source of sedimentation at this location. These actions should slightly improve the fish habitat capability. The recent introduction of genetically pure fish from a different population also presumably improved their genetic fitness. Thus the combination of Alternative B – Proposed Action and the recent genetic rescue, should help bolster the viability of the cutthroat trout population. Although there is no certainty that these actions are sufficient to ensure viability, the prognosis for the small Herrick Run population is better than the No Action Alternative.

LINDBERGH LAKE ANALYSIS AREA

ALTERNATIVE B –PROPOSED ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

The Proposed Action would generate a short-term, moderate amount of sedimentation into Lindbergh Lake. The largest source of sedimentation would be from construction of Temporary Road #22B (access to Units 84 and 85) and, to a lesser extent, Road #15C (access to Units 67 and 69). These roads would cross two intermittent streams that flow directly to Lindbergh Lake. Since no template exists in the area now, creating new stream crossings would disturb the stream bed and adjacent ground. The culvert could remain in the stream for a few years (depending on contractor's harvest schedule); it would then be removed and the area reclaimed. Both installation and removal of the culverts would mobilize fine sediments. To minimize impacts, Design Criteria (Table 2- 16) would require dry channel conditions during in-channel work, but some sedimentation would be inevitable the following spring when water scours the streams again. Temporary Road #22B crosses a high-gradient stream that flows directly into Lindbergh Lake; and thus, all sedimentation from this stream crossing would transport to the lake. Temporary Road #15C flows into a small wetland first, and some (or all) of the sedimentation would deposit in the wetland with less reaching the lake.

A second sedimentation source is the use of NFS Road #10732, which provide access to Units 82-87. This road was built in 1952 at lesser standards than modern forest roads. Due to chronic erosion problems, water bars were installed and culverts removed a few years ago. The road was not decommissioned, but rather "put into storage." Alternative B would re-utilize the road, and by doing so, re-install two culverts across the high-gradient, intermittent stream that flows directly to Lindbergh Lake. The amount of sedimentation produced would be less than a temporary road, because the road approach to the stream already exists, but there would still be sedimentation after a culvert installation. The work would be done during a dry period; but the next spring, the channel would have to adjust to a new culvert and some in-channel erosion would be anticipated.

There are no other potential sedimentation sources from this alternative. The work on NFS Road #9552 in the "nested" Herrick Run Analysis Area would not be detectable past Bunyan Lake and cannot reach Lindbergh Lake. The other proposed temporary roads are upland and would not cross stream channels. The use of the other "stored" roads (NFS Road #10731, Road #10733, and Road #10734) would have no impact, since they do not cross stream channels. Furthermore, just as with the Glacier Creek Analysis Area, the Design Criteria of RHCA buffers are sufficient to trap sediments from harvest activity. Several public commenters wondered if the buffer by Lindbergh Lake should be increased, but if the goal is to prevent sediment, this would not be necessary. A 150-foot buffer by the lake would preclude any sediment from harvest activity from reaching the lake.

It would be reasonable to conclude that the consequences of all these actions would be pretty similar to the 1989 PCTC activity in the "nested" Herrick Run Watershed. Both activities had roughly similar total acreage (600 acres in 1989 versus 516 acres in this proposal). The 1989 project had two stream crossing, and this proposal has four. On the other hand, the 1989 project harvested riparian areas;

this proposal does not. As described earlier, sedimentation into the lake from 1989 harvest was not measured directly, but indirect measurements (total phosphorus, etc.) were tracked for several years. Monitoring efforts noted a small spike in each attribute for one year; following that, conditions returned to baseline. The overall water quality in Lindbergh Lake remained excellent.

The cumulative effect of this project, along with the reasonably foreseeable Beaver Creek Landscape Restoration Project and the 3 acre wetland restoration project, would mean a small amount of sediment could reach Lindbergh Lake but it would not impair water quality. This project could have a temporary change in sediment and the Beaver Creek project could temporarily increase sediment (in the worst-case scenario), while the wetland project contributes nothing. But even when Alternative B and the Beaver Creek Project are combined, the net sediment contribution is within natural variations and does not harm water quality. The scale of these contributions is far below what is periodically experienced after wildfires or floods. Lindbergh Lake would remain oligotrophic in character and fish habitat would be unchanged.

FISH HABITAT COMPLEXITY

Alternative B would not have activity near riverine fish habitat in the Lindbergh Lake Analysis Area. Habitat complexity is not a factor in a lake. Fish habitat complexity would remain unaffected by this alternative and all other cumulative effects.

FISH MIGRATION BARRIER

There are no migration barriers in this analysis area, and Alternative B would not change that situation.

NATIVE FISH POPULATION

As described earlier, the long-term prognosis for native cutthroat trout is uncertain and the prognosis for bull trout is poor. Cutthroat trout still persist between Lindbergh Lake and Gray Wolf Lake, but there is nothing to prevent invasive species from colonizing this area. Bull trout are still present in Lindbergh Lake, but there is nothing to prevent nonnative lake trout from decimating bull trout numbers. Alternative B would not change fish habitat and would not change the role of invasive species. Alternative B would not add to cumulative effects that hinder native fish populations.

SWAN RIVER VALLEY ANALYSIS AREA

ALTERNATIVE B – THE PROPOSED ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

There are several aspects of Alternative B that could result in a small amount of sedimentation into the Swan River. Temporary Road #36C (access to Unit 23) would cross an intermittent channel that flows directly into the Swan River. This stream has fragile stream banks about 2-feet high, and erosion would be inevitable during installation and subsequent removal when the road is reclaimed. Temporary Road #24A (access to Unit 14) also would cross an intermittent channel, but the streambanks are only a few inches high and would have less erosive potential. Design Criteria to install and remove culverts when the streams are naturally dry would help minimize erosion (Table 2-16). Neither of these streams is fish-bearing. The amount of sedimentation that would settle downstream would be too small to detect.

Another aspect of Alternative B that could generate sedimentation is the implementation of BMPs on NFS Road #10567. This road is partially grown in, but would be cleared for access and haul for Units 41, 42, and various pre-commercial thinning units. The road has two undersized culverts that cross a small, perennial stream that flows directly into the Swan River, and an unstable road cut near the stream. Best Management Practices work would clear the trees; re-slope the road cut and replace the



Photo 2. This photo illustrates where temporary roads would cross streams. Shows stream crossing location of NFS Road #24A, which accesses Unit 14. Blue hardhat is about 1 foot high and included for scale. (6/2011)



Photo 3. This photo illustrates where temporary roads would cross streams. Shows stream crossing location for NFS Road #36C that accesses Unit 23. Blue hardhat is about 1 foot high and included for scale. (6/2011)

culverts. All of these actions would generate sediment for a short time. The low gradient, meandering stream would slowly transport sediment to the Swan River, but the total amount would be too small to detect. Over the long term, this action should prevent sedimentation from the road. The unstable road cut and small culverts are not currently eroding into the stream, but they could become substantial sediment sources if high water washes out the culverts. Alternative B also includes BMP work on other roads, but no impact would be anticipated. Most of the other roads are widely scattered and in good condition.

There are no other potential sedimentation sources from Alternative B. Five roads totaling 2.1 miles are proposed for decommissioning, but none need ground disturbance near stream channels; the culverts are already removed. Likewise, the other temporary roads in this analysis area would have no impact to sedimentation in fish habitat. Temporary Road #36C crosses another channel to reach Unit 20, and this would create sedimentation; however, it would settle in a wetland with no fish habitat. All other temporary roads are located in upland areas.

The commercial and pre-commercial vegetation management proposed would not create sedimentation. Most of them have no activity within RHCA buffers and, thus, avoid sedimentation to streams or wetlands. A few harvest units have some activity within the RHCA buffer, because historic roads travel through the buffer. These units (19, 24, 57, 61, 64, and 205) are located near wetlands. The District Fisheries Biologist examined these units and verified that there is no potential for erosion from the harvest activity to reach any of the wetlands. Some harvest units in this analysis area have design criteria for winter harvest only but this has no consequence to sedimentation in fish habitat.

In consideration of all past, present, and reasonably foreseeable activities, Alternative B would add only a small amount of sedimentation to the Swan River Valley and would not trigger a long-term, substantial harm. This includes all activities of the project, even the “nested” Glacier, Herrick Run and Lindbergh Watersheds. As described earlier, there are many past, present, and reasonably foreseeable actions that have contributed or reduced sedimentation to streams. Available monitoring data suggests a stable or possibly decreasing trend of sedimentation in Swan Lake and Swan River. This is believed to be attributable to road BMPs and improved logging practices (leaving streamside buffers). Alternative B would add short-term impacts, primarily from temporary roads crossing

streams, decommissioning NFS Road #561F, applying BMPs and replacing culverts. In the long term, Alternative B would reduce chronic sedimentation. These actions would not be measurable within the Swan River and do not reverse the overall trend.

FISH HABITAT COMPLEXITY

Alternative B would not have detectable effects to fish habitat complexity. A total of 2.1 miles of roads would be decommissioned in the Swan River Analysis Area (plus another 2.1 miles within the “nested” analysis areas). This would be a very small change to the landscape. There is no evidence that past, present, or reasonably foreseeable actions have impacted fish habitat complexity and Alternative B would not result in any measurable change.

FISH MIGRATION BARRIERS

As described earlier, there are 16 known fish migration barriers in the Swan River Valley, which includes the one at NFS Road #9552 near Bunyan Lake. Alternative B would remove the barrier near Bunyan Lake. This may or may not make a difference to the cutthroat trout of Bunyan Lake but it certainly does no harm. Meanwhile it is reasonably foreseeable that a new barrier would be installed on “Sunset Creek” as part of the Beaver Creek Landscape Restoration Project (to block invasive fish) and also a culvert on Windfall Creek would be removed. The cumulative effect of Alternative B would be that the Swan River Valley would eliminate two barriers and build one, thus have a net of 15 barriers. The total amount of fish habitat blocked would be (about 6 percent of available fish habitat).

NATIVE FISH POPULATION

Cumulatively, Alternative B has a slight benefit to the Herrick Run “conservation population” and gives it a better chance to persist throughout the analysis timeframe. Alternative B has no impact to the Red Butte, Kraft Creek “or Upper Swan River “conservation populations.” The Kraft Creek Population is likely to disappear due to cumulative effects of non-native species. The Upper Swan River Population is also vulnerable and it is uncertain how long the population may persist. Red Butte population is secure and viable. Alternative B does not help or hinder the viability of Red Butte, Kraft or Upper Swan River Populations.

The alternative has no impact whatsoever to bull trout. No impact to bull trout or their habitat is anticipated in Lindbergh Lake, Swan River, Glacier Creek or Kraft Creek.

GLACIER CREEK ANALYSIS AREA

ALTERNATIVES C AND D

DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

Alternatives C and D have almost identical impacts to the Glacier Creek Analysis Area. These alternatives would contribute only a very small amount of sediment to Glacier Creek. Alternative C would build approximately 5.3 miles of temporary roads and Alternative D would build 4.0 miles. Both alternatives have only one temporary road that could generate sediment. Temporary Road #12A crosses a small channel between two wetlands to access units 60, 62 and 214 in Alternative C. The road is a historic road with a culvert already in place and thus there would be no sedimentation to the channel by using the road. After harvest is complete, the culvert would be removed and channel restored since the road would be reclaimed. Alternative D does not need the temporary road but Design Criteria (Table 2- 16) for this alternative would require removal of the culvert anyway. This is considered more advantageous than ignoring the old road and letting the culvert wash out at some point in the future. Removing the culvert in both Alternatives C and D would create a small amount of sediment which would transport to a wetland about a hundred yards downstream. This wetland has no fish habitat.

The alternatives vary slightly in the total length of haul routes with BMPs but the impact to fish habitat is almost the same. Alternative C would install 13.7 miles of BMPs within the Glacier Creek Watershed while Alternative D would install 12.4 miles (thus 12-14 percent of the total road network). As described earlier, installing BMPs would temporarily generate a small amount of sediment as ditches are cleared and road surfaces re-shaped. Ultimately, the BMPs would reduce the relatively small amount of erosion taking place currently. The only difference between the two alternatives is that Alternative C would include BMP work at NFS Road #561 at Glacier Creek while Alternative D does not. This site erodes about 125 pounds of sediment annually (about 4 percent of all road erosion into Glacier Creek). This amount is far below detectable levels in the stream and provides no evidence for differentiation between the alternatives and the amount of chronic erosion that is taking place now.

Alternatives C and D propose the same road decommissioning as Alternative B – Proposed Action. Decommissioning NFS Road #561F would create some sedimentation during project implementation but ultimately halt erosion on the single largest known sediment point-source in Glacier Loon Analysis Area. Decommissioning the other roads in this analysis area would have no impact to sedimentation.

Alternatives C and D vary in the number and types of vegetation treatments but none of the proposed harvest units have any potential to generate sediment. The alternatives would retain un-harvested RHCA buffers beside streams which would prevent any overland erosion from reaching the streams.

In consideration of past, present, and reasonably foreseeable activities, it is concluded that neither Alternative C nor D would really have any impact to sedimentation in the Glacier Creek Analysis Area. The road network is currently contributing only a very small amount of sediment and these alternatives would only increase it slightly in the short term and then decrease it in the long term. Sedimentation into Glacier Creek would remain below detectable levels.

FISH HABITAT COMPLEXITY

Similar to the Proposed Action, Alternatives C and D would not alter fish habitat complexity. As reviewed in the Hydrologist's Report, the total amount of harvest activity is too small to alter flow regimes. The alternatives include construction of temporary roads and thus Alternative C would temporarily increase the total road density from 1.80 to 1.89 miles per square mile while Alternative D would temporarily increase it from 1.80 to 1.88 miles per square mile. Following harvest, the temporary roads would be removed and an additional 1.1 miles of NFS roads would be decommissioned. This would leave the net road density of 1.78 miles of road per square mile, the same as the Proposed Action. Since there is no evidence that the current road density is impacting fish habitat complexity, it is concluded that adding or subtracting less than 0.1 miles per square mile would also make no difference. These alternatives would not add to cumulative effects in the Glacier Creek Analysis Area.

FISH MIGRATION BARRIERS

Alternatives C and D would not create any new fish migration barriers in the Glacier Creek Watershed. **The intentional and desirable fish barrier on Red Butte Creek would remain unchanged. The culvert on Windfall Creek, which is blocking about 0.19 miles (300 meters) of brook trout spawning habitat, is reasonably foreseeable to be removed.**

NATIVE FISH POPULATION

Alternatives C and D would have essentially the same impact to native fish as Alternative A - No Action. The alternatives generate small amounts of sedimentation that would have no impact to habitat complexity or fish migration. Therefore the cumulative effect of non-native species would remain the primary impact to native fish populations. The Kraft Creek cutthroat trout "conservation population" would no longer be viable due to the spread of *Oncorhynchus* hybridization and domination by brook trout. The cutthroat trout in Glacier Creek would also be hybridized. **Red Butte Creek would remain free of non-native fish.** Brook trout would be the most numerous species in most of the analysis area. Bull trout may persist in low numbers in Upper Glacier Creek where they appear to be resident (non-migratory) fish and are isolated from lake trout. Lower Kraft Creek, which hosts

foraging habitat for migratory bull trout, would have fewer bull trout for a while because of the lake trout's negative impacts. It is reasonably foreseeable that lake trout suppression would eventually result in some recovery of bull trout numbers.

HERRICK RUN ANALYSIS AREA

ALTERNATIVES C AND D

DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

Just like the Proposed Action, Alternatives C and D would equally create some short-term sedimentation and then long-term reduction of sediment due to road-related activities. In the short-term, the replacement of the fish barrier on NFS Road #9552 would disturb the channel and cause a small amount of erosion into the stream between Meadow Lake and Bunyan Lake. Design Criteria described in Alternative B would apply for these alternatives as well and would minimize the erosion but some is inevitable. A minor amount of BMP work on Forest Roads #79 and #9552 may also result in very minor sedimentation. In the long-term, addressing the chronic erosion at the fish barrier on Road #9552 (Resource Enhancement #2) would reduce sedimentation to fish habitat.

The alternatives also include total obliteration and re-contouring of 0.9 miles of Forest Road #9575 in the headwaters of Herrick Run. Additionally, 0.4 miles of Road #9573 would have water bars constructed to halt the rills and gullies but the road prism would not be re-contoured. These actions are not anticipated to create or remediate any erosion in Herrick Run. The roads are too far from any channel to deliver sediment to fish habitat. Therefore, Alternatives C and D would ultimately slightly reduce the cumulative effect of sedimentation from the road network due to the replacement of the culvert on Road #9552. The alternatives do not address other cumulative effects caused by roads on former PCTC lands.

FISH HABITAT COMPLEXITY

Alternatives C and D include total obliteration and full re-contour of 0.9 miles of Forest Road #9575. This action would immediately halt any compaction and disturbance of groundwater movement from this old road in the headwaters of Herrick Run. The alternative also would decommission 0.4 miles of Forest Road #9573. This road would have water bars to halt the gullies in the road but the template would remain in place. Forest Road #9573 would have less of impact of hillslope water movement but it may take decades for full recovery of vegetation on the road at 5600' elevation, well beyond the analysis timeframe. Therefore the net impact of these actions are assume to be 100 percent effective in restoring natural hillslope and groundwater movement on Forest Road #9575 and perhaps 50 percent effective on Forest Road #9573. This equates to a reduction of about 1.1 miles of roads in the Herrick Run Watershed in the analysis timeframe. Alternatives C and D would reduce road density from 3.51 to 3.27 miles per square mile. Reducing the road network by about 7 percent is laudable but it is probably not be substantial enough to have any measurable impact on fish habitat. There is insufficient data to be certain that Herrick Run has been impaired in its present state. Therefore, the conclusion is that Alternatives C and D would not meaningfully add or substrate to the cumulative effect on fish habitat complexity in Herrick Run.

FISH MIGRATION BARRIER

Alternatives C and D would replace the culvert on NFS Road #9552 to provide improved fish passage, just like Alternative B - Proposed Action. Cutthroat trout from Bunyan Lake would be able to access another 0.2 miles of spawning habitat, although it is uncertain if this would be meaningful to the population.

NATIVE FISH POPULATION

Alternatives C and D would have minor, beneficial impacts to the cutthroat trout in Herrick Run Analysis Area. These alternatives would reduce chronic erosion, provide fish passage for 0.2 miles and slightly reduce the road density. There are no negative consequences from these alternatives. The impacts are all positive but may not have a measurable difference to fish habitat. At best, the alternatives could slightly help improve the habitat capacity for this tiny population. **Meanwhile the recent introduction of genetically pure fish has presumably helped improved genetic fitness and reduced inbreeding. All of these actions cumulatively help this small "conservation population", although it remains still vulnerable to landscape disturbance. While there is uncertainty if the population is truly viable and could persist indefinitely, the cumulative effects of Alternative C and D do improve the odds.**

LINDBERGH LAKE ANALYSIS AREA

ALTERNATIVES C AND D DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

These alternatives would deliver a very small amount of sedimentation into Lindbergh Lake; a lessor amount than Alternative B – Proposed Action. The only source of this impact is from decommissioning of Forest Roads #10732, #10733, and #10734. Road #10732 has three streams that would need to be crossed during implementation. None of these have culverts anymore and heavy equipment would need to cross them a few times during the re-contouring the rest of the road template. Each crossing has stable stream channels and the road fill correctly matches the natural hillslope but the stream banks have only grasses and forbs at this time. Moving an excavator or other equipment down the banks would trigger a small amount of erosion. Design Criteria (Table 2- 16) to minimize sedimentation would be implemented when the channels are dry or at low flow and to reshape the stream banks after equipment is finished crossing. The disturbed area would erode slightly the following spring during snowmelt and then cease. The net amount of erosion would be too small to detect. There is no long-term reduction or benefit from this project since Forest Road #10732 is not presently delivering sediment to fish habitat. Re-contouring NFS Roads #10733 and #10734



Photo 4. One of the stream crossings on NFS Road #10732 that will need to be crossed during road decommissioning.

also have slight potential to contribute sediment to streams. The roads do not cross the streams but they terminate near them. The same Design Criteria used for NFS Road #10732 would be utilized for these two roads and should keep the amount of sediment reaching stream channels to a minimum.

Decommissioning #10730 would involve constructing water bars to halt the gullies on the road but this road is also far from stream channels and would not impact fish habitat.

Likewise decommissioning of NFS Roads #10731 and #79B would have no impact since the roads are already naturally grown in and need no active restoration.

No other activities from Alternatives C and D would generate any sedimentation to fish habitat. The

alternatives have temporary roads proposed that total between 1.0 to 1.5 miles (varies by alternative) but none cross any stream channels and would not generate sediment. The alternatives include some timber harvest activity but do not have harvest within RHCA buffers and thus the buffers would trap any overland surface erosion caused by logging equipment.

Thus the net impact of implementing either Alternative C or D includes the potential for a small amount of short-term sedimentation from decommissioning Forest Roads #10732, #10733, and #10734 as well as activities in the “nested” Herrick Run Analysis Area described earlier. Best Management Practices would be implemented on haul routes to reduce the potential for soil erosion.

In consideration of reasonably foreseeable Beaver Creek Landscape Restoration Project and the 3 acre wetland restoration project, implementing either Alternative C or D would add to a temporary cumulative amount of sediment to Lindbergh Lake but it is too small to affect water quality. Even if these projects were implemented simultaneously, the scale of the sediment contribution is less than what periodically occurs with fires or floods. Lindbergh Lake would remain oligotrophic and fish habitat would remain in good condition

FISH HABITAT COMPLEXITY

Alternatives C and D would decommission 4.1 miles of road in the analysis area (plus another 1.3 miles in the “nested” Herrick Run analysis area). A total of 3.9 miles of roads in the Lindbergh Lake and Herrick Run Analysis Areas would be completely removed from the landscape and the old road prism would disappear. The remaining roads are already vegetated and would naturally disappear anyway within the analysis timeframe, except for Road #9573 in the “nested” Herrick Run Area. Therefore the net road density in the Lindbergh Lake Analysis Area would drop from 1.25 to 1.13 miles per square mile. Normally, minimizing a road network to such low levels would benefit fish habitat complexity in streams since it allows natural hillslope and groundwater movement across the landscape. Fish habitat complexity in streams is sensitive to landscape groundwater movement but not lakes. Therefore, reducing the road density actually has no impact to this analysis area. Fish habitat in Lindbergh Lake is not impacted by any cumulative effect of forest road network. Fish habitat in the inlet river to Lindbergh Lake is already entirely roadless.

FISH MIGRATION BARRIERS

There are no migration barriers in the Lindbergh Lake Analysis Area and Alternatives C and D would not change this situation.

NATIVE FISH POPULATION

Alternatives C and D would have the same impact to native fish populations as Alternative A - No Action. The alternatives would generate only a very small, un-measurable amount of sedimentation into Lindbergh Lake for a short period. Fish habitat in the lake would remain high quality. Therefore, the cutthroat trout “conservation population” between Lindbergh Lake and Gray Wolf Lake, would be completely unaffected by these alternatives. The cumulative effects of non-native species in Lindbergh Lake would remain a threat to the long term persistence of the population, regardless of implementation of either Alternative C or D. Likewise, bull trout would be unaffected by these alternatives. Their designated critical habitat would remain in good condition but the population is very vulnerable to impacts from the growing non-native lake trout population in Lindbergh Lake.

SWAN RIVER VALLEY ANALYSIS AREA

ALTERNATIVES C AND D DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

SEDIMENTATION

Alternatives C and D do vary on where sedimentation would occur but the net impact on this large

analysis area are the same.

Alternative C defers construction of any temporary roads that need new stream crossings. Therefore since Temporary Roads #36C and a portion of Temporary Road #24A are deferred, the two unnamed tributaries to Swan River would not experience any sedimentation. However, Alternative C does include BMP work on the haul route of Forest Road #10567. As described earlier, this road has an unstable road cut and two undersized culverts that would need to be addressed by BMPs. During project implementation, a small amount of sediment would be transported to the Swan River, although it would be too small for normal detection. In the long run, this activity would reduce potential erosion that would have taken place if the culverts washed out.

Alternative D proposes to construct Temporary Roads #36C and #24A just like Alternative B. These new stream crossings would generate a small amount of sedimentation during culvert installation and again during culvert removal. Meanwhile, Alternative D does not include any commercial harvest units on Forest Road #10567 and, therefore, it would not be improved to BMP standards. Thus Alternative D does not include any short-term sedimentation associated with replacing culverts and stabilizing a road slump. While this avoids any short-term sedimentation, there is a risk that the old culverts would wash out in the future. It is impossible to forecast just when this would happen; and given the low gradient characteristic of the stream, it may or may not happen within the 25 year analysis timeframe.

All other BMP work for both alternatives are widely scattered and have minor effects. All other temporary roads would be in upland areas and would have no impact. Both alternatives propose to decommission five roads totaling 2.1 miles. The roads are largely grown-in and the culverts were removed long ago, thus no ground disturbance is needed. The vegetation management proposed in both alternatives would have no-harvest buffers near water bodies and, thus, would have no impact.

This analysis area also includes the “nested” Glacier Creek, Herrick Run and Lindbergh Lake analysis area. In consideration of the sum of all activities in the nested analysis areas, Alternative C would create some sedimentation primarily from BMPs on Road #10567, decommissioning Road #561F and #10732, replacing the fish barrier near Bunyan Lake and removing a culvert on Temporary Road #12A. Alternative D is the same except it includes some sedimentation from two temporary roads and not BMPs on Road #10567. For both Alternatives C and D, all of these activities combined would create only a minor amount of sediment to fish habitat in the Swan River Valley and it would not be detectable. As described earlier, there are many past, present, and reasonably foreseeable actions that add and remove sedimentation, the available data suggests either a stable or decreasing trend of sedimentation in Swan Lake and the Swan River. Alternative C or D would not reverse the trend and cause new, elevated levels of sedimentation in the Swan River Valley.

FISH HABITAT COMPLEXITY

Alternatives C and D would have small benefits to fish habitat complexity. The alternatives would decommission five roads in the Swan River Analysis Area that total 2.1 miles. The roads are largely grown-in and the culverts on stream channels were removed long ago. The alternative also decommissions other roads in the “nested” analysis areas for a total of 8.4 miles of roads that would be removed. This would be a very small change to the Swan Valley landscape as a whole. The alternatives do not result in any meaningful restoration of past land management that created a network of forest roads. However there is no evidence that large-scale restoration is needed anyway. As described earlier, while some individual watersheds may have been impaired, monitoring data compiled across the Swan River landscape indicates that fish habitat complexity has not been degraded by cumulative effects of land management.

FISH MIGRATION BARRIERS

As described earlier, there are 16 known fish migration barriers in the Swan River Valley, including the one at NFS Road #79 near Bunyan Lake. Alternatives C and D would remove the barrier near Bunyan Lake. It is also reasonably foreseeable that the barrier on Forest Road #9590 at Windfall Creek would be removed in the future but also a new one constructed at “Sunset Creek” in order to block invasive fish. Thus, the cumulative effects of Alternatives C and D would reduce the number of migration barriers in the Swan River Valley to 15 total. Five of those barriers would be beneficial to

cutthroat trout, three are uncertain impacts, and the rest are undesirable. The net amount of fish habitat blocked would be relatively unchanged from the existing condition at about 6 percent of available habitat.

NATIVE FISH POPULATION

Although Alternatives C and D would have slightly less sedimentation and slightly more road decommissioning than Alternative B, they are only minor benefits to cutthroat trout. The alternatives do not address the primary threats to cutthroat trout. Non-native brook trout and *Oncorhynchus* hybrid fish would continue to expand and the Kraft Creek “conservation population” would eventually disappear. The long-term prognosis for the “conservation population” in Upper Swan River is uncertain due to potential invasion from non-native species. **The only benefit to cutthroat trout is from improved habitat conditions for the Herrick Run “conservation population”. This would improve the likelihood of persistence for this small population, although there is no certainty of long-term viability.**

Bull trout would not be impacted by either Alternative C or D. The alternatives do not alter any critical habitat in the Lindbergh Lake Analysis Area and have minor effects to bull trout habitat in Glacier Creek Analysis Area. The cumulative effect to bull trout will primarily be driven by non-native species found in Swan Lake and Lindbergh Lake. Lake trout suppression in Swan Lake is expected to help recover bull trout numbers in the Swan River Valley but there are no reasonably foreseeable proposals to address lake trout in Lindbergh Lake.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternative C and D would change 221 acres from MA 15 and 15C to MA 5. All of the change would be located near Lindbergh Lake, in an area of high visual quality. The impact of this change to the Fisheries Resources would be minor. There is no fish habitat immediately within the 221 acres (this portion of Herrick Run is fishless due to very high gradient). The standard RHCA buffer of 150 feet from Lindbergh Lake would apply no matter which MA is in effect, so routine timber management practices would not result in erosion into the lake. However, there would be a minor benefit, since it would be unlikely that any new roads would be constructed in MA 5. Roads are permissible if they are in harmony with visual objectives; but since this would be unlikely in such steep countryside, it is reasonable to assume that no roads would be built. Deferring any new roads in the area would avoid any stream crossings and potential sedimentation to Lindbergh Lake. This would be beneficial, but the effects it would have on such a large lake would be minor in scale.

REGULATORY FRAMEWORK AND CONSISTENCY

All action alternatives comply with direction and goals set forth in the Forest Plan, including Amendment #3 and the Inland Native Fish Strategy Amendment. The Forest Plan prohibits “unacceptable fish losses” from land management actions, and this is not anticipated with Alternatives B, C or D.

In 1990, the Forest adopted Amendment #3, which added more trout stream standards. The amendment required various protections for certain bull trout streams, none of which are in the Glacier Loon Project Area. The amendment has several requirements for cutthroat trout streams, which are applicable to this project. The amendment prescribes a certain amount of riparian tree retention and shading, and these are achieved in that no activity would take place within RHCA buffers beside the cutthroat trout streams. The amendment requires sediment sources be identified and controlled. As described in the Existing Condition Section of this EA, essentially no sediment sources were found in the analysis areas, so the requirement is met. The amendment also seeks “opportunities for recovery of westslope cutthroat trout populations in streams having non-native trout.” The Glacier Loon Project did initially propose a barrier on Kraft Creek to block non-native species and allow recovery for Kraft Creek’s conservation population. However this idea was not fully

developed due to deteriorating genetic condition of the cutthroat trout (i.e., “too late to save them”) and also potential conflicts with other Forest Plan standards. Failure to consider the barrier does not mean the project does not comply with Amendment #3; it just means the opportunity was not ripe.

In 1995, the Forest Service adopted the Inland Native Fish Strategy with the goal of recovering native fish populations. Activities must not retard the goal. Any activity within a RHCA in non-priority watersheds (such as most of the project area) needs to be analyzed by a site-specific analysis. The action alternatives have no activity within RHCAs except for 4.3 to 6.4 acres scattered among six units (varies by alternative). These six units have small “slivers” of designated RHCAs located uphill of existing roads. Harvest activity in these “slivers” does not retard the goal of Inland Native Fish Strategy. A site-specific analysis is available in Project File Exhibit N-8. The Lindbergh Lake Watershed is a priority watershed but no activities were proposed in those RHCAs.

Bull trout are listed as a “threatened” species under the ESA. A Biological Assessment (BA) is required for significant federal actions that may impact bull trout. **The District Fisheries biologist determined that the Glacier Loon Project “may affect, but not likely adversely affect” bull trout and critical bull trout habitat since the small amount of sediment associated with the action alternatives would be too small to actually impair bull trout use of Lindbergh Lake or the migratory critical habitat. The BA and concurrence by the USFWS is found in Project File Section AA.**

The Meltwater Lednian stonefly is “proposed” as a threatened species under ESA. This species is found at the outlet of a few mountaintop glaciers but has not been found in the project area. A Biological Assessment determined this project has “no effect” to the stonefly (Project File Exhibit AA-5).

The Regional Forester has identified two aquatic species that are “sensitive species” and requires a Biological Evaluation (BE) for each action alternative. The two species are westslope cutthroat trout and the western pearlshell mussel. Alternatives B, C, and D all have very minor short-term sedimentation and also minor long-term benefits to fish habitat. The alternatives do not address the primary threat to cutthroat trout (non-native species and isolation) and thus cannot be considered “beneficial.” Neither are the alternatives expected to harm the cutthroat trout. Therefore the alternatives were all determined **“may impact individuals or habitat, but will not likely result in a trend towards federal listing or reduced viability for the population or species”** for cutthroat trout. Pearlshell mussels have not been found in the project area. Alternatives B, C, and D were considered to have **“no impact”**. The BE is located in the Project File (Exhibit N-3).

WILDLIFE

CHANGES FROM THE 2012 EA

The threatened, endangered, proposed wildlife species section was updated to include the analysis of effects to wolverine (during the 2012 EA, wolverine was analyzed as a sensitive species). Effects to Canada lynx critical habitat were also separated from the Canada lynx analysis to ensure that the determination for lynx critical habitat did not rely on Northern Rockies Lynx Management Direction. The grizzly bear section was updated to reflect the recent court decision that the Amendment 19 numerical objectives apply to the Glacier Loon and Buck Holland Grizzly bear subunits. All analyses were updated to include consideration of the cumulative effects of the foreseeable Beaver Creek project as appropriate for each resource. Additionally, after the Glacier Loon EA was published in August 2012 and the wildlife biological assessment (BA) was signed by the Glacier Loon project biologist on September 4, 2012, the Forest Service received harvest plans from The Nature Conservancy (TNC) for the Two Bears project (203 acres of over-story removal and 111 acres of commercial thinning) and the Last Gasp project (209 acres of overstory removal) in October 2012 and December 2012, respectively. Two Bears was completed in February 2013 and Last Gasp was completed in March 2013. These two harvest areas are not located within the Glacier Loon project area (area where project activities are taking place), or within the grizzly bear subunits used to analyze cumulative effects or the wolverine analysis area, but are located within the lynx and critical lynx cumulative effects analysis areas. The cumulative effects section for both lynx and lynx critical habitat has been updated to include the effects of these two harvest projects.

INTRODUCTION

The Glacier Loon Project Area is located in a mountainous region of northwest Montana, in the Swan Valley, between the Mission Mountains Range on the west and the Swan Mountain Range to the east. The project area is directly adjacent to the Mission Mountains Wilderness, where natural ecosystem processes prevail. The Swan River runs along the eastern border of the Glacier Loon Project Area, Lindbergh Lake borders the area on the south and an abundance of wetlands can be found throughout. Wildlife species in the Glacier Loon Area have evolved in ecosystems influenced by fire, insects, and disease. The Glacier Loon Project contains activities that could affect wildlife use, including: timber harvest, pre-commercial thinning, road management, and slash disposal.

The Forest Plan lists as Management Indicator Species (MIS) all threatened and endangered species, sensitive species, and commonly hunted (big game) ungulates including elk, mule deer, and white-tailed deer. Life history information, including relevant habitat and population information on these species, can be found in the document, Flathead National Forest Evaluation and Compliance With National Forest Management Act Requirements to Provide For Viability and Diversity of Animal Communities (USDA 2015a), incorporated in this document by reference (Project File Exhibit Section AA). **Threatened, endangered, proposed wildlife species, and critical habitat for these species are designated by the USFWS. The listed and proposed to be listed species (as of 3/37/2017) that are found within the Glacier Loon project area and the Upper Swan Valley area are as follows:**

- Grizzly bear (*Ursus arctos*),
- Canada lynx (*Lynx Canadensis*),
- Canada lynx critical habitat
- Wolverine (*Gulo gulo luscus*)

Sensitive wildlife species are designated by the Regional Forester on a Forest-wide basis (FSM 2670.5) and are managed under the authority of the NFMA. Sensitive Species for the Flathead National Forest at the time of this analysis include the following:

- Bald eagle
- Bighorn sheep
- Black-backed woodpecker
- Common loon
- Fisher
- Flammulated owl
- Gray wolf
- Harlequin duck
- Northern bog lemming
- Northern leopard frog
- Peregrine falcon
- Townsend's big-eared bat
- Western (boreal) toad

Amendment 21 (USDA 1999b) to the Flathead Forest Plan recognized concerns over the ability of any individual species to represent the needs of all other old growth species and amended the MIS list regarding old growth associated species. Instead of a list of MIS old growth species, Amendment 21 added specific management direction for old growth and snag habitat and all associated species. Consequently, the wildlife analysis includes sections on effects to Old Growth Associated Species and effects to Snag and Down Woody Associated Species. Potential effects to northern goshawk are discussed in the section on effects to Old Growth Associated Species.

The wildlife analysis also includes project effects on relevant neo-tropical migrants. In 2008, a Memorandum of Understanding (MOU) was signed between the Forest Service and the USFWS to promote the conservation of migratory birds. Within 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.

THREATENED AND ENDANGERED WILDLIFE SPECIES

INTRODUCTION

The threatened, endangered, and proposed to be listed wildlife species, and critical habitat that may be found in the Glacier Loon Project Area, as well as throughout the Upper Swan Valley are listed below in Table 3- 63. Life history information on these species can be found in the Flathead National Forest Evaluation and Compliance with NFMA Requirements to Provide for Diversity of Animal Communities, amended August 2016 (USDA 2016).

TABLE 3- 63 THREATENED, ENDANGERED, AND PROPOSED SPECIES KNOWN OR SUSPECTED TO OCCUR WITHIN THE INFLUENCE AREA OF THE PROPOSED ACTION.		
SPECIES	STATUS	OCCURRENCE
Grizzly Bear (Ursus arctos)	Threatened	Resident
Canada Lynx (Lynx canadensis)	Threatened	Resident
Canada Lynx Critical Habitat	Critical Habitat	Resident
Wolverine (Gulo gulo luscus)	Proposed	Resident

GRIZZLY BEAR

INTRODUCTION

Grizzly bears have a large home range and use a wide variety of relatively undisturbed habitats that indicate relatively broad environmental limits (USDA 2016). The high level of topographic and vegetative diversity allows grizzly bears to effectively use different habitats, leads to their omnivorous or generalist feeding habit, and an adaptable ability to eat a wide variety of plant and animal foods. Various articles on grizzly bear food habits and habitat use in the NCDE indicate bears use a diverse array of habitats, consume a variety of foods which can vary substantially by location and season. Mixed-shrub fields, seeps, grasslands, timbered side-hill parks, and burns are used for feeding and resting. A seasonal elevation gradient is often used, including low elevation riparian areas, avalanche chutes, and meadows in spring and fall, and higher elevation habitats, such as subalpine forests, alpine tundra, and boulder fields in summer, early fall and winter.

Grizzly bears have been shown to have a negative relationship with human development and activity. Roads and their associated motorized traffic are known to lessen the effectiveness and use of adjacent habitat, and expose bears that do travel on or near them to elevated risks from human-caused mortality (Kasworm et al. 1990; Mace et al. 1997; McLellan et al. 1989). Within the South Fork of the Flathead, Mace and Waller (1997) showed substantive blocks of unroaded habitat as a component of adult female home ranges. Approximately 67.5 percent of composite home range for 8 female bears was greater than 0.3 miles (0.5 kilometer) from a road. The least amount of core area used in the South Fork Study was roughly 55 percent (USDA 1994a). In summary, vast areas of limited human access, moist, open-land habitats in combination with timbered areas are essential for optimum grizzly bear habitat.

ANALYSIS AREA

SPATIAL BOUNDS

The Glacier Loon Project is located in the Northern Continental Divide Grizzly Bear Ecosystem (NCDE). The NCDE has been divided into Bear Management Units (BMUs), Areas (BMAs), and Subunits. The BMU Subunits approximate the size of a female grizzly bear's home range. The Glacier Loon Project lies within several subunits (Map 3-4). Most of the proposed treatments are in the Glacier Loon Grizzly Bear Subunit. Nine proposed treatment units are on the east side of the Swan River and MT Highway 83, in the Buck Holland Grizzly Bear Subunit. These subunits were used to analyze direct, indirect, and cumulative effects to the grizzly bear. Conservation measures for the grizzly bear, including standards and guidelines, have been addressed at the subunit scale (e.g., Interagency Grizzly Bear Guidelines, Forest Plan Amendment 19, and the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA)).

TEMPORAL BOUNDS

The length of time for effects analysis is approximately 1-5 years. This is based on the probable contract length for the proposed project, the timeframes for related activities, and the reasonably foreseeable actions identified. **Effects from activities would last approximately 1-20 years. Temporal bounds for specific activities are discussed below.**

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included aerial photography, National Agricultural Imagery Program (NAIP) images, stand exams, Vector Map (VMAP) Data, research literature, and GIS and dataset information for features, such as general forest attributes, slope, aspect, habitat type, forest type, elevation, and mapped security core and road density information. In addition, site-specific information on habitat characteristics was collected from on-site visits of proposed treatment areas.

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology of grizzly bear, certain elements are thought to be essential to the conservation of the species. These elements include adequate amounts of denning and forage habitat, adequate hiding cover, and a level of security within their territory that provides for a low risk of displacement or mortality. These elements of grizzly bear habitat, and the anticipated effects to these elements from project implementation, are the measurement indicators used in this analysis.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

The historical distribution of grizzly bears ranged throughout much of Europe, Asia, and western North America, but is now found in extremely small numbers in most of these areas. In North America, grizzly bears inhabited a variety of habitats from the Great Plains to the mountains of western North America, from central Mexico to the Arctic Ocean. With the advent of Euro-American colonization in the early 19th Century, grizzly bear numbers were reduced from over 50,000 to less than 1,000 in North America south of the Canadian border (**USDA 2016**). In Montana, grizzly bears

were associated with large buffalo herds, but occurred in forested mountain areas, as well.

Historically, the grizzly bear would have moved freely throughout the Swan Valley in the absence of human development. With the Congress' passing of the Homestead Act in 1882, the way was paved for human development in the valley. In 1864, the Federal government granted land to the Great Northern Railroad for rail right-of-way development. The checkerboard ownership pattern that existed in the Swan Valley until just recently, was largely the result of this rail development and later land exchanges. In the early 1900s, people began to move into the Swan Valley in greater numbers and active forest management began. As human settlements, developments, and roads increased in grizzly bear habitat, grizzly bear populations became fragmented; fragmented population segments became smaller, more isolated, and consequently, more vulnerable. As human activity levels in the Swan Valley increased, mortality risk for the grizzly bear increased as well. Grizzly bears became a target in predator control programs in the 1930s, with predator control being partly responsible for extirpation in many states outside of Montana.

The grizzly bear was listed as a threatened species under the Endangered Species Act (ESA) in the lower 48 states in 1975. The Grizzly Bear Recovery Plan was completed in 1982 and revised in 1993. The 1993 Revised Recovery Plan delineated grizzly bear recovery zones and detailed recovery objectives and strategies.

EXISTING CONDITION

Grizzly bears, one of the largest terrestrial mammals in North America, have a large home range and use a wide variety of relatively undisturbed habitats. The grizzly bear occupies less than 2 percent of its former range south of Canada (USDI 1993). There are an estimated 1200 to 1500 grizzly bears distributed in Washington, Idaho, Montana, and Wyoming (USDA 2015a).

In Montana, grizzly bear mainly occupy high mountain wilderness areas and associated foothills in western and south central Montana. The two primary challenges in grizzly bear conservation are the reduction of human-caused mortality and the conservation of remaining habitat (USDI 1993). Recent human-caused mortality in Montana includes management control actions, defense of life, vehicle and train collisions, defense of property, mistaken identity by black bear or other big game hunters, poaching, and malicious killing.

The Revised 1993 Recovery Plan (USDI 1993) for grizzly bear delineated grizzly bear recovery zones in six mountainous ecosystems: The Glacier Loon Project lies within the Northern Continental Divide Grizzly Bear Ecosystem (NCDE). National Forest System lands encompass 63 percent of the NCDE recovery zone. At 40 percent of the NCDE, the Flathead National Forest is the majority Federal manager of lands within the NCDE recovery zone (USDA 2015)(USDA 2006b).

It appears that in the NCDE, grizzly bears are increasing their range and have a population beyond recovery plan levels (USDA 2002, 2015a). The Grizzly Bear Recovery Plan (USDI 1993) identifies a minimum NCDE-wide grizzly bear population of 391 (211 bears outside Glacier National Park and 180 bears inside Glacier National Park). Grizzly bear population monitoring using a DNA sampling technique was carried out in 1998 and 2000 in approximately the northern one-third of the NCDE. The sample area included the North Fork of the Flathead River and Glacier National Park. Adjusted for lack of study area closure, the average number of grizzly bears in 1998 was 241; in 2000 the average number of grizzly bears was also 241 (Kendall et al. 2008). Numbers not adjusted for geographic closure were 319 in 1998 and 336 in 2000.

Many cooperators, including the Flathead National Forest, were involved in the 2004 USGS Northern Continental Divide Grizzly Bear Project, which was designed to derive a population estimate for grizzly bears in the entire NCDE based on DNA sampling. On September 16, 2008, the population results of the 2004 study were released (USDI Geological Survey 2008). The NCDE grizzly bear population estimate was 765 animals, with the range estimated to be between 715 and 831 individuals. Current information suggests that the grizzly bear population in the NCDE, and on the Flathead National Forest, is expanding its range outside of the recovery zone (Kendall et al. 2008; [USDA 2016](#)). The USFWS has concluded that it is unlikely that the movement of grizzly bears from

inside to outside the recovery zone is driven by displacement from roads, human development, or activity alone (Kendall et al. 2009).

An ongoing NCDE-wide population trend monitoring conducted by the MFWP has estimated that the NCDE grizzly bear population increased at a rate of 2.3 percent per year between 2004 and 2010. Therefore, the total population size and the positive, increasing trend indicate that human-caused mortality in the ecosystem has been low enough (i.e., sustainable) to allow population growth (Mace et al. 2011; Costello et al. 2015). The population demographics indicate high survival for female bears (95 percent) within the ecosystem accredited in part to habitat security (Mace et al. 2012; Mace et al. 2013). The Flathead Forest represents 63% of the Northern Continental Divide Ecosystem. Both reproductive and survival rates in the NCDE are higher and the population growth rate is positive when compared to other grizzly bear populations further north in Alberta (Boulanger and Stenhouse 2014). Mace et al. (2011) attributed the high survival, reproduction and positive population growth in part to habitat security measures in the NCDE.

The Glacier Loon Project is located on lands that have been designated as Management Situation 1 (MS-1) for grizzly bears, which is identified as areas needed for the survival and recovery of the species (USDA 2001a). The entire Glacier Loon Project is located within the SVGBCA Area.

The Glacier Loon Project is located in the Buck Holland and Glacier Loon Grizzly Bear Subunits. The situation for grizzly bears in the Glacier Loon Area is summarized in the following table.

TABLE 3- 64 GRIZZLY BEAR POPULATION AND HABITAT STATUS.

BEAR MANAGEMENT UNIT (BMU)	SUB-UNIT	VISUAL SIGHTINGS	DEN SITES	MORTALITY
Big Salmon	Buck Holland			From fall 2003 through winter 2005, there were nine grizzly bear mortalities in the Swan Valley. Most of these mortalities were management actions, as a result of conflicts near human dwellings. Grizzly bear mortalities have continued from 2006 through 2008, in lesser numbers. There were two known mortalities in 2008 in the Swan Valley. One was a natural mortality; a cub drowned in the Swan River. The other was a road kill on the Swan Highway, near Rumble Creek. In addition, a sub-adult female was captured and relocated to the Cabinet Mountains as part of an Augmentation Program for the Cabinet Ecosystem. There was one known grizzly bear mortality in the Swan Valley in 2009, a management removal of a bear that was breaking in to cabins in the Cold Creek Area. Three conflicts were reported for grizzly bears accessing human foods around residential homes in the Swan Valley in 2010. These conflicts resulted in one capture of a male grizzly; this bear was euthanized. In 2011, there were eight different occurrences of grizzly bear/ human conflict with bears getting into human food. Most of these conflicts were attributed to a male grizzly bear that was later captured and euthanized. Grizzly bear mortalities in the Swan Valley continue to be human-caused deaths (e.g., management actions as a result of conflicts with humans or collision with automobiles).
Mission Range	Glacier Loon	Grizzly bear are known to use lands in these units/subunits. There have been reliable visual sightings and information on radio-collared grizzlies. At least 3 grizzly bears were wearing radio collars in or adjacent to the Swan Valley in all or part of 2016-2017 Based on MDFW&P and USFWS telemetry data, grizzly bears are known to move between the Swan and Mission Mountains, crossing MT State Highway 83.	There are no known den sites in the vicinity of the proposed project. The project is not located in likely grizzly bear denning habitat.	In 2012-2014, there were no grizzly bear mortalities in the project subunits or in the upper Swan Valley or within the project subunits. In 2015 and 2016, there were 4 bear mortalities (2 females; 2 males) hit by a vehicles on Highway 83. These mortalities occurred outside the project subunits.

ENVIRONMENTAL CONSEQUENCES

The Glacier Loon Project consists of a No Action Alternative and three action alternatives. A cumulative effect considers and describes proposed activities in addition to the past, current, and

reasonably foreseeable activities. Cumulative effects are discussed throughout this section under the specific alternatives. For a detailed discussion of all known past, present, and foreseeable activities see the Cumulative Effects Worksheet for Threatened and Endangered Species (Project File Exhibit H-20).

ALTERNATIVE A - NO ACTION ALTERNATIVE DIRECT AND INDIRECT EFFECTS

Since there would be no vegetation treatments or associated activities proposed with this alternative, there would be no direct effects to grizzly bear as a result of implementing the No Action Alternative; there would be no loss of cover, no decrease in security, and no displacement from the management activities proposed in the Glacier Loon Project. Indirectly, not implementing the proposed vegetative treatments could increase the risk of a wildfire burning more intensely in the Glacier Loon Project Area, which could result in a change in available forage and cover for grizzly bear over the short and long term. Fires have historically produced both positive and negative effects for grizzly bears; loss of hiding cover would be a potential negative effect. On the positive side, forage habitat could be potentially increased.

There would be no MA changes under the Alternative A, and no road decommissioning.

ALTERNATIVE A - NO ACTION ALTERNATIVE CUMULATIVE EFFECTS

In forest stands where the Glacier Loon Project is proposed, natural vegetative processes would continue on NFS lands in and adjacent to the project area. The juxtaposition of forage and cover for grizzly bear would change over time as open areas provide more forage, then grow in and provide cover habitat.

As described above, by not implementing the Glacier Loon Project, there could be an increase in the potential for a larger, stand-replacing wildfire to occur in the project area. This would be largely determined by the location, temperature, winds, drought conditions, etc., at the time of the fire start. A large intense wildfire would potentially decrease overall cover, at least short-term; forage production would increase initially, and then decrease as overstory cover increases.

The Glacier Loon Area contains established human activities, including vegetation management, road management, private land development, and recreational use. Road construction and logging activity have occurred on NFS and private forested land throughout the Swan Valley. Most major logging activity on NFS lands, including road building, occurred almost a decade ago. Logging and road construction have continued on private timberlands up to the present time. There is a timber sale in the adjacent Hemlock Elk Grizzly Bear Subunit that was recently completed and other current timber management activities on subunits to the east of the project area, across MT Highway 83, in the Meadow Smith, and Buck Holland Subunits. Timber removal has already occurred on Legacy Lands in the project area as part of the Fiber Agreement between TNC and PCTC (e.g., Fredswood Project in the Glacier Loon grizzly bear subunit). The Forest Service acquired Section 13 (T20N, R17W) in 2013 from TNC through the Land and Water Conservation Fund. Prior to acquisition TNC conducted 173 acres of overstory removal harvest (Krafty 13).

The Beaver Creek Project is a restoration project proposed in the adjacent Beaver Creek Subunit, where the bulk of the vegetation management activities will occur, but also includes some treatment units in the Buck Holland Subunit near MT Highway 83. The Beaver Creek Project would reduce hiding cover in the Buck Holland Subunit by approximately 130 acres or 1%. The Beaver Creek project would decommission approximately 4.5 miles of road and store approximately 12.6 miles of road which would be treated to meet the “reclaimed” definition under Amendment 19. In the Buck Holland subunit, these activities would result in a decrease of 4% TRD once completed. When considering the Beaver Creek Project effects, the Buck Holland Subunit would still meet Forest Plan direction, make progress towards A19 numerical objectives, and cover would be distributed to allow

secure grizzly bear travel throughout the subunit.

Forest Service land acquisitions and conservation easements in the Swan Valley have helped to maintain grizzly bear habitat now and into the future. Land acquisitions also provide for grizzly bear security by reducing the mortality risks associated with habitat fragmentation and human conflicts.

Alternative A would not contribute significantly to negative cumulative effects on grizzly bear in the Swan Valley.

ALTERNATIVE B - PROPOSED ACTION DIRECT AND INDIRECT EFFECTS

In a comparison of the action alternatives, negative direct and indirect effects to grizzly bear would be greatest with Alternative B, slightly less with Alternative C, and least with Alternative D, as described below.

Under Alternative B, there are 773 acres of Regeneration Treatment proposed (Clearcut /Seed Tree/Shelterwood) and 976 acres of Intermediate Treatment (Commercial Thin, Sanitation/Salvage, and Improvement Cut); total proposed commercial treatment is 1,749 acres. There are also 353 acres of non-commercial treatment proposed in Alternative B, including 343 acres of Pre-Commercial Thinning and 10 acres of Post and Pole Treatment. Total acres treated under Alternative B would be 2,102 acres.

Proposed slash treatment consists of a variety of methods, including the scattering of slash where fuel loads are lighter, chipping of woody material, piling slash and burning the piles, and broadcast burning following logging activity. There is a potential for any of the proposed slash treatment methods to decrease hiding cover in the project area.

Access to proposed units would include open roads, restricted roads, and temporary roads. Under Alternative B, approximately 11.5 miles of proposed temporary road construction is proposed.

DENNING HABITAT

Denning habitat has been characterized as steep (> 45 percent slope), relatively inaccessible slopes with northern and western aspects at or above 5,900 feet in elevation (Mace 1997). The proposed activities in the Glacier Loon Project are outside of areas that would be expected to provide potential denning habitat for grizzly bear. There is no proposed activity in known or potential grizzly bear denning habitat. There would be no direct or indirect effects to grizzly bear denning habitat as a result of implementing Alternative B.

FORAGING HABITAT

Grizzly bears are opportunistic feeders and will prey or scavenge on almost any available food. Plants with high crude protein content and animal matter are the most important food items. Habitats with abundant grasses, forbs, sedges, shrubs, and plant roots and bulbs are heavily used by grizzly bears (e.g., avalanche chutes, riparian areas, shrub lands). Mace et al. (1997), in their discussion of grizzly bear ecology in the Swan Mountains, describe how grizzly bears move to lower elevations after emerging from their dens to seek green vegetation and carrion. During mid-spring, bears move to median elevations in search of optimum forage. During early summer, median elevations drop slightly as bears exploit early ripening huckleberries at lower elevations and then follow the pattern of ripening to higher elevations. Elevations again decline as food resources at higher elevations become unavailable due to frost and snow.

The Glacier Loon Area provides potential foraging habitat for grizzly bear throughout the spring, summer, and fall. Proposed treatments in Alternative B would decrease the amount of available forage due to ground disturbance in cutting units and the construction of temporary roads. The potential for a decrease in the amount of forage would be greatest in Alternative B, due to the amount of acres treated and the amount of proposed temporary road construction (2,102 acres/11.5 miles).

Riparian areas, including streams, lakes, small wetlands, and ponds or potholes, provide high quality

grizzly bear forage. There are management guidelines and BMPs in place (e.g., INFISH) that mitigate effects to riparian habitat. Riparian Habitat Conservation Areas restrict activities within a designated distance from streams, lakes, and wetlands (See Fisheries Section). The riparian guidelines in place for Alternative B would help protect important riparian habitats for grizzly bear. However, it should be mentioned that riparian habitats, when considering grizzly bear use, encompass more acreage than the wetland itself and probably extend beyond the guidelines established for aquatic riparian values. In other words, there would still be direct and indirect effects to riparian habitats or wetland complexes that are important forage areas for grizzly bear in the Glacier Loon Area. Direct and indirect effects to forage would include the decrease of forage vegetation in important wetland areas, as well as displacement from riparian habitats while activities are occurring in close proximity.

Important riparian habitat for grizzly bear in the Glacier Loon Project Area includes portions of Sections 26 and 36, T20N R17W, portions of Section 6, T19N R16W, and portions of Sections 11 and 12, T19N R17W. Under Alternative B, there would be 101 acres treated in Section 26 (Units 15-17), 224 acres treated in Section 36 (Units 19-31, 205), 64 acres treated in Section 6 (Units 41, 42, 206-210), and 223 acres treated in Sections 11 and 12 (Units 50-54, 213-217); a total of 612 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats.

There are no treatments proposed in the Glacier Loon Project in important avalanche chute or shrub land habitats.

Forage production would begin to increase again in treated areas within 5 years, as a greater amount of sunlight and moisture reach the forest floor. Over time, the openings and thinned areas would be expected to again produce quality forage for grizzly bears. In some areas forage production could increase over the long-term.

Hiding Cover

Currently, approximately 70 percent of the Glacier Loon Project Area provides hiding cover for grizzly bears. This percentage includes all NFS lands (e.g., Legacy Lands and Wilderness), but does not include private lands within the project area boundary. Approximately 96 percent (2,030 acres) of the mature and immature forest stands where treatment is proposed in Alternative B currently provide hiding cover. The project area includes the Glacier Loon subunit, as well as approximately 3% (1,118 acres) of the Buck Holland subunit (see Appendix A). Approximately 69% of the Glacier Loon subunit and 55% of the Buck Holland subunit presently provide hiding cover (SVGBCA monitoring report 2015). The Glacier Loon Project proposed treatments would decrease the amount of hiding cover across the Glacier Loon Area.

Approximately 95 percent (1,366 acres) of the mature and immature forest stands where treatment is proposed in the Glacier Loon Project currently provide hiding cover. All of these stands are located in the Glacier Loon Subunit with the exception of 9 units (157 acres) located in the Buck Holland Subunit. The proposed fuels reduction and forest health treatments would decrease the amount of hiding cover across the Glacier Loon area.

There would be little to no hiding cover left in stands proposed for Regeneration Treatment (Clearcut, Seed Tree, or Shelterwood) or Post and Pole. In stands proposed for Intermediate Treatment (Commercial Thin, Improvement Cut, Sanitation/Salvage), some of the area would continue to provide hiding cover following treatment and some of the area would not. This is due to the wide variability in the proposed prescriptions. For example, Commercial Thinning treatments would leave 50 to 150 trees per acre (TPA). At the lower end (50 to 80 TPA) of the scale, there probably would not be sufficient cover left to function as hiding cover for grizzly bear. At the higher end (80+ TPA), there would probably be sufficient cover to function as hiding cover. Pre-commercial treatments would be similar to the commercial intermediate treatments; depending on the residual density target (e.g., 50 to 300 TPA), hiding cover would be eliminated or retained.

Taking these prescriptions into account, under Alternative B there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 1,453 acres. This assumes that half of the intermediate treatments would still provide hiding cover. This reduction in hiding cover under Alternative B would lower the percentage of hiding cover in the Glacier Loon Project Area from 70 percent to approximately 66 percent.

Hiding cover would take approximately 10 to 20 years to recover, depending on stand conditions. There would be some decrease in hiding cover naturally, notably in the proposed regeneration cuts with large amounts of lodgepole pine. This would be regardless of treatment implementation, due to on-going mountain pine beetle mortality.

Design Criteria (Table 2- 16) for Alternative B stipulate that vegetative screening be retained along open roads in the project area to mitigate potential effects to grizzly bear from loss of hiding cover. In addition, treatment units would be laid out in a manner that ensures that no point in the unit would be more than 600 feet from hiding cover. These Design Criteria would help to mitigate negative effects on hiding cover.

Habitat Security

Temporary Road Construction

There would be no permanent road construction under Alternative B; however, approximately 11.5 miles of temporary road would be needed to access treatment areas. Temporary roads would be constructed to the minimum standards necessary for log hauling. Table 3- 65 displays temporary road information for Alternative B.

TABLE 3- 65 PROPOSED TEMPORARY ROADS - ALTERNATIVE B.				
TEMP ROAD	UNIT ACCESS	APPROX. LENGTH (MILES)	MILES IN UNIT	MILES OUT OF UNIT
021714A	2	0.269	0.269	--
021714B	6	0.093	0.030	0.063
021714D	9	0.351	0.051	0.300
021723A	3,4,5,6,7	0.763	0.563	0.200
021723B	10	0.141	0.027	0.114
021723C	11	0.107	0.007	0.100
021726A	15,16,17	0.646	0.646	--
021727A	18	0.168	0.008	0.160
021736A	24	0.158	0.158	--
021736B	26	0.300	0.300	--
021736C	20,21,22,23	0.981	0.830	0.151
191606A	41	0.126	0.126	--
191701A	30	0.126	0.084	0.042
191701B	27,28	0.343	0.286	0.057
191701C	29	0.194	0.130	0.064
191702D	48	0.116	0.116	--
191711A	47,48	0.439	0.439	--
191711B	51	0.476	0.446	0.030
191711C	66	0.265	0.265	--
191712A	60,61,62	0.397	0.377	0.020
191712B	63	0.199	0.161	0.038
191712C	60	0.164	0.082	0.082
191712D	59	0.344	0.307	0.037
191712E	52,54,58	0.840	0.783	0.057
191714B	66	0.101	0.101	--
191715A	76	0.196	0.196	--
191715B	76	0.346	0.346	--
191715C	67,68,69,70	0.741	0.703	0.038
191715D	71	0.191	0.031	0.160
191722A	80,81	0.608	0.308	0.300
191722B	84,85	0.258	0.193	0.065
191722C	90	0.299	0.099	0.200
201724A	12,13,14	0.792	0.742	0.050
TOTAL		11.538	9.210	2.328

Mechanical activities would displace bears in harvest units and on temporary roads. Temporary roads that are constructed within a unit boundary do not have additional displacement effects to grizzly bear above the effects of the unit treatment; the ground disturbance within the treated unit would include the temporary road construction, due to the rehabilitation of the temporary road following completion of the unit treatment. Temporary roads that are constructed outside of a unit boundary would be additional negative effects to grizzly bear; there would be additional ground disturbance that can decrease available forage and hiding cover, and there would be potential short-term displacement from a larger area. As displayed in Table 3- 65, in Alternative B there would be approximately 2.3 miles of temporary road construction that would occur outside of cutting unit boundaries.

Temporary roads would be rehabilitated following use. The rehabilitation work would include the removal of any culverts, installing erosion control features, re-vegetation with native shrubs or seed mix, re-contouring, and the placement of woody debris on the reclaimed road. The goal of

rehabilitating the temporary roads is to discourage motorized use. There would always be a potential for these temporary roads to be vectors of human use, but the potential would be low, if the rehabilitation work is successful.

Temporary roads would not increase the total road density (TRD) in a subunit because they would be rehabilitated after harvest activities. Open road densities (ORD) would increase temporarily during sale activities.

Use of Restricted Roads

Existing open roads and closed roads (currently bermed or gated) would be used to access proposed treatment units in Alternative B. Use of open roads would not be a change from the existing condition. Use of gated or bermed roads would increase human activity levels in areas normally more secure for the grizzly bear. Under Alternative B, approximately 23.6 miles of gated or bermed roads would be used for accessing proposed cutting units. The following table displays the use of closed roads:

TABLE 3- 66. RESTRICTED ROADS - ALTERNATIVE B.			
RESTRICTED ROAD #	CLOSURE DEVICE	UNITS ACCESSED	MILES OF RESTRICTED ROAD UTILIZED
9500	Berm	15	0.06
9552	Gate	94	1.01
9575	Gate	92	0.43
9578 (9773, 11648, 11648B, 91239 located behind 9578 gate)	Gate	45,46,48,49,72-75	6.00
9579 (9579C located behind 9579 gate)	Gate	19-31	2.58
9598	Gate	1	0.37
10566	Berm	60-64	0.23
10567	Gate	41,42	1.37
10728	Gate	77	1.45
10732 (10733, 10734 located behind 10732 gate)	Gate	81-87	2.35
10741	Gate	48,50,51,56,57	0.90
90242	Gate	71	0.45
90244	Gate	57,73	1.80
91240	Gate	67-70	0.39
91241 (91242 located behind 91241 gate)	Gate	76	2.05
91305 (91306 located behind 91305 gate)	Gate	3-8,10,11	1.28
79Y (79Z located behind 79Y gate)	Berm	38,39,40	0.90
Total			23.62

The bermed and gated roads are ML-1 Roads. They are constructed to the minimum standards necessary and are designed to be re-used for timber and fire management. The gated roads are closed year-long. Between re-entries, both the bermed and gated roads are closed to public use. Because they are all ML-1 Roads, they are currently included in the TRD for a grizzly bear subunit. The short-term use of normally restricted roads would not increase the net TRD in a subunit. Open road densities would increase temporarily during project activities.

The following Design Criteria would help to reduce the potential negative effects to grizzly bear from the use of normally restricted roads:

- Roads that are currently closed, but that would be used for access and for hauling, would be closed to the general public during the time that they are utilized for fuel management or forest health treatments.
- Where berms are removed for access to treatment units, temporary gates would be installed.
- Contractors associated with sale operations would be prohibited from carrying firearms on normally closed roads within the project area.
- Berms would be re-installed when sale activities in that area are completed.
- Vegetation and/or rock barriers would be retained around berms and gates, where needed, to maintain closure effectiveness following sale activities.

Road Decommissioning

In Alternative B, there are 4.1 miles of road decommissioning proposed; approximately 2.5 miles is passive decommissioning (no ground-disturbing work anticipated), and 1.6 miles would involve culvert removal and water bar construction to decommission the road. Road decommissioning is beneficial for bears because it improves long-term habitat security. Switalski et al. (2011) demonstrated extensive use of decommissioned roads by wildlife. Under Alternative B, there would be no re-contouring of roads as part of decommissioning. As a result of proposed decommissioning under Alternative B, ORD would decrease 0.1 percent in the Glacier Loon Subunit; TRD would decrease approximately 0.5 percent in the Glacier Loon Subunit and 0.1 percent in the Buck Holland Subunit (Table 3- 72). Please refer to the Transportation Section of this EA for more detailed information concerning the conditions of the roads proposed for decommissioning.

Displacement/Mortality Risk

High human-activity levels could negatively affect grizzly bears by causing displacement from preferred habitats. Grizzly bears are highly dependent upon learned habitat; displacement into unknown territory could lead to sub-marginal nutrition, reduced reproduction, or greater exposure to adult predatory bears or human food sources, which could lead to human-caused mortality (USDA Forest Service 2006b; Waller et al. 1997). The potential for displacing grizzly bears during implementation of proposed activities would be greater in Alternative B than in Alternatives C or D, due to the greater amount of units, temporary roads, and miles of restricted roads needed for access. Potential displacement would be short-term, during the length of the proposed sale activity (1 to 5 years). During this time, grizzly bears using the area could be displaced from key habitats, which could alter their normal ability to find food, breed and raise young, or find shelter.

Most of the activities proposed in Alternative B are located in the Glacier Loon Grizzly Bear Subunit. This subunit is:

- Inactive from 2015 thru 2020, and then becomes
- Active again in 2021.

There are nine proposed treatment units in the Buck Holland Grizzly Bear Subunit (Units 32 – 40). The units are near Highway 83, in the eastern portion of the project area (Units 32-40). The Buck Holland Subunit is:

- Inactive from 2015 thru 2017 and
- Active again in 2018 thru 2010.

The harvest activity in the Glacier Loon or Buck Holland Subunits would comply with SVGBCA guidelines for Active/Inactive subunits based on the time periods listed above.

In order to avoid the potential disturbance of grizzly bears in important spring habitat, management activities that would be planned in spring habitat [areas within designated linkage zones and below 5,200 feet (USDI 1997)] would not occur within the Spring Period (April 1 through June 15). This

timing restriction would apply to all units except Units 1-14, 19-26, 30-34, 90, 92, 94, 200, and 205. Units 2, 5, 10, 11, 16, 34, and 59 would require winter logging due to soils design criteria; winter logging would decrease the potential for displacement of grizzly bears in these units. It should be noted, however, that any temporary road required for the winter logged units would still be constructed outside of the winter period and there would still be a chance for disturbance/displacement of grizzly bears from the temporary road construction activity.

There is no activity (e.g., harvest, temporary road construction, use of restricted roads) proposed in grizzly bear Security Core areas in Alternative B. Security Core in the Glacier Loon and Buck Holland Grizzly Bear Subunits would remain unchanged during the proposed activities.

The majority of activities in Alternative B occur in the Glacier Loon Subunit. Project implementation while the subunit is inactive would decrease potential for disturbance and displacement to grizzly bears because non-salvage commercial activities would be implemented during the denning season. Salvage activities or administrative use for project activities would not occur during the Spring Period in spring habitat. Further, salvage activities would not occur during the fall between August 31 and November 15 and would only occur for an aggregate of 30 days during the Restricted Period (see [Project File Section AA](#)). The remainder of the project's commercial activities would occur during the denning season. The Buck Holland is Active beginning in 2018 and commercial activities could occur during the Restricted Period (grizzly bear active season) across a relatively small area; 9 units or 157 acres. Further, no activities would occur in security core or grizzly bear denning habitat. Restricted roads used for project activities would remain closed to the public during project implementation.

EFFECT OF MANAGEMENT AREA CHANGE

There would be no change to existing MA designations under Alternative B.

ALTERNATIVE C DIRECT AND INDIRECT EFFECTS

Under Alternative C, there would be 685 acres of Regeneration Treatment proposed (Clearcut/Seed Tree/Shelterwood) and 871 acres of Intermediate Treatment (Commercial Thin, Sanitation/Salvage, Improvement Cut and Modified Commercial Thin); total proposed Commercial Treatment is 1,556 acres. There are also 353 acres of non-commercial treatment proposed in Alternative C, including 343 acres of Pre-Commercial Thinning and 10 acres of Post and Pole Treatment. A total of 1,909 acres would be treated under Alternative C.

Proposed slash treatment would consist of a variety of methods, including the scattering of slash where fuel loads are lighter, chipping of woody material, piling slash and burning the piles, and broadcast burning following logging activity. There would be a potential for any of the proposed slash treatment methods to decrease hiding cover in the project area.

Access to proposed units would include open roads, restricted roads, and temporary roads. Under Alternative C, there would be approximately 7.4 miles of proposed temporary road construction.

DENNING HABITAT

Denning habitat has been characterized as steep (> 45 percent slope), relatively inaccessible slopes with northern and western aspects at or above 5,900 feet in elevation (Mace et al. 1997). The proposed activities in the Glacier Loon Project are outside of areas that would be expected to provide potential denning habitat for grizzly bear. There would be no proposed activity in known or potential grizzly bear denning habitat under Alternative C; therefore, there would be no direct or indirect effects to grizzly bear denning habitat.

FORAGING HABITAT

Grizzly bears are opportunistic feeders and will prey or scavenge on almost any available food. Plants with high crude protein content and animal matter are the most important food items. Habitats with abundant grasses, forbs, sedges, shrubs, and plant roots and bulbs are heavily used by grizzly bears

(e.g., avalanche chutes, riparian areas, shrub lands). Mace et al. (1997), in their discussion of grizzly bear ecology in the Swan Mountains, describe how grizzly bears move to lower elevations after emerging from their dens to seek green vegetation and carrion. During mid-spring, bears move to median elevations in search of optimum forage. During early summer, median elevations drop slightly as bears exploit early ripening huckleberries at lower elevations and then follow the pattern of ripening to higher elevations. Elevations again decline as food resources at higher elevations become unavailable due to frost and snow.

The Glacier Loon Area provides potential foraging habitat for grizzly bear throughout the spring, summer, and fall. Proposed treatments in Alternative C would decrease the amount of available forage due to ground disturbance in cutting units and the construction of temporary roads.

Riparian areas frequently provide good foraging habitat for grizzly bear. As described above under Alternative B, important riparian habitat for grizzly bear in the Glacier Loon Project Area includes portions of Sections 26 and 36, T20N R17W, portions of Section 6, T19N R16W, and portions of Sections 11 and 12, T19N R17W. Under Alternative C, there would be 101 acres treated in Section 26 (Units 15-17), 223 acres treated in Section 36 (Units 19-31, 205), 64 acres treated in Section 6 (Units 41, 42, 206-210), and 209 acres treated in Sections 11 and 12 (Units 50-54, 213-217); a total of 597 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats. Direct and indirect effects to forage would include the decrease of forage vegetation in important wetland areas, as well as displacement from riparian habitats, while activities are occurring in close proximity.

There are no treatments proposed in the Glacier Loon Project in important avalanche chute or shrub land habitats.

Forage production would begin to increase again in treated areas within 5 years, as a greater amount of sunlight and moisture reach the forest floor. Over time, the openings and thinned areas would be expected to again produce quality forage for grizzly bears.

Hiding Cover

Currently, approximately 70 percent of the Glacier Loon Project Area provides hiding cover for grizzly bears. This percentage includes all NFS lands (e.g., Legacy Lands and Wilderness), but does not include private lands within the project area boundary. Approximately 96 percent (2,030 acres) of the mature and immature forest stands where treatment is proposed in Alternative B currently provide hiding cover. The Glacier Loon Project proposed treatments would decrease the amount of hiding cover across the Glacier Loon Area.

The proposed fuels reduction and forest health treatments proposed in Alternative C would decrease the amount of hiding cover across the Glacier Loon Area.

As described in Alternative B, there would be little to no hiding cover left in stands proposed for Regeneration Treatment (Clearcut, Seed Tree, or Shelterwood) or Post and Pole. In stands proposed for Intermediate Treatment (Commercial Thin, Modified Commercial Thin, Improvement Cut, Sanitation/Salvage), some of the area would continue to provide hiding cover following treatment and some of the area would not. Non-commercial Treatments would be similar to the commercial intermediate treatments; depending on the residual density target (e.g., 50 to 300 TPA), hiding cover would be eliminated or retained.

Taking these prescriptions into account, under Alternative C, there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 1,310 acres. This reduction in hiding cover under Alternative C would lower the percentage of hiding cover in the Glacier Loon Project Area from 70 percent to approximately 67 percent.

Hiding cover would take approximately 10 to 20 years to recover, depending on stand conditions. There would be some decrease in hiding cover naturally, notably in the proposed regeneration cuts with large amounts of lodgepole pine. This would be regardless of treatment implementation, due to on-going mountain pine beetle mortality.

As under Alternative B, Design Criteria (Table 2- 16) for Alternative C would stipulate that vegetative

screening be retained along open roads in the project area. In addition, treatment units would be laid out in a manner that ensures that no point in the unit would be more than 600 feet from hiding cover. These Design Criteria would help to reduce negative effects on hiding cover.

Habitat Security

Temporary Road Construction

There would be no permanent road construction under Alternative C; however, approximately 7.4 miles of temporary road would be needed to access treatment areas. Temporary roads would be constructed to the minimum standards necessary for log hauling. Table 3- 67 displays temporary road information for Alternative C.

TABLE 3- 67. PROPOSED TEMPORARY ROADS - ALTERNATIVE C.				
TEMP	UNIT(S) ACCESSED	APPROX. LENGTH (MILES)	MILES IN UNIT	MILES OUT OF UNIT
021714A	2	0.073	0.073	--
021714D	9	0.351	0.051	0.300
021723A	3,4,5,6,7	0.763	0.563	0.200
021723B	10	0.097	--	0.097
021723C	11	0.107	0.007	0.100
021726A	15,16,17	0.453	0.453	--
021727A	18	0.168	0.008	0.160
021736B	26	0.300	0.300	--
191701A	30	0.058	--	0.058
191701B	27,28	0.216	0.159	0.057
191701C	29	0.194	0.130	0.064
191702D	48	0.116	0.116	--
191711A	47,48	0.368	0.368	--
191711B	51	0.476	0.446	0.030
191711C	66	0.265	0.265	--
191712A	60,61,62	0.397	0.377	0.020
191712B	63	0.199	0.161	0.038
191712D	52,54,58,59	0.965	0.700	0.265
191714B	66	0.101	0.101	--
191715B	76	0.346	0.346	--
191715C	67,68,69,70	0.238	0.200	0.038
191715D	71	0.191	0.031	0.160
191722A	80,81	0.052	--	0.052
191722C	90	0.299	0.099	0.200
191727A	89	0.089	0.030	0.059
201724A	12,13,14	0.476	0.476	--
TOTAL		7.358	5.460	1.898

Mechanical activities would displace bears in harvest units and on temporary roads. Temporary roads that would be constructed within a unit boundary do not have additional effects to grizzly bear above the effects of the unit treatment; the ground disturbance within the treated unit would include the temporary road construction, due to the reclamation of the temporary road following completion of the unit treatment. Temporary roads that are constructed outside of a unit boundary would be additional negative effects to grizzly bear; there would be additional ground disturbance that could decrease available forage and hiding cover, and there would be potential short-term displacement from a larger area. As displayed in Table 3- 67, in Alternative C there would be approximately 1.9 miles of temporary road construction that would occur outside of cutting unit boundaries.

Temporary roads would be rehabilitated following use. The rehabilitation work would include the removal of any culverts, installing erosion control features, re-vegetation with native shrubs or seed mix, re-contouring, and the placement of woody debris on the reclaimed road. The goal of reclaiming the temporary roads is to discourage motorized use. There would always be a potential for these temporary roads to be vectors of human use, but the potential would be low, if the rehabilitation work is successful.

As described under Alternative B, temporary roads would not increase the TRD in a subunit because they would be reclaimed after harvest activities. Open road densities would increase temporarily during sale activities.

Use of Restricted Roads

Existing open roads and closed roads (currently bermed or gated) would be used to access proposed treatment units in Alternative C. Use of gated or bermed roads would increase human activity levels in areas normally more secure for the grizzly bear. Under Alternative C, approximately 21.6 miles of gated or bermed roads would be used for accessing proposed cutting units. The following table displays the use of closed roads for Alternative C.

TABLE 3- 68 RESTRICTED ROADS - ALTERNATIVE C.			
RESTRICTED ROAD #	CLOSURE DEVICE	UNITS ACCESSED	MILES OF RESTRICTED ROAD UTILIZED
9500	Berm	15	0.06
9552	Gate	94	1.01
9575	Gate	92	0.43
9578 (9773,11648,11648B,91239 located behind 9578 gate)	Gate	45,46,48,49,72-75	6.00
9579 (9579C located behind 9579 gate)	Gate	19,20,22-31	2.58
9598	Gate	1	0.37
10566	Berm	60-64	0.23
10567	Gate	41,42	1.37
10728	Gate	77	1.45
10732	Gate	81,82	0.35
10741	Gate	48,50,51,56,57	0.90
90242	Gate	71	0.45
90244	Gate	57,73	1.80
91240	Gate	67-70	.39
91241 (91242 located behind 91241 gate)	Gate	76	2.05
91305 (91306 located behind 91305 gate)	Gate	3-8,10,11	1.28
79Y (79Z located behind 79Y gate)	Berm	38,39,40	0.90
Total			21.62

The bermed and gated roads are ML-1 roads. They are constructed to the minimum standards necessary and are designed to be re-used for timber and fire management. The gated roads are closed year-long. Between re-entries, both the bermed and gated roads are closed to public use. Because they are all ML-1 roads, they are currently included in the TRD for a grizzly bear subunit. The short-term use of normally restricted roads would not increase the net TRD in a subunit. Open road densities would increase temporarily during project activities.

The following Design Criteria would help to reduce the potential negative effects to grizzly bear from the use of normally restricted roads:

- Roads that are currently closed, but that would be used for access and for hauling, would be closed to the general public during the time that they are utilized for fuel management or forest health treatments.
- Where berms are removed for access to treatment units, temporary gates would be installed.
- Contractors associated with sale operations would be prohibited from carrying firearms on normally closed roads within the project area.
- Berms would be re-installed when sale activities in that area are completed.
- Vegetation and/or rock barriers would be retained around berms and gates, where needed, to maintain closure effectiveness following sale activities.

Road Decommissioning

In Alternative C, there are 8.4 miles of road decommissioning proposed. The decommissioning work would include 2.4 miles of passive work (no ground disturbance), 2.1 miles of culvert removal and water bar construction, and 3.9 miles of re-contouring. Road decommissioning is beneficial for bears because it improves long-term habitat security. Switalski et al. (2011) demonstrated extensive use of decommissioned roads by wildlife. As a result of proposed road decommissioning under Alternative C, ORD would decrease 0.1 percent in the Glacier Loon Subunit; TRD would decrease 2.96 percent in the Glacier Loon Subunit, and 0.1 percent in the Buck Holland Subunit. Please refer to the Transportation Section of this EA for more detailed information concerning the conditions of the roads proposed for decommissioning.

Displacement/Mortality Risk

As described in Alternative B, high human-activity levels could negatively affect grizzly bears by causing displacement from preferred habitats. Grizzly bears are highly dependent upon learned habitat; displacement into unknown territory could lead to sub-marginal nutrition, reduced reproduction, or greater exposure to adult predatory bears or human food sources, which could lead to human-caused mortality (USDA Forest Service 2006b; Waller et al. 1997). The potential for displacing grizzly bears during implementation of proposed activities is slightly less in Alternative C than in Alternative B, because there are a few less units, less use of restricted roads, and less temporary roads. During this time, grizzly bears using the area could be displaced from key habitats, which could alter their normal ability to find food, breed and raise young, or find shelter.

The activities proposed under Alternative C would occur within the Glacier Loon and Buck Holland Subunits. The Sub Holland subunit is:

- Active from 2015 thru 2017 and
- Inactive from 2018 thru 2020.

If harvest activity in the Glacier Loon or Buck Holland Subunits is not completed by the end of 2017, proposed actions would comply with SVGBCA guidelines for an Inactive subunit.

In order to avoid the potential disturbance of grizzly bears in important spring habitat, management activities would not occur within the Spring Period (April 1 through June 15) in all units except Units 1-14, 19, 20, 22-26, 30-34, 90, 92, 94, 200, and 205 (Table 2- 16). Units 2, 5, 10, 11, 16, and 34 would require winter logging due to soils design criteria; winter logging would decrease the potential for displacement of grizzly bears in these units. It should be noted, however, that any temporary road required for the winter logged units would still be constructed outside of the winter period and there would still be a chance for disturbance/displacement of grizzly bears from the temporary road construction activity.

There is no activity (e.g., harvest, temporary road construction, use of restricted roads) proposed in grizzly bear Security Core under Alternative C. Security Core in the Glacier Loon and Buck Holland Grizzly Bear Subunits would remain undisturbed during proposed activities.

The majority of activities in Alternative C occur in the Glacier Loon Subunit. Project implementation while the subunit is Inactive would decrease potential for disturbance and displacement to grizzly bears because non-salvage commercial activities would be implemented during the denning season. Salvage activities or administrative use for project activities would not occur during the Spring Period in spring habitat. Further, salvage activities would not occur during the fall between August 31 and November 15 and would only occur for an aggregate of 30 days during the Restricted Period (see [Project File Section AA](#)). The remainder of the project's commercial activities would occur during the denning season. The Buck Holland is Active beginning in 2018 and commercial activities could occur during the Restricted Period (grizzly bear's active season) across a relatively small area; 9 units or 157 acres. Further, no activities would occur in security core or grizzly bear denning habitat. Restricted roads used for project activities would remain closed to the public during project implementation.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative C would include a MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake.

Under Alternative C, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5 designation. On MA 15 and MA 15C lands, cost-effective timber production with roads is emphasized. Lands with an MA 5 designation consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would likely translate to less regeneration cutting and road building on the forested slopes along the western side of Lindbergh Lake; there would probably be an increased potential for these 221 acres to provide more secure habitat for grizzly bear.

ALTERNATIVE D DIRECT AND INDIRECT EFFECTS

In a comparison of the action alternatives, negative direct and indirect effects to grizzly bear would be least with Alternative D.

Under Alternative D, there would be 595 acres of Regeneration Treatment proposed (Clearcut/Seed Tree/Shelterwood) and 450 acres of Intermediate Treatment (Commercial Thin, Sanitation/Salvage, and Improvement Cut); total proposed commercial treatment is 1,045 acres. There are also 105 acres of non-commercial treatment proposed in Alternative D, including 95 acres of Pre-Commercial Thinning and 10 acres of Post and Pole Treatment. A total of 1,150 acres would be treated under Alternative D.

Proposed slash treatment consists of a variety of methods, including the scattering of slash where fuel loads are lighter, chipping of woody material, piling slash and burning the piles, and broadcast burning following logging activity. There is a potential for any of the proposed slash treatment methods to decrease hiding cover in the project area.

Access to proposed units would include open roads, restricted roads, and temporary roads. Under Alternative D, there are approximately 5.8 miles of proposed temporary road construction.

DENNING HABITAT

Denning habitat has been characterized as steep (> 45 percent slope), relatively inaccessible slopes with northern and western aspects at or above 5,900 feet in elevation (Mace et al. 1997). The proposed activities in the Glacier Loon Project are outside of areas that would be expected to provide potential denning habitat for grizzly bear. There is no proposed activity in known or potential grizzly bear denning habitat under Alternative D.

FORAGING HABITAT

Grizzly bears are opportunistic feeders and would prey or scavenge on almost any available food. Plants with high crude protein content and animal matter are the most important food items. Habitats with abundant grasses, forbs, sedges, shrubs, and plant roots and bulbs are heavily used by grizzly bears (e.g., avalanche chutes, riparian areas, shrub lands). Mace et al. (1997), in their discussion of grizzly bear ecology in the Swan Mountains, describe how grizzly bears move to lower elevations after emerging from their dens to seek green vegetation and carrion. During mid-spring, bears move to median elevations in search of optimum forage. During early summer, median elevations drop slightly as bears exploit early ripening huckleberries at lower elevations and then follow the pattern of ripening to higher elevations. Elevations again decline as food resources at higher elevations become unavailable due to frost and snow.

The Glacier Loon Area provides potential foraging habitat for grizzly bear throughout the spring, summer, and fall. Proposed treatments in Alternative D would decrease the amount of available forage due to ground disturbance in cutting units and the construction of temporary roads. The potential for a decrease in the amount of forage would be less in Alternative D than in the other two action alternatives due to less proposed temporary road construction, and the lesser amount of acres treated.

Riparian areas, including streams, lakes, small wetlands, and ponds or potholes, provide high quality grizzly bear forage. The riparian guidelines in place for Alternative D would help protect important riparian habitats for grizzly bear. There would still be direct and indirect effects to riparian habitats or wetland complexes that are important forage areas for grizzly bear in the Glacier Loon Area. Direct and indirect effects to forage would include the decrease of forage vegetation in important wetland areas, as well as displacement from riparian habitats while activities are occurring in close proximity.

Important riparian habitat for grizzly bear in the Glacier Loon Project Area includes portions of Sections 26 and 36, T20N R17W, portions of Section 6, T19N R16W, and portions of Sections 11 and 12, T19N R17W. Under Alternative D, there would be 21 acres treated in Section 26 (Units 15-17), 149 acres treated in Section 36 (Units 19-31, 205), 19 acres treated in Section 6 (Units 41, 42, 206-210), and 131 acres treated in Sections 11 and 12 (Units 50-54, 213-217); a total of 320 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats. In some of the units, notably the proposed regeneration cuts where lodgepole pine is the dominant species, a decrease in thermal cover would occur naturally, regardless of whether proposed fuels reduction or forest health treatments would be implemented, due to on-going mountain pine beetle mortality in the stand. Hiding cover would decrease naturally in these stands as well, although to a lesser extent.

There are no treatments proposed in the Glacier Loon Project in important avalanche chute or shrub land habitats under any of the alternatives, including Alternative D.

Forage production would begin to increase again in treated areas within 5 years, as a greater amount of sunlight and moisture reach the forest floor. Over time, the openings and thinned areas would be expected to again produce quality forage for grizzly bears.

HIDING COVER

Currently, approximately 70 percent of the Glacier Loon Project Area provides hiding cover for grizzly bears. This percentage includes all NFS lands (e.g., Legacy Lands and Wilderness), but does not include private lands within the project area boundary. As described above, in the effects analysis for Alternatives B and C, the proposed fuels reduction and forest health treatments would decrease the amount of hiding cover across the Glacier Loon Area. There would be little to no hiding cover left in stands proposed for regeneration treatments (Clearcut, Seed Tree, or Shelterwood) or Post and Pole. In stands proposed for Intermediate Treatment (Commercial Thin, Improvement Cut, Sanitation/Salvage), some of the area would continue to provide hiding cover following treatment and some of the area would not. This is due to the wide variability in the proposed prescriptions. Taking the different prescriptions described in Alternative B into account, under Alternative D, there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 888 acres. This assumes that half of the intermediate treatments would still provide hiding cover. The decrease in hiding cover under Alternative D (888 acres) would be less than Alternative B (1,453 acres) or Alternative C (1,310 acres). This reduction in hiding cover under Alternative D would lower the

percentage of hiding cover in the Glacier Loon Project Area from 70 percent to approximately 68 percent.

Hiding cover would take approximately 10 to 20 years to recover, depending on stand conditions. There would be some decrease in hiding cover naturally, notably in the proposed Regeneration Cuts with large amounts of lodgepole pine. This would be regardless of treatment implementation, due to on-going mountain pine beetle mortality.

Design Criteria (Table 2- 16) for Alternative D stipulate that vegetative screening be retained along open roads in the project area to decrease potential effects to grizzly bear from loss of hiding cover. In addition, treatment units would be laid out in a manner that ensures that no point in the unit would be more than 600 feet from hiding cover. These Design Criteria would help to reduce negative effects on hiding cover.

HABITAT SECURITY

Temporary Road Construction

There would be no permanent road construction under Alternative D; however, approximately 5.9 miles of temporary road would be needed to access treatment areas. Temporary roads would be constructed to the minimum standards necessary for log hauling. Table 3- 69 displays temporary road information for Alternative D.

TABLE 3- 69 PROPOSED TEMPORARY ROADS - ALTERNATIVE D.				
TEMP RD	UNIT ACCESSED	APPROX. LENGTH (MILES)	MILES IN UNIT	MILES OUT OF UNIT
021714A	2	0.071	0.071	--
021714D	9	0.351	0.051	0.300
021723A	3,4,5,6,7	0.763	0.563	0.200
021723B	9,10	0.097	--	0.097
021726A	17	0.449	0.260	0.189
021736B	26	0.300	0.300	--
021736C	22	0.430	0.279	0.151
191702D	48	0.116	0.116	--
191711A	48	0.439	0.439	--
191711C	66	0.265	0.265	--
191712A	61,63	0.115	0.095	0.020
191712B	61,63	0.199	0.161	0.038
191712D	52,53,59	0.747	0.558	0.189
191714B	66	0.101	0.101	--
191715C	68,70	0.236	0.198	0.038
191722C	90	0.299	0.099	0.200
191727A	89	0.089	0.030	0.059
201724A	12,13,14	0.792	0.742	0.050
Total		5.859	4.328	1.531

Mechanical activities would displace bears in harvest units and on temporary roads. Temporary roads that are constructed within a unit boundary do not have additional effects to grizzly bear above the effects of the unit treatment; the ground disturbance within the treated unit would include the temporary road construction, due to the reclamation of the temporary road following completion of the unit treatment. Temporary roads that are constructed outside of a unit boundary would be additional negative effects to grizzly bear; there would be additional ground disturbance, which can decrease available forage and hiding cover, and there would be potential short-term displacement from a larger area. As displayed in Table 3- 69, in Alternative D there would be approximately 1.5 miles of temporary road construction that would occur outside of cutting unit boundaries.

Temporary roads would be reclaimed following use. The reclamation work would include the removal of any culverts, installing erosion control features, re-vegetation with native shrubs or seed mix, re-contouring, and the placement of woody debris on the reclaimed road. The goal of reclaiming the temporary roads is to discourage motorized use. There is always a potential for these temporary roads to be vectors of human use, but the potential is low, if the reclamation work is successful.

Temporary roads would not result in a net increase the TRD in a subunit. Open road densities would increase temporarily during sale activities.

Use of Restricted Roads

Existing open roads and closed roads (currently bermed or gated) would be used to access proposed treatment units in Alternative D. Use of open roads would not be a change from the existing condition. Use of gated or bermed roads would increase human activity levels in areas normally more secure for the grizzly bear. Under Alternative D, approximately 16.0 miles of gated or bermed roads would be used for accessing proposed cutting units. The following table displays the use of closed roads.

TABLE 3- 70 RESTRICTED ROADS - ALTERNATIVE D.			
RESTRICTED ROAD NO.	CLOSURE DEVICE	UNITS ACCESSED	MILES OF RESTRICTED ROAD UTILIZED
9552	Gate	94	1.01
9575	Gate	92	0.43
9578 (9773,11648,11648B,91239 located behind 9578 gate)	Gate	48,49,73-75	6.00
9579	Gate	19,20,22,24,25,26,31	1.51
10566	Berm	61,63	0.23
10728	Gate	77	1.45
10732	Gate	81-83	0.57
10741	Gate	48,57	0.90
90244	Gate	57,73	1.80
91240	Gate	68,70	0.39
91305 (91306 located behind 91305 gate)	Gate	3-8,10	0.83
79Y (79Z located behind 79Y gate)	Berm	38,39,40	0.90
Total			16.02

The bermed and gated roads are ML-1 roads. They are constructed to the minimum standards necessary and are designed to be re-used for timber and fire management. The gated roads are closed year-long. Between re-entries, both the bermed and gated roads are closed to public use. Because they are all ML-1 roads, they are currently included in the TRD for a grizzly bear subunit. The short-term use of normally restricted roads would not increase the net TRD in a subunit. Open road densities would increase temporarily during project activities.

The following Design Criteria (included in all of the action alternatives) would help to mitigate the potential negative effects to grizzly bear from the use of normally restricted roads:

- Roads that are currently closed, but that would be used for access and for hauling, would be closed to the general public during the time that they are utilized for fuel management or forest health treatments.
- Where berms are removed for access to treatment units, temporary gates would be installed.
- Contractors associated with sale operations would be prohibited from carrying firearms on normally closed roads within the project area.
- Berms would be re-installed when sale activities in that area are completed.

- Vegetation and/or rock barriers would be retained around berms and gates, where needed, to maintain closure effectiveness following sale activities.

Road Decommissioning

In Alternative D, there are 8.4 miles of road decommissioning proposed. The decommissioning work would include 2.4 miles of passive work (no ground disturbance), 2.1 miles of culvert removal and water bar construction, and 3.9 miles of re-contouring. Road decommissioning is beneficial for bears because it improves long-term habitat security; Switalski et al. (2011) demonstrated extensive use of decommissioned roads by wildlife. As a result of proposed decommissioning under Alternative D, ORD would decrease 0.1 percent in the Glacier Loon Subunit; TRD would decrease approximately 0.5 percent in the Glacier Loon Subunit and 0.1 percent in the Buck Holland Subunit (Table 3-72).

Displacement/Mortality Risk

High human-activity levels could negatively affect grizzly bears by causing displacement from preferred habitats. Grizzly bears are highly dependent upon learned habitat; displacement into unknown territory could lead to sub-marginal nutrition, reduced reproduction, or greater exposure to adult predatory bears or human food sources which can lead to human-caused mortality (Mace and Waller 1997, USDA 2006b). The potential for displacing grizzly bears during implementation of proposed activities is the least in Alternative D.

Most of the activities proposed in Alternative D are located in the Glacier Loon Grizzly Bear Subunit. This subunit is Inactive from 2015 through 2020, and then becomes Active again in 2021. There are nine proposed treatment units in the Buck Holland Grizzly Bear Subunit (Units 32-40). The Buck Holland Subunit is also Inactive from 2015 through 2017. If harvest activity in the Glacier Loon or Buck Holland Subunits is not completed by the end of 2017, proposed actions would comply with SVBCA guidelines for an “Inactive” subunit.

In order to avoid the potential disturbance of grizzly bears in important spring habitat, management activities that are planned in spring habitat, which is defined as areas within designated linkage zones and below 5,200 feet (USDI 1997), would not occur within the Spring Period (April 1 through June 15). In Alternative D, this timing restriction would apply to all units except Units 2-10,12-14,19, 20, 22, 24-26, 31-34, 90, 92, 94, and 205 (See Table 2- 16). Units 2, 5, 10, 17, 20, 22, and 34 would require winter logging due to soils design criteria; winter logging would decrease the potential for displacement of grizzly bears in these units. It should be noted, however, that any temporary road required for the winter logged units would still be constructed outside of the winter period and there would still be a chance for disturbance/displacement of grizzly bears from the temporary road construction activity.

There is no activity (e.g., harvest, temporary road construction, use of restricted roads) proposed in grizzly bear security core areas in Alternative D. Security Core percentages and location in the Glacier Loon and Buck Holland Grizzly Bear Subunits would remain unchanged as a result of the proposed activities.

The majority of activities in Alternative D occur in the Glacier Loon Subunit. Project implementation while the subunit is Inactive would decrease potential for disturbance and displacement to grizzly bears because non-salvage commercial activities would be implemented during the denning season. Salvage activities or administrative use for project activities would not occur during the Spring Period in spring habitat. Further, salvage activities would not occur during the fall between August 31 and November 15 and would only occur for an aggregate of 30 days during the Restricted Period (see [Project File Section AA](#)). The remainder of the project’s commercial activities would occur during the denning season. The Buck Holland is Active beginning in 2018 and commercial activities could occur during the Restricted Period (grizzly bear’s active season) across a relatively small area; 9 units or 157 acres. Further, no activities would occur in security core or grizzly bear denning habitat. Restricted roads used for project activities would remain closed to the public during project implementation.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative D would include a MA change in the Forest Plan. Under Alternative D, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5 designation. The proposed MA change on 221 acres above Lindbergh Lake would likely translate to less regeneration cutting and road building on the forested slopes along the western side of Lindbergh Lake and an increased potential for these 221 acres to provide more secure habitat for grizzly bear.

ALTERNATIVES B, C, AND D – ACTION ALTERNATIVES CUMULATIVE EFFECTS

The Swan Valley contains established human activities, including vegetation management, road management, private land development, and recreational use. Road construction and logging activity have occurred on Federal and private forested land throughout the Swan Valley, with most major logging activity on Federal lands, including road building, occurring almost a decade ago. Logging and road construction have continued on private and public timberlands up to the present time. There is past timber harvest in the adjacent Hemlock Elk Grizzly Bear Subunit (Hemlock Elk) and other current timber management activities on subunits to the east of the project area, across MT Highway 83 in the Meadow Smith, and Buck Holland Subunits (Cooney McKay, Meadow Smith, Summit Mountain Pine Beetle Salvage). Timber removal has occurred on Legacy Lands throughout the Swan Valley as part of the Fiber Agreement between TNC and PCTC (i.e. Fredswood Project, Krafty 13, and Barber Chair in the project subunits). In January of 2016 the fiber agreement was terminated. As activities for these projects have concluded, there would not be any cumulative effects for disturbance or displacement to the Glacier Loon project. These projects were considered in the habitat baseline reported above. The Forest Service acquired Section 13 (T20N, R17W) in 2013 from TNC through the Land and Water Conservation Fund. Prior to acquisition TNC conducted 173 acres of overstory removal harvest (Krafty 13). Acquisition of Section 13 into NFS lands provides long-term management of habitat for grizzly bear and promotes conservation of the species.

The Beaver Creek project would occur in the Beaver Creek and Buck Holland Subunits. When considering both the Beaver Creek and Glacier loon projects, hiding cover would be reduced by an approximate total of 267 acres. The Beaver Creek project would reduce TRD in the Buck Holland Subunit by approximately 4% improving habitat security for grizzly bears. The Beaver Creek project could contribute displacement in the Buck Holland subunit in combination with Glacier Loon activities. Road densities would be affected during the Beaver Creek project activities and Buck Holland and Glacier Loon subunits (See Regulatory Consistency Section, Table 3-73b). Log hauling from the Beaver Creek project may occur on Highway 83 through the Buck Holland subunit. The effects of this to grizzly bears would be insignificant relative to the motorized traffic already occurring on the highway in the Buck Holland subunit.

This displacement would occur outside of the spring period and is not expected to contribute negative cumulative effects due to the relatively small proportion of the Buck Holland subunit where activities would occur. The remainder of the Beaver Creek project is located outside the Glacier Loon and Buck Holland subunits, in the adjacent Beaver Creek subunit to the south. Sounds from machinery, motorized use, and human activity by carry and disturb bears when located near (within 500 m) of the Glacier Loon subunit boundary. Lindbergh Lake provides a partial border between the Glacier Loon activities and remainder of the Beaver Creek and would mitigate effects of sounds and human activity from a majority of the Beaver Creek units on grizzly bears in the Glacier Loon subunit. Helicopter ignition over security core in the Beaver Creek subunit (just south of Glacier Loon subunit boundary) would result in short-term displacement of 1-2 days. The helicopter would not land and no on-the-ground motorized use will occur in Security Core from the Beaver Creek project. Considering when considering the timing, design, and spatial arrangement of these projects, no adverse cumulative effects are expected. The Beaver Creek project is consistent with the guidelines of the SVGBCA and Flathead Forest plan direction.

High levels of human activity usually have a negative effect on the grizzly bear population. From 2000 to 2010, known grizzly bear mortality averaged about 21.45 bears per year. The greatest cause of mortality from 2000 to 2010 was from human-site conflict associated with food, garbage or stock (59 of the 236 deaths or 25 percent). Other major causes of mortality were from illegal or malicious

activities (17 percent), trains and vehicles (20 percent) and self-defense (11 percent). Mortality occurs in all parts of the NCDE with most mortalities occurring on private lands (139/236 = 59 percent) and associated with human-site conflicts, which includes vehicle mortality. An increase in known human-caused or management-related mortality has been associated more with rural roaded areas, and primarily on private property adjacent to National Forests (USDA 2006b).

Since 1995, access changes across the forest, including the Swan Valley, have contributed to improved conditions for grizzly bears. At the ecosystem level, nearly half (48 percent) of the NCDE is essentially roadless or free of motorized use (USDA 2006b). In addition, in 1995 a Conservation Agreement was entered into by PCTC, DNRC, the USDA Forest Service, and the USFWS. The purpose of the agreement has been to adopt an adaptive management approach to manage the integrated pattern of ownership and development in such a way as to reduce the impact of activities on the grizzly bear in the Swan Valley. Since 1995, the different timberland managers have adhered to the Agreement. Adherence to the agreement has helped to ensure that negative cumulative impacts to the grizzly bear do not occur.

A Special Food Storage Order on the Flathead National Forest has contributed to improved conditions for grizzly bears. The Food Storage Order requires all users of NFS lands to store food, garbage, and other bear attractants in a bear resistant manner. Contractors, and others implementing the proposed project, would be required to comply with this order.

To further minimize the risk of human-grizzly conflicts in the Swan Valley, the Forest Service and local residents have become very active in providing information and educational programs on living in grizzly bear country and on food storage techniques. In addition, the Forest and local partners have provided bear-proof storage containers for the community, and employed a Bear Ranger to work with local publics in an effort to reduce human-bear conflicts and to help enforce the Forest's Food Storage Order. In 2008, a task force was initiated in the upper Swan Valley, Swan Valley Bear Resources, near the community of Condon, Montana. The mission of this task force is to involve the community in a Bear Smart Program.

In 2008, the Montana Legacy Project between the Trust for Public Land, The Nature Conservancy, and PCTC, enabled the Flathead National Forest to acquire approximately 47,000 acres of former PCTC lands in the Swan Valley. This historic land acquisition will benefit grizzly bears in the Swan Valley by minimizing the negative effects of human-related activities and the development of private lands; it will help maintain grizzly bear habitat now and into the future, and provide for grizzly bear security by reducing the mortality risks associated with habitat fragmentation.

Under the action alternatives, as described above, direct and indirect effects would include a decrease in forage, a decrease in hiding cover across the project area, a decrease in habitat security, and an increase in potential for displacement during the proposed implementation of the Glacier Loon Project. The greatest negative effects to grizzly bear would occur with implementation of Alternatives B and C; implementation of Alternative D would also have negative effects, but to a lesser degree. Although the action alternatives would have varying degrees of negative effects on grizzly bear habitat in the Glacier Loon and Buck Holland Subunits, the cumulative effects of the proposed actions with past, present, and known future actions in the Swan Valley would not preclude grizzly bear use in the valley and would not jeopardize the recovery of the grizzly bear across the NCDE because:

1. Design Criteria in place for the Glacier Loon Project (e.g., subunit rotation, spring restrictions, distance to cover) limit potential long-term displacement of grizzly bears and help provide for grizzly bear security.
2. There would be no decrease in security core, and there are adjacent subunits and wilderness that could provide security for grizzly bear that might be temporarily displaced. Across the Flathead National Forest, approximately 67 percent of the land base is in wilderness or inventoried roadless.
3. The Flathead National Forest and the Swan Valley community have been very active in minimizing the risk of human-grizzly conflicts.

4. With a high degree of confidence, Kendall et al. (2009) estimates that 765 grizzly bears (range of 715 to 831) make their home in the Northern Continental Divide Ecosystem. Overall, the genetic health and diversity of the population is good (Kendall, et al. 2009).
5. After 6 years and based on the number of females with cubs being monitored, a reliable trend estimate indicates that the trend is up and the trend is good at 1.03% (USDA 2006b).
6. The best current information suggests that the grizzly bear population on the Flathead National Forest and NCDE is expanding its range beyond the recovery zone and has a population above recovery plan level estimates. With more bears and people on the landscape, human/bear encounters are expected to increase with mortal consequences to bears, but with an expanding grizzly bear population the higher level of mortality is not thought of as being excessive or beyond what is expected to be sustainable (USDA 2006b).

REGULATORY FRAMEWORK AND CONSISTENCY

The grizzly bear is currently classified as Threatened in Montana and is protected under the ESA. The Glacier Loon Project is located in lands that have been designated as MS-1, which is identified as an area needed for the survival and recovery of the species (USDA 2001b). The project area is also located within the SVGBCA area. Forest-wide management direction for grizzly bear is included in the Forest Plan, including Amendments 8, 9, 11, and 19. Interagency Grizzly Bear Guidelines (Interagency Grizzly Bear Committee 1986) were adopted as Forest Plan Appendix OO.

The alternatives comply with Section 9, ESA of 1973 as amended, the SVGBCA, the Flathead Forest Plan, as amended, and the Interagency Grizzly Bear Guidelines.

SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT

The SVGBCA is a formal agreement between the USFWS, the Forest Service, PCTC, and DNRC. The purpose of the Agreement is to cooperate and coordinate management activities in order to conserve grizzly bears in a mixed land-ownership environment. The Agreement includes habitat management guidelines that maintain or improve grizzly bear habitat in the Conservation Area. Table 3- 71 demonstrates that the proposed alternatives for the Glacier Loon Project comply with guidelines outlined in the SVGBCA.

TABLE 3- 71 SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT.			
GUIDELINES	PRE-TREATMENT	POST TREATMENT	COMPLIANCE
<i>Open Road Densities:</i> No more than 33% of a given Subunit shall exceed ORD of 1 mile/sq. mile during the Restricted Period.	Glacier Loon 22% Buck Holland 24%	No Change	Yes (would increase temporarily during implementation, but no net increase)
<i>Operations And Uses:</i> Mgmt activities, other than planting and limited burning, should not be conducted in Preferred Habitats from 4/1-6/15.		No mgmt. activities in Preferred Habitat from 4/1-6/15	Yes
<i>Operations And Uses:</i> For Inactive Subunits, Commercial use (major forest management) will not occur during the Restricted Period except for Salvage Activities.		Commercial use would not occur during the Restricted Period except for Salvage Activities.	Yes

GUIDELINES	PRE-TREATMENT	POST TREATMENT	COMPLIANCE
<i>Salvage Harvest:</i> short term activities to harvest dead and dying trees resulting from fire, disease, blowdown or the like and shall not continue for periods of more than two consecutive weeks or for more than 30 days in aggregate during a given calendar year in the non-denning period (April 1st –November 15th).	A majority of some units are comprised of dead and dying insect affected trees (see project file exhibit section AA).	Salvage activities would occur between June 16th and August 31st and would not exceed 30 days in aggregate or for more than two consecutive weeks.	Yes
<i>Spring Period:</i> No management activities (other than replanting, limited burning, and non-motorized Administrative Use) during the Spring Period (April 1 – June 15) in Spring Habitat (Within Linkage Zones below 5,200' elevation).		No project activities are proposed within Spring Habitat during the Spring Period.	Yes
<i>Road Locations:</i> Limit the construction of new roads in Preferred Habitat and Riparian Zones. (Minimize the density/mileage of roads built in these areas). Those existing roads in these areas not needed for management will be reclaimed or relocated.		No new permanent road construction on NFS lands. Temporary roads would be reclaimed. Decommissioning would reduce TRD and increase core.	Yes
<i>Cover:</i> Cover will be managed so that a minimum of 40% is maintained in each sub-unit.	Project Area: 70% Glacier Loon: 69% Buck Holland: 55%	Project Area: 68% Glacier Loon: 67% Buck Holland: 54.5%	Yes
<i>Cover:</i> Visual screening will be the management objective in areas adjacent to open roads.		Visual screening would be retained along open roads.	Yes
<i>Cover:</i> Even-aged cutting units will be laid out so that no point in the unit is greater than 600 feet from cover.		In the clearcut, seedtree, and shelterwood units, which are essentially even-aged management or regeneration, no point in the unit would be more than 600 feet from cover.	Yes
<i>Riparian Zones:</i> Use uneven-aged forest management practices.		No treatment would occur in riparian zones as defined by the SVGBCA (SMZs). Cover would be retained in riparian zones.	Yes
<i>Security:</i> Contribute to security in Linkage Zones by reclaiming or restricting roads. Reclaim roads to enhance use of Preferred Habitat or other high quality habitat areas, and to complement adjacent areas of secure habitat.		All temporary roads would be reclaimed; decommissioning of some roads would be accomplished.	Yes
<i>Security:</i> Do not increase TRD on National Forest System lands except to grant legal access to inholders.	There has been no net increase in TRD.	No net increase in TRD would result with implementation; there would be a net decrease of ~3%.	Yes (TRD would increase temporarily during implementation)
ORD = Open Motorized Access Density, TRD = Total Motorized Access			

AMENDMENT 19

BACKGROUND

Amendment 19 (A-19 USDA Forest Service 1995) of the Flathead Forest Plan is a comprehensive

programmatic strategy that addresses grizzly bear habitat security. It was developed to minimize negative impacts of motorized access identified in the 1987 Grizzly Bear Compendium (IGBC 1987), and was based on recommendations of the 1994 IGBC Taskforce Report and the 1993 progress report for the South Fork Grizzly Bear Project (Mace and Manley 1993), commonly referred to as the South Fork Study.

Amendment 19 provides motorized access standards and objectives for grizzly bear habitat management. The forest standard includes “no net increase” in total or open motorized road access density and “no net decrease” in security core and “Forest Service actions will result in a net gain towards the objectives on National Forest System Lands.” The forest plan objectives include the following: 1) limit high density (> 1 mile/square mile) open motorized access to no more than 19% of a BMU Subunit; 2) limit high density (> 2 miles/square mile) total motorized access to no more than 19% of a BMU Subunit and; and 3) provide security core areas that equal or exceed 68% of each BMU Subunit (referred to as 19/19/68 objectives). These objectives applied to all grizzly bear subunits that are predominantly (greater than 75 percent) National Forest System (NFS) land.

At the time Amendment 19 became forest direction in 1995 the two grizzly bear subunits associated with the Glacier Loon Project were less than 75% NFS ownership. One of the litigation disputes on the Glacier Loon Project was whether the Amendment 19 numerical access objectives apply to the subunits in the Project area due to The Nature Conservancy's 2010 donation of land to the Forest Service, which included land in the Glacier Loon and Buck Holland subunits.

Amendment 19 and the Glacier Loon Project

In a recent court order on the Glacier Loon Project the judge found that under the Forest Plan as it currently stands, the specific numerical objectives required for lands that are predominantly National Forest System lands under Amendment 19 apply to the Glacier Loon and Buck Holland subunits.

As described previously, during the activities proposed with the Glacier Loon Project there would be a temporary increase in the ORD and TRD in whichever subunit the activities were occurring; the road densities would be changing on a regular basis, both increasing and then decreasing, as restricted roads and temporary roads are utilized, then closed or reclaimed. The changes in ORD and TRD would be temporary; there would be no net increase in open or total motorized road densities and no net decrease in security core at the completion of the project. During project increases in ORD and TRD, could result in displacement of individual grizzly bears in areas where activity is occurring. Spring timing restrictions and no activity during fall hyperphagia (August 31st to November 15) would reduce displacement when forage may be limited due to seasonal change in the project area. The project would comply with inactive subunit guidelines, limited salvage activities (maximum of 30 days in aggregate) would occur during the grizzly bear active season. The remainder of project activities would occur during the denning period. No activities would occur in security core, providing a large area free from effects of displacement.

Table 3- 72 and Table 3- 73 display the open road density (ORD) and total road density (TRD) by individual subunit and by alternative. The road densities are displayed for pre-project (existing), during project, and post-project. The ‘during project’ estimates are a worst case scenario, assuming all units are active at the same time, all haul routes and temporary roads being used. Based on current timelines for the proposed project, the majority of the activities would occur during the denning period for bears eliminating the possibility for the “worst case scenario” during project ORD calculations below in Table 3- 73a.

TABLE 3- 72 POST PROJECT RESULTS OPEN ROAD DENSITY (ORD) AND TOTAL ROAD DENSITY (TRD)												
SUBUNIT NAME	EXISTING			ALT. B			ALT. C			ALT. D		
	% ORD	% TRD	% CORE	% ORD	% TRD	% CORE	% ORD	% TRD	% CORE	% ORD	% TRD	% CORE
Buck Holland	23.78	40.83	41	23.78	40.73	41	23.78	40.73	41	23.78	40.73	41
Glacier Loon	22.06	43.28	40	21.96	42.83	40	21.96	40.32	40	21.96	40.32	40

TABLE 3- 73A DURING IMPLEMENTATION ¹ OPEN ROAD DENSITY (ORD) AND TOTAL ROAD DENSITY (TRD)						
SUBUNIT NAME	ALT. B		ALT. C		ALT. D	
	% ORD	%TRD	%ORD	%TRD	%ORD	%TRD
Buck Holland	24.05	40.84	24.66	40.83	24.66	40.83
Glacier Loon	41.90	47.28	40.73	46.65	38.13	46.08
¹ Assuming all units are active at the same time; all haul routes and temporary roads being used simultaneously						

TABLE 3- 74B DURING IMPLEMENTATION ¹ OPEN ROAD DENSITY (ORD) AND TOTAL ROAD DENSITY (TRD)						
SUBUNIT NAME	ALT. B		ALT. C		ALT. D	
	% ORD	%TRD	%ORD	%TRD	%ORD	%TRD
Buck Holland	30.34	40.84	30.34	40.83	30.34	40.83
Glacier Loon	41.90	47.28	40.73	46.65	38.13	46.08
¹ Assuming all units are active at the same time; all haul routes and temporary roads being used simultaneously						

Table 3-73b displays the during implementation road densities for both the Glacier Loon and the Beaver Creek project. While the Beaver Creek project activities would affect road densities in the project subunits, the percentage of ORD >1 mi/mi² and the percentage of TRD >2 mi/mi² in the Glacier Loon subunit and the percentage of TRD in the Buck Holland subunit would not change. This is because the effects to road densities from the Beaver Creek project would occur in areas where road densities would exceed these levels based on the Glacier Loon project existing or during project A19 calculations. The Beaver Creek project would not have a during project or post project reduction to Security Core in the Glacier Loon or Buck Holland subunits.

The existing conditions of neither the Buck Holland nor Glacier Loon grizzly bear subunits meet the A19 objectives of 19% ORD, 19% TRO and 68% security core. At project completion, the Glacier Loon project would reduce total road densities in both subunits and would decrease open road densities in the Glacier Loon subunit. After project completion the Buck Holland and Glacier Loon subunits would still not meet A19 numerical objectives for ORD, TRD, or security core. As discussed below in 2014 the USFWS issued a Biological Opinion, based on a 2009 Biological Assessment revising the schedule for meeting these objectives. The effects of access management on the Flathead National Forest, including the Buck Holland and Glacier Loon subunit road densities, were fully considered in the 2014 A19 Biological Opinion.

In 2009 the Flathead Forest submitted a Biological Assessment for A19 and a revised schedule for allowable sale quantity and objectives and standards for grizzly bear habitat management. This schedule revised the 2005 A19 implementation schedule through 2018 or until consultation on a revised Forest Plan is completed, by committing to complete specific actions that will reduce open motorized access density (OMAD) and total motorized access density (TMAD), as well as increase core (areas with no motorized route access) within specific grizzly bear subunits. The 2009 BA stated:

"The Forest proposes to revise the implementation schedule for A19, based in part on the following factors: 1) the Forest realized in 1995 there may be unanticipated or impractical results obtained when the A19 objectives were applied to site specific analyses; 2) the FNF Forest Plan has not yet been revised; 3) the best available science indicates that the NCDE grizzly bear population was growing in terms of abundance, occupied habitat and connectivity in areas of historically low genetic interchange; 4) the 2004 abundance estimate of 765 grizzlies more than doubled the existing estimate; 5) the ongoing partnerships to determine grizzly bear population trend; and 6) annual costs of currently authorized decommissioning basically exhausts the Forest's financial capacity" (USDA 2009).

On January 31st, 2014 the USFWS issued a biological opinion on the effects of the revised implementation schedule for A19 extending the time frame for implementation access management direction and objectives through 2018 (USDI-USFWS 2014). The USFWS defined “harm” to grizzly bears as; “when OMAD (ORD) exceeds 1 mile per square mile in 19 percent of a subunit and TMAD (TRD) exceeds 2 miles per square mile in 19 percent of a subunit” (USDI-USFWS 2014). This condition occurs in the project subunits and the Flathead Forest received “take” for this condition in the USFWS’ 2014 biological opinion on A19. The USFWS (USDI-USFWS 2014) acknowledges “that recent information on the grizzly bear population in the NCDE (Kendall 2009, Mace et al. 2011) suggests that the grizzly bear population has grown despite the fact that A19 management direction has not been met in every grizzly bear subunit” including Buck Holland and Glacier Loon.

The Glacier Loon and Buck Holland subunits do not meet the 19/19/68 objectives under forest plan Amendment 19. However, the Glacier Loon project would reduce road densities (Table 3-72) in both project subunits and result in a reduction of 4% TRD in the Glacier Loon subunit. The project would result in progress towards A19 objectives improving habitat security for bears. Project design features and compliance with Forest Plan direction and the SVGBCA would favor the needs of the bear (see below). The USFWS’s 2014 Biological Opinion on the Amendment 19 Revised Schedule examined the period from the end of 2009 through 2018, the access improvements that have been accomplished during this period, planned access improvements, and additional access changes included in recent project decisions and/or consultations. The 2014 Incidental Take Statement specifically included the existing habitat baseline in the Glacier Loon and Buck Holland subunits.

On September 6, 2016, the USFWS issued a letter stating that they find that the access conditions of the seven Swan Valley subunits, including Glacier Loon and Buck Holland, are consistent with the USFWS effects analysis in the 2014 biological opinion on A19 and the incidental take statement issued for that biological opinion (Project File Section AA).

IGBG GUIDELINES AND MANAGEMENT SITUATION 1 LANDS

The IGBC developed the Interagency Grizzly Bear Guidelines (Interagency Grizzly Bear Committee 1986) in order to promote conservation of the grizzly bear. The Flathead National Forest has incorporated the guidelines into its Forest Plan (Appendix OO). The IGBC established grizzly bear management situations. The Glacier Loon Project is located in MS-1. Management direction for these lands is:

“Grizzly habitat maintenance and improvement, and grizzly-human conflict minimizations will receive the highest management priority. Management decisions will favor the needs of the grizzly bear when grizzly habitat and other land use values compete.”

Management decisions and Design Criteria (Table 2- 16) for this project favor, and make this project compatible with, the needs of grizzly bear recovery and conservation by:

- Strict adherence to a grizzly bear subunit rotation by major landowners and cooperators (Forest Service, DNRC, and TNC) that leaves every subunit in the Swan Valley inactive for a minimum of 3 years;
- Within inactive, disturbance to grizzly bears would be minimal and limited to only 30 days in aggregate for salvage activities during the bear’s active period. The remainder of commercial activities would occur during the denning period;
- Commercial activities would not occur in spring habitats during the spring period. Within Inactive subunits, no commercial or salvage activities would occur in the fall between August 31st and November 15th;
- Retention of visual screening along open roads;
- Open and total road density restrictions. There would be no net increase in motorized road density;

- Decommissioning of roads would improve motorized access conditions in the project subunits and contribute towards meeting A19 subunit numerical objectives;
- The maintenance of a minimum of 40 percent cover across all ownerships in the affected subunits;
- Linkage zone designation for grizzly bears in the affected subunits;
- Under all alternatives, the contract for the Glacier Loon Project would include a clause for the temporary suspension or cessation of activities, if needed, to resolve any grizzly bear/human conflict; and
- A Special Order (2010) is in effect that requires all users of NFS lands in the Swan Valley, and throughout the Flathead National Forest, to store food, garbage and other bear attractants in a bear-resistant manner. This special order is included in all contracts associated with the project.

Further strategies to manage the lands encompassing the proposed Glacier Loon Project in a manner that favors the grizzly bear include active participation in Bear Smart Community Programs, a District Bear Ranger Program, and land acquisition endeavors.

CANADA LYNX

ANALYSIS AREA

SPATIAL BOUNDS

In accordance with the Lynx Conservation Assessment and Strategy (USDA Forest Service et al. 2000), 109 Lynx Analysis Units (LAU's) were identified and mapped on the Flathead National Forest. Lynx Analysis Units approximate the size of an area used by an individual lynx and encompass both lynx habitat and areas classified as non-habitat. The LAU's are the geographic area used to analyze direct, indirect, and cumulative effects for Canada lynx. The proposed Glacier Loon Project is located across six LAUs (See Map 3-5):

- Buck
- Elk
- Glacier
- Holland
- Lower Beaver
- Upper Beaver

TEMPORAL BOUNDS

The length of time for effects analysis is approximately 1 to 5 years. This is based on the probable contract length for the Glacier Loon Project, the timeframes for related activities, and the reasonably foreseeable actions identified. Effects from activities would last approximately 1-20 years. Specific duration of different direct, indirect or cumulative effects are discussed below.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included aerial photography, stand exams, Vector Map (VMAP) Data, field surveys of downed logs, old growth surveys, project area field visits to verify lynx habitat classification, research literature, and GIS and dataset information for features such as general forest attributes, slope, aspect, habitat type, forest type, elevation, and mapped lynx habitat.

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology of lynx, certain elements are thought to be essential to the conservation of the species. These elements include the presence of snowshoe hares and their preferred habitat conditions (forage) and sites for denning. These elements of lynx habitat, and the anticipated effects to these elements from project implementation, are the measurement indicators used in this analysis.

AFFECTED ENVIRONMENT

POPULATION AND HABITAT STATUS

Canada lynx were listed as a threatened species under the Endangered Species Act (ESA) in 2000, and The Lynx Conservation Assessment and Strategy (LCAS) was developed in 2000 to provide a consistent and effective approach to conserve Canada lynx (*Lynx canadensis*) and to assist with Section 7 consultation under ESA on federal lands in the contiguous United States (LCAS 2000). In 2007, the Northern Rockies Lynx Management Direction, or NRLMD (USDA 2007), was completed. The NRLMD amended 18 USFS Northern Region Forest Plans. The U.S. Fish and Wildlife Service prepared a biological opinion on the effects of the amendment and determined that the NRLMD was not likely to jeopardize lynx (USDI 2007). The NRLMD has been incorporated as lynx management direction into the Flathead National Forest Plan and includes standards and guidelines that are intended to avoid or reduce adverse effects to Canada lynx. The NRLMD directs the continued use of LAU's for effects analysis. The Glacier Loon Project is located in the Buck, Elk, Glacier, Holland, Lower Beaver, and Upper Beaver LAU's.

Lands within the LAU's have been delineated into lynx habitat and non-lynx habitat. This delineation is based on both elevation and snow-depth, and on site characteristics; non-habitat includes dry forest habitat types, areas with less than 24-30 inches of snow, high elevation habitat types on specific sites, and other unusable areas such as permanent water, rock, and human development. Most of the project area is located in designated lynx habitat; the only portion of the project area not in lynx habitat is the area adjacent to Highway 83 (proposed units 32-40; 157 acres).

The Interagency Lynx Biology Team (ILBT) identified core areas in the LCAS. Northwestern Montana is included as one of these core areas. Core areas are places where long-term persistence of lynx and recent evidence of reproduction have been confirmed (LCAS 2000). Core areas were identified to be the areas with the strongest long-term evidence of the persistence of lynx populations supported by a sufficient quality and quantity of habitat (LCAS 2000; IBLT 2013).

Canada lynx modeled habitat is widespread across USFS Region One and the Flathead National Forest (USDA 2007). A Regional multi-scale lynx habitat assessment by Hillis et al. (2002) 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. Table 3- 74 summarizes the situation for potential Canada lynx habitat across the region and forest level. However, the assessment only analyzed stand initiation habitat and did not include estimates for multistory forage. As described above, at the USFS Region One scale, foraging habitat is only present on 5.4% of lynx habitat, below the historic average. However, the fires of 1988, 2000, 2001, 2003, and 2007 have provided a substantial “pulse” of unsuitable habitat that will provide foraging habitat after 5 -15 years post-burn depending on the burn conditions. The results of the information displayed in Table 3- 74 suggest that, at the broad-scale, foraging habitat may be limiting to lynx and denning habitat is not limiting.

The NRLMD standard for a maximum of 30% unsuitable habitat within an LAU was imposed to avoid timber management that results in “boom or bust” foraging conditions for lynx. The existing amount of unsuitable habitat is consistent with the pattern expected from large burns.

TABLE 3- 75 LYNX HABITAT COMPONENTS AT THE FLATHEAD NATIONAL FOREST AND REGION ONE SCALES.				
HABITAT COMPONENT	HISTORIC RANGE OF VARIABILITY*	NORTHERN ROCKIES LYNX MANAGEMENT DIRECTION	FLATHEAD NATIONAL FOREST	REGION ONE
Unsuitable	9.5%	30% max	10%	9.2%
Foraging	19%	--	5%	5.4%
Denning	10%	Distributed	--	15.1%
* Historic Range of Variability reflects average conditions before fire suppression or logging substantially changed vegetative patterns.				

Lynx have evolved with forest disturbance (LCAS 2000). Stand-replacing fire has been a dominant influence historically in the northern Rocky Mountains. The dominant regime in lynx habitat in pre-

settlement times was long-interval (40–200 years), high severity, stand-replacing fire in continuous forests of lodgepole pine, spruce, and subalpine fir, often with smaller acreages subjected to non-lethal, low-severity fires in the intervals between stand-replacing fires (LCAS 2000). Dense regenerating vegetation as stand initiation from disturbance or as an understory in stands provides horizontal cover for snowshoe hare. The amount and density of horizontal cover strongly influences snowshoe hare abundance (Mills et al. 2005). Depending on the prescription type, vegetation management may mimic natural disturbance and can reduce stand density and encourage understory growth (Fuller and Harrison 2010).

Snowshoe hares are the primary prey of lynx, comprising 35–97% of the diet throughout the range of the lynx (Apps 2000, Mowat et al. 2000, Squires and Ruggiero 2007, Burdett 2008, Hanson and Moen 2008, Maletzke et al. 2008, Shenk 2009). Lynx habitat selection largely reflects that of hares, both seasonally as well as through the hare population cycle (Mowat and Slough 2003, Squires and Ruggiero 2007, McCann and Moen 2011).

Squires and Ruggiero (2007) found that lynx in western Montana prey almost exclusively on snowshoe hares during the winter; good hare habitat equates to good foraging habitat for lynx. Foraging habitat for lynx includes dense sapling size stands (e.g., stand initiation) that would likely support snowshoe hare (USDA 1999a) and multistory forest stands that include dense patches of trees or shrubs or overstory trees with limbs that touch the ground. Red squirrels are an alternate prey species; however, in northwestern Montana red squirrels were only 2% of the biomass of the winter diet (Squires and Ruggiero 2007).

Squires et al. (2010) found that in the winter, lynx foraged in mature, multi-layer forests with Engelmann spruce and subalpine fir in the overstory and midstory. The importance of multistory forests is further supported by Berg (2010) and Berg et al. (2012), which documented the highest hare densities in multi-story forests in Wyoming. In northwest Montana, forests used during winter were composed of larger diameter trees with higher horizontal cover, more abundant snowshoe hares, and deeper snow (Squires et al. 2010). During the winter, lynx selected an elevation band between 1,260 -2,355 m or 4,134 - 7,726 ft (Squires et al. 2010). During summer, lynx broadened their resource use to select younger forests with high horizontal cover, abundant total shrubs, abundant small-diameter trees, and dense saplings, especially spruce and fir saplings (Squires et al. 2010). Squires (2010) recommended that, "Given that lynx in Montana exhibit seasonal differences in resource selection, we encourage managers to maintain habitat mosaics. Because winter habitat may be most limiting for lynx, these mosaics should include abundant multistory, mature spruce–fir forests with high horizontal cover that are spatially well-distributed" (Squires et al. 2010). This science is consistent with management direction in the NRLMD. The NRLMD sets standards, objectives and guidelines for lynx habitat including early stand initiation, stand initiation and multi-story forage (i.e. Veg S1 -Veg S6). The mosaic of forest openings and lynx forage throughout the project LAUs were considered in regard to habitat distribution and lynx travel when designing the proposed project.

Composition of a landscape between forest stands that support snowshoe hares and adjacent less suitable stands has been studied to examine influence on snowshoe hare densities, lynx foraging, and movement. Lewis et al (2011) found stand density and moist stand habitats as the best predictors of high hare densities. Lewis et al. (2011) also detected a negative correlation for snowshoe hare density within 300 m of open stand types. However, snowshoe hare and lynx are a disturbance dependent species where a mosaic of stand conditions persists into the future. Fuller and Harrison (2010) examined lynx foraging strategies and found high forage selection for past clear-cuts with high stem density and tall regenerating trees. Lynx traversed through stands with low understory density less than randomly expected (Fuller and Harrison (2010). Squires et al. (2013) found that lynx selected high densities of vegetative cover when traversing landscapes. Squires et al. (2013) points out that vegetative density can decrease as forests age. At the population level, Squires et al. (2013) suggests that degree of infrastructure (highway traffic volume, urbanization) most impacts landscape connectivity for lynx movement. Information from Squires et al. (2013) suggests that while forest fragmentation between patches of lynx habitat can increase resistance to lynx movement, lack of genetic isolation within the population indicates good landscape connectivity through the northern

region (Schwartz et al. 2002). Squires et al. (2013) identified a large scale putative corridor for lynx connectivity from Canada to the Northern Rockies that extended from the Whitefish range down the western front of the Swan Mountains to Seeley Lake. None of the proposed activities would occur on the western front of the Swan Mountains. The Glacier Loon project considered Squires et al. (2013) and structured treatments to maintain lynx foraging and travel habitats in a mosaic pattern across the project LAUs suitable for lynx travel. The NRLMD speaks to making habitats permeable for lynx and maintaining travel and foraging habitats. Developed corridors such as highways or urbanization that most impact connectivity for lynx are not a part of the Glacier Loon project. Furthermore, State Highway 83 bisects the Swan Valley, but it does not appear to impede movement since radio-collared lynx have been documented to cross this highway (Squires and Laurion 2000, Squires et al. 2013).

Denning habitat includes older forest stands where larger amounts of down woody material would be expected to occur (USDA 1999a). In a study in northwestern Montana (Squires et al. 2006), it was found that lynx denned in pre-existing sheltered spaces created by downed logs (62%), root-wads from wind-thrown trees (19%), boulder fields (10%), slash piles (6%), and live trees (4%). Squires et al. (2008) found that female dens were primarily located in spruce-fir stands with abundant coarse woody debris and high horizontal cover; however denning did occur in stands with coarse woody debris but insufficient cover for snowshoe hares. In this study, 80% of dens were in mature forest stands and 13% in mid-seral regenerating stands; young regenerating stands and thinned stands were seldom used for denning. Lynx denning habitat did not appear to be limiting in Northwestern Montana (Squires et al. 2008).

Kosterman (2014) examined reproductive success of five simplified forest structure types within female home ranges. Kosterman (2014) found that 50 percent mature forest and approximately 10 – 15 percent young regenerating forest appeared to be the optimal combination of structure types. However, Kosterman's (2014) work did not include a detailed examination of forest understory density for stand initiation or multistory lynx foraging conditions. Instead, the analysis classified general forest types from satellite imagery and VMAP. Kosterman's coarse classifications cannot be directly compared to the project area analysis as the Glacier Loon analysis was based on stand visits to determine presence of lynx foraging habitat. Further, the habitat analysis included in this report represents a more detailed and accurate classification of lynx habitat as it includes representation of types of lynx foraging habitats, is consistent with the best available science and is not based solely on simplified forest structure classes from remotely sensed imagery.

Lynx are expected to occur over much of the FNF, with over 1.7 million acres (73% of the forest) modeled as lynx habitat (USDA 2006b). Lynx populations appear to occur at naturally low densities, probably because of limited habitat and limited availability of their primary prey, snowshoe hares. The FWS (USDI 2000) concluded when listing the species that a resident population of lynx is distributed throughout its historic range in Montana. Numerous historic and current lynx records exist in western Montana; winter snow-track surveys and ongoing telemetry studies indicate a number of lynx in Montana as well. There are numerous reports of lynx sightings or their tracks across the FNF, including those of lynx adults with kittens (USDA 2006b). Although lynx populations are difficult to monitor without the aid of large-scale telemetry or hair snare programs, efforts such as carnivore snow-track surveys, lynx hair-snare sampling, and the compilation of incidental sightings continue across the forest. Canada lynx are known to occur within the Glacier Loon project LAUs; there have been multiple confirmed detections from 2011 up to the present. Winter track transects have been documented to be an effective way of detecting lynx within an area (Squires et al. 2012). It should be noted that carnivore surveys (2012-2017) in the Swan Valley have detected more lynx in the Glacier Loon and Beaver Creek areas than anywhere else in the valley; indications are that this area is important habitat for Canada lynx as well as other carnivore species (SWCC monitoring Team progress report, 2015; Project File Exhibit H-9).

The Seeley area is located due south of the 6 project LAUs. For the Seeley area, a letter to Missoula County Rural Initiatives stated, "preliminary analysis of population viability suggest that lynx in the Seeley area may be declining, so concerns for maintaining available habitat does have a scientific bases" (Squires 2009). Lynx vital rates such as adult and kitten survival can drive population trend.

These rates can be influenced by prey density, predation and other mortality from trapping and shooting (Squires et al. 2006; Squires et al. 2010). The preliminary analysis in Squires (2009) was based on empirical data, but adult survival, not habitat was determined to be the driving factor behind the indication of population decline. No relationship was determined between adult survival and habitat in the modeling exercise (USDA 2013). Population trajectory for lynx in another area (the Yaak) was also calculated as part of the evaluation used in Squires (2009). Population trend in this area, where the NRLMD is also applied, was found to have an increasing population trend. Among the differences between the Yaak and Seeley areas is the amount of non-federal land. The Yaak is almost entirely federal land (NFS land), while the Seeley area has a substantial amount of interspersed non-federal land, that generally does not support lynx (USDA 2013). The FWS determined (USDI 2013) that Squires' 2009 letter, along with other information made available since 2007 (USDA 2013), is consistent with information considered for the NRLMD's 2007 Biological Opinion.

The following table (Table 3- 75) displays the existing condition for lynx habitat within the affected Lynx Analysis Units, those LAU's that are at least partially located within the Glacier Loon Project Boundary. The total percentages and acres for potential habitat were determined using V-Map (2006 R1-VMP). Specific treatment units were field verified to confirm lynx habitat proposed in treatment units.

TABLE 3- 76. EXISTING SITUATION FOR LYNX AND NON-LYNX HABITAT IN AFFECTED LAU'S

LAU NAME	TOTAL LYNX HABITAT ACRES (% OF LAU)	MODELED AND FIELD VERIFIED LYNX HABITAT				PERMANENT NON-LYNX ⁵ HABITAT ACRES (% OF LAU)	LAU TOTAL ACRES
		EARLY STAND INITIATION ¹ ACRES (% OF LYNX HABITAT)	STAND INITIATION HARE HABITAT ² (PROVIDES WINTER FORAGE) ACRES (% OF LYNX HABITAT)	MULTISTORY HARE HABITAT ³ (PROVIDES WINTER FORAGE) ACRES (% OF LYNX HABITAT)	STEM EXCLUSION ⁴ (NON-FORAGE; INCLUDES MULTISTORY THAT IS NON- FEEDING) ACRES (% OF LYNX HABITAT)		
Buck	12,988 (53%)	1,429 (11%)	1,818 (14%)	2,598 (20%)	7,143 (55%)	11,705 (47%)	24,693
Elk	25,517 (87%)	3,828 (15%)	4,593 (18%)	6,379 (25%)	10,717 (42%)	3,804 (13%)	29,321
Glacier	25,489 (82%)	4,146 (16%)	5,098 (20%)	5,098 (20%)	11,147 (44%)	5,550 (18%)	31,039
Holland	10,942 (69%)	1,094 (10%)	1,751 (16%)	2,188 (20%)	5,909 (54%)	5,032 (31%)	15,974
Lower Beaver	19,722 (88%)	1,381 (7%)	3,155 (16%)	5,917 (30%)	9,269 (47%)	2,730 (12%)	22,452
Upper Beaver	11,655 (57%)	3,147 (27%)	1,632 (14%)	3,496 (30%)	3,380 (29%)	8,816 (43%)	20,471

¹Stand initiation structural stage that *currently does not provide* winter snowshoe hare habitat. It may provide summer forage. This structural stage has also been referred to as 'unsuitable' (NRLMD).

²Structural stage where the trees have grown tall enough to protrude above the snow in winter.

³Multistory structural stage with many age classes and vegetation layers that *provide snowshoe hare habitat*. The amount of Multistory structure is *likely an over-estimate* and may be a maximum rather than an average percentage. For this reason the figure has been rounded to the nearest 5%. This structural stage would include denning habitat.

⁴Stem Exclusion structural stage is closed canopy with limited understory or a Multistory structural stage with many age classes but vegetation layers that *do not provide snowshoe hare habitat*. This structural stage may include denning habitat.

⁵Includes dry forest habitat types, rock outcrops, low elevations, sites dominated by dry grass/forbs/shrubs, and bodies of water if present within the LAU.

The difference between "LAU Total Acres" and "Total Lynx Habitat Acres" in Table 3- 75 is the acreage of areas that are not lynx habitat due to water, rocky areas, dry forest types or low elevation (snow depth factor). "Total Lynx Habitat Acres" are suitable vegetative areas within an LAU that may provide forage, denning, or hiding cover for lynx based on snow depth and potential natural vegetation. "Early stand initiation" acres are areas that do not currently provide winter lynx forage such as sapling stands that are not tall enough to extend above the snow or dense enough to provide suitable horizontal cover for snowshoe hare. "Stand initiation" structural stage acres and "Multistory" structural stage acres currently provide winter snowshoe hare habitat and are considered to be lynx foraging habitat. "Stem Exclusion" includes mature forest stands not providing snowshoe hare habitat. Some of these stands may contain larger amounts of down woody material to support lynx denning. These acres could also function as habitat for lynx hiding cover to travel between foraging stands. Old, mature forest stands (including designated old growth) were included as potential denning habitat. Ongoing research suggests that lynx also commonly use second growth stands as denning habitat if there is a down woody component (e.g. stumps, root wads, blowdown).

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A - NO ACTION DIRECT AND INDIRECT EFFECTS

Since there would be no vegetation treatments or associated activities proposed with this alternative, there would be no direct effects to Canada lynx as a result of implementing Alternative A – No Action; there would be no loss of forage habitat or hiding cover, no decrease in security, and no displacement from the management activities proposed in the Glacier Loon Project. Within the old Crazy Horse Fire burn area, trees and shrubs would continue to grow thicker and taller; stands that only provide summer forage for lynx now, because they are too short to protrude above the snow in winter, would continue to grow, becoming good winter hare habitat (i.e., stand initiation hare habitat). Red squirrel habitat (alternate prey for lynx) would be maintained in old growth and other mature forest stands across the Glacier Loon Area.

Indirectly, not implementing the proposed vegetative treatments could increase the risk of a wildfire burning more intensely in the project area in the future, which could result in changes in available forage and cover for lynx. Fires have historically produced both positive and negative effects for lynx; loss of hiding cover and a decrease in hiding cover connectivity would be a potential negative effect. On the positive side, forage habitat would be potentially increased. The Beaver Creek project would occur in the Lower and Upper Beaver LAUs and would reduce lynx foraging habitat, and recruit early stand initiation habitat in these LAUs. There would be no MA changes under the No Action Alternative, and no road decommissioning.

ALTERNATIVE A - NO ACTION CUMULATIVE EFFECTS

In forest stands where the Glacier Loon Project is proposed, natural vegetative processes would continue on NFS lands in and adjacent to the project area. The juxtaposition of forage and denning habitat and hiding cover would change over time as open areas provide more forage, then grow in and provide cover habitat.

As described above, by not implementing the Glacier Loon Project, there could be an increase in the potential for a larger, stand-replacing wildfire to occur in the project area; this would be largely determined by the location, temperature, winds, drought conditions, etc., at the time of the fire start. A large, intense wildfire would potentially decrease lynx forage for 20 years and hiding cover for 10 to 20 years; forage production and hiding cover would begin to increase as seedlings grow into saplings. Fire-killed trees and older trees would die and fall over, likely increasing the amount of available denning habitat; overstory cover would take the longest time to grow back (e.g., 50 to 100 years).

The Glacier Loon Area contains established human activities, including vegetation management, road management, private land development, and recreational use. Road construction and logging activity have occurred on Federal and private forested land throughout the Swan Valley. Most major logging activity on NFS lands, including road building, occurred almost a decade ago. Logging and road construction have continued on private timberlands up to the present time. There has been timber harvest to the northwest, in the Hemlock and Elk Creek Area, and other management activities to the east of the project area, across MT Highway 83, in the Meadow, Smith, and Buck Creek Areas.

Timber removal **occurred** on Legacy Lands throughout the Swan Valley as part of the Fiber Agreement between TNC and PCTC (including Fredswood, Mac-n-Cheese, Pickpocket, Krafty13, Elk Meadow, Elk Point, Last Gasp, Barber Chair, Beaver Highway and Two Bears harvests). In addition, south of the Glacier Loon Project Area, across the Summit Divide, is the Lolo National Forest where various forest management activities are occurring similar to the Flathead National Forest (e.g., Colt Summit Project). **Additionally, two other TNC harvests occurred within the lynx analysis units after the 2012 EA was published; the Two Bears project was located in the Lower Beaver LAU and the Last Gasp project was located in the Buck LAU. The Two Bears project was logged in December 2012 through February 2013. The Last Gasp project was logged in February and March 2013. Both activities have been completed. The Last Gasp project occurred in non-lynx habitat. The Two Bears**

project reduced lynx foraging habitat and stem exclusion and recruited early stand initiation habitat in the Lower Beaver LAU. Conditions in the Lower Beaver LAU still meet NRLMD direction and provide a mosaic of forest structural stages including lynx foraging habitat that is well-distributed throughout the LAU. As part of continued acquisition of parcels from TNC, the Forest Service acquired a section of land in 2013 located in the Elk LAU which had a prior 2011/12 TNC harvest called Krafty 13. The land acquisition into NFS ownership would reduce the likelihood of private land development and promote conservation of lynx and lynx habitat into the future.

The Beaver Creek project is planned to occur in the Lower and Upper Beaver LAUs. The Beaver Creek project would affect approximately 590 acres of lynx foraging habitat in the Lower Beaver LAUs. The Beaver Creek project would also treat stem exclusion and regenerate stands contributing to early stand initiation habitat in both Lower and Upper Beaver LAUs.

The effect to Canada lynx from multiple activities occurring across the Swan Valley landscape is a decrease in hiding cover and forage, and a decrease in habitat security.

Land acquisitions by the Forest Service in the Swan Valley, and conservation easements, have helped provide security for Canada lynx by reducing the mortality risks associated with habitat fragmentation.

Alternative A would not contribute significantly to negative cumulative effects on Canada lynx in the Swan Valley.

ALTERNATIVE B (PROPOSED ACTION) DIRECT AND INDIRECT EFFECTS

Under Alternative B, there are 773 acres of Regeneration Treatment proposed (Clearcut/Seed Tree/Shelterwood) and 976 acres of Intermediate Treatment (Commercial Thin, Sanitation/Salvage, and Improvement Cut); total proposed commercial treatment is 1,749 acres. There are also 353 acres of non-commercial treatment proposed in Alternative B, including 343 acres of Pre-Commercial Thinning, and 10 acres of Post and Pole Treatment. Total acres treated under Alternative B would be 2,102 acres; 1,945 acres of which are designated lynx habitat and Critical Habitat.

In a comparison of the action alternatives for the Glacier Loon Project, negative direct and indirect effects to Canada lynx would be greatest with Alternative B, slightly less with Alternative C, and least with Alternative D. This comparison is based largely on the overall amount of treatment in lynx habitat under each alternative, since Canada lynx have been found to avoid thinned areas and large clearcuts (USDA Forest Service 2010b). **Table 3- 76**, below, summarizes the effects to lynx habitat with implementation of Alternative B.

FORAGE HABITAT

Lynx productivity is highly dependent on the quantity and quality of winter snowshoe hare habitat (USDA Forest Service 2007d). Winter foraging habitat has been identified as the most critical component dictating lynx population size and distribution. Ideal winter foraging habitat supports high numbers of snowshoe hares, the primary prey for lynx (Squires et al. 2007; Squires et al. 2010). In western Montana, during the winter months, hares are most abundant in areas with dense young trees or shrubs tall enough to protrude above the snow. These dense concentrations of trees or shrubs can be found in young regenerating forests, in multi-storied forests with dense pockets of young trees or shrubs, or in older age class multi-story forests where tree boughs touch the snow surface but stem density is low (Squires, Ruggiero, et al. 2006). Under Alternative B, there would be a decrease of 517 acres of existing lynx forage due to proposed vegetative treatments, including regeneration and intermediate treatments, as well as non-commercial treatment and proposed slash disposal. The reduction of lynx forage habitat would occur in stand initiation hare habitat (252 acres), multi-story hare habitat (147 acres) and early stand initiation hare habitat in the Crazy Horse Fire Area that is becoming winter hare habitat (118 acres), but is proposed for Pre-Commercial Thinning. The reduction of lynx forage would occur within the WUI boundary. This reduction in lynx forage within the WUI is allowed as an exception in the NRLMD (USDA Forest Service 2007c) and is

discussed more in depth in that section of this effects analysis.

The reduction in lynx forage resulting from the implementation of Alternative B would not be permanent; natural regeneration and planted seedlings would eventually grow back and provide snowshoe hare habitat. Lynx are a disturbance dependent species; disturbances that create early successional forests (e.g., insects) provide, over time, forage and cover for snowshoe hare (Ruggiero et al. 1994). However, it should be noted that where regeneration harvest is proposed, lynx foraging opportunities may not increase for 20 years or more; Squires (Squires et al. 2010)(USDA 2010) found that in Montana, hares are not using regenerated stands as early as originally thought (e.g., not in 15 years after logging or fire). Also, if the regenerated stands are pre-commercially thinned in the future, then an increase in winter forage habitat for lynx would not occur, or only occur briefly in summer feeding habitat.

TABLE 3- 77 . PROPOSED TREATMENTS BY LYNX ANALYSIS UNIT (LAU) AND STRUCTURAL STAGE

LAU NAME	EARLY STAND INITIATION ¹	STAND INITIATION HARE HABITAT ²	MULTISTORY HARE HABITAT ³	STEM EXCLUSION ⁴ (NON- FORAGE; INCLUDES MULTISTORY THAT IS NON-FEEDING)
	ACRES	(PROVIDES WINTER FORAGE)	(PROVIDES WINTER FORAGE)	
	(% OF LYNX HABITAT)	ACRES	ACRES	ACRES
Buck	-	-	-	47
Elk	-	8	12	132
Glacier	-	316	31	375
Holland	-	-	-	238
Lower Beaver	-	13	-	208
Upper Beaver	-	-	-	25

¹Stand initiation structural stage that *currently does not provide* winter snowshoe hare habitat. It may provide summer forage. This structural stage has also been referred to as 'unsuitable' (NRLMD).

²Structural stage where the trees have grown tall enough to protrude above the snow in winter.

³Multistory structural stage with many age classes and vegetation layers that *provide snowshoe hare habitat*. The amount of Multistory structure is likely an over-estimate and may be a maximum rather than an average percentage. For this reason the figure has been rounded to the nearest 5%. This structural stage would include denning habitat.

⁴Stem Exclusion structural stage is closed canopy with limited understory or a Multistory structural stage with many age classes but vegetation layers that *do not provide snowshoe hare habitat*. This structural stage may include denning habitat.

DENNING HABITAT

Lynx den sites are predominately found in mature boreal forest stands that have a large amount of cover and abundant, coarse, woody debris, such as downed trees and root wads (Miller et al. 2005; Squires et al. 2008). Den sites have also been associated with moister forest stands containing denser understory cover (Squires et al. 2008). Under Alternative B, there is proposed treatment in 327 acres of existing lynx denning habitat; due to proposed harvest and slash disposal treatments, available denning habitat for lynx would be decreased in the Glacier Loon Project Area as a result of these proposed treatments. Many of the multi-story feeding stands mentioned above under forage habitat (125 acres) provide denning habitat, as well as forage habitat; the loss of denning habitat in those stands would be additional to the 327 acres of denning habitat that do not provide forage habitat.

The reduction of lynx denning habitat would occur both within and outside of the WUI. As discussed above, denning habitat for lynx is not a limiting factor at the broad scale. In the Glacier Loon Project, there are no proposed units located in old growth habitats or other older forest stands with large diameter down woody debris. These are the habitats that would provide the highest quality denning habitat for lynx.

STEM EXCLUSION LYNX HABITAT

Stands of trees in designated lynx habitat with a relatively closed overstory canopy and limited understory vegetation are labeled as stem exclusion lynx habitat. Stem exclusion habitat does not

provide lynx forage (hare habitat) due to a lack of horizontal cover. Stem exclusion stands usually provide hiding cover for travel and may provide denning habitat.

In Alternative B, there are treatments proposed in 1,101 acres of existing stem exclusion habitat. Of this total treatment in stem exclusion lynx habitat, 580 acres are proposed Regeneration Treatment, 511 acres would be Intermediate Harvest, and 10 acres would be proposed Post and Pole Treatment. In the Intermediate Harvest Units, there would be trees left in the overstory (approximately 50 to 150 trees per acre); some of these units would likely still provide hiding cover following treatment and could be used by lynx for movement between foraging and denning habitat. In the Regeneration Units (590 acres including the Post and Pole Unit), there would be no hiding cover remaining following treatment; lynx movement patterns would change as they avoid openings in their travel across the Glacier Loon Area. Several Design Criteria (Table 2- 16) would be in place to help mitigate the effects of a loss of hiding cover; Regeneration Units would be laid out so that no point in the unit is more than 600 feet from cover, and visual screening would be retained adjacent to open roads.

Stand exclusion habitat structure is generally not progressing towards hare habitat, so although there would be a loss of hiding cover over the short term (10 to 20 years), there is also an opportunity through harvest prescriptions to move the stands towards conditions that provide future forage and/or denning habitat for Canada lynx. Intermediate cutting would open up the stands and encourage an increase in horizontal cover (understory regeneration); remaining trees in the stand would have improved growing conditions and would increase in size. Many of the stands where Intermediate Harvest is proposed would have the potential to become multi-story forage and/or denning habitat. Most of the stands where Regeneration Treatment is prescribed have a high percentage of lodgepole pine trees that have either already been attacked by mountain pine beetle or are very susceptible to attack. The proposed regeneration of these stands with the Glacier Loon Project would remove most of the existing overstory structure and return the stands to a seedling/sapling structure within approximately 5 to 20 years. It should be noted that if the future sapling stands are Pre-Commercially Thinned, there would not likely be an increase in quality forage for lynx.

LYNX HABITAT SECURITY

Adult mortality is an issue for Canada lynx (Squires et al. 2010) (Squires 2006); this includes starvation in winter and early spring, predation by lions during non-snow periods, and human conflict (e.g., accidental trapping or malicious shooting).

High human activity levels could negatively affect lynx by causing displacement from preferred habitats (e.g., winter forage areas or denning habitat). The potential for displacing Canada lynx during implementation of proposed activities is greatest in Alternative B, slightly less in Alternative C, and least in Alternative D, due to the greater amount of units (acres treated), temporary roads, and miles of restricted roads needed for access. Potential displacement would be short-term, during the length of the proposed sale activity (1 to 5 years). During this time, lynx using the area could be displaced from key habitats, which could alter their normal ability to find food, breed and raise young, or find shelter.

Potential disturbance to lynx would be partially mitigated by Design Criteria (Table 2- 16) in place for grizzly bear that limits activity during the spring period (April 1 through June 15). Road management in place for grizzly bear (USDA 1999b; USDI 1997) would also benefit Canada lynx by providing more acres of potentially secure habitat. In addition, standard contractual requirements used in all contracts provide for modification or termination of the contract to avoid impacts and protect threatened and endangered species. This allows for modification of the project should an unforeseen issue(s) be identified during operations.

Under Alternative B, no new over-the-snow routes would be created. Winter logging would be required in several units due to soil issues; however, there is no existing evidence that snow compaction from winter logging causes competition with other predators, exerting a population level threat to lynx (USDA Forest Service 2007c). As an example, Kolbe et al. (2007) provides evidence for northwest Montana that the overall influence of snowmobile trails in the Seeley Lake area appeared to be minimal. Other than the potential for short-term displacement described above, there would be no significant negative effects to lynx as a result of any planned winter logging operations.

Access to proposed units would include open roads, restricted roads, and temporary roads. Under Alternative B, there are approximately 11.5 miles of proposed temporary road construction. Temporary roads would be constructed to the minimum standards necessary for log hauling. Temporary roads would be reclaimed following use. The reclamation work would include the removal of any culverts, installing erosion control features, revegetation with native shrubs or seed mix, recontouring, and the placement of woody debris on the reclaimed road. There is always a potential for these temporary roads to be vectors of human use, but the potential is low if the reclamation work is successful.

Temporary Road #191715D, which accesses Unit 71, is located through a sapling stand that presently provides winter snowshoe hare habitat. There would be a reduction of approximately 0.4 acres of lynx forage as a result of building this temporary road. The road is located within the WUI.

Existing open roads and closed roads (currently bermed or gated) would be used to access proposed treatment units in Alternative B. Use of open roads would not be a change from the existing condition. Use of gated or bermed roads would increase human-activity levels in areas normally more secure for Canada lynx. Under Alternative B, approximately 23.6 miles of gated or bermed roads would be used for accessing proposed cutting units. The following actions would help to mitigate the potential negative effects to lynx and other wildlife species from the use of normally restricted roads:

- Roads that are currently closed, but that would be used for access and for hauling, would be closed to the general public during the time that they are used for fuel management or forest health treatments.
- Where berms are removed for access to treatment units, temporary gates would be installed.
- Contractors associated with sale operations would be prohibited from carrying firearms on normally closed roads within the project area.
- Berms would be re-installed when sale activities in that area are completed.
- Vegetation and/or rock barriers would be retained around berms and gates, where needed, to maintain closure effectiveness following sale activities.

In Alternative B, there are 4.1 miles of road decommissioning proposed. This would help to improve long-term habitat security for Canada lynx.

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no change to existing MA designations under Alternative B.

ALTERNATIVE C DIRECT AND INDIRECT EFFECTS

Effects to lynx under Alternative C are very similar to the effects described above for Alternative B. Under Alternative C, there are 685 acres of Regeneration Treatment proposed (Clearcut/Seed Tree/Shelterwood) and 871 acres of Intermediate Treatment (Commercial Thin, Sanitation/Salvage, Improvement Cut, and Modified Commercial Thin); total proposed commercial treatment is 1,556 acres. There are also 353 acres of non-commercial treatment proposed in Alternative C, including 343 acres of Pre-Commercial Thinning and 10 acres of Post and Pole Treatment. Total acres treated under Alternative C would be 1,909 acres; 1,752 acres of which are designated lynx habitat and critical habitat, summarizes the effects to lynx habitat with implementation of Alternative C.

FORAGE HABITAT

Similar to Alternative B, under Alternative C there would be a decrease of 517 acres of existing lynx forage due to proposed vegetative treatments. The reduction of lynx forage would occur within the WUI and is allowed as an exception in the NRLMD (USDA Forest Service 2007c).

DENNING HABITAT

Under Alternative C, there is proposed treatment in 263 acres of existing lynx denning habitat; available denning habitat for lynx would be decreased in the Glacier Loon Area as a result of these proposed treatments. The reduction of lynx denning habitat would occur both within and outside of the WUI.

STEM EXCLUSION LYNX HABITAT

In Alternative C, there are treatments proposed in 972 acres of existing stem exclusion habitat. Of this total treatment in stem exclusion lynx habitat, 551 acres are proposed Regeneration Treatments, 411 acres would be Intermediate Harvest, and 10 acres would be proposed Post and Pole Treatment. As described above for Alternative B, a portion of the Intermediate Harvest Units would likely still provide hiding cover following treatment and could be used by lynx for movement between foraging and denning habitat. In the Regeneration Units (561 acres including the Post and Pole Unit), there would be no hiding cover remaining following treatment; lynx movement patterns would change as they avoid openings in their travel across the Glacier Loon Area.

Stand exclusion habitat structure is generally not progressing towards hare habitat, so although there would be a loss of hiding cover over the short term (5 to 10 years), there is also an opportunity through harvest prescriptions to move the stands towards conditions that provide future forage and/or denning habitat for Canada lynx.

LYNX HABITAT SECURITY

The potential for displacing Canada lynx during implementation of proposed activities is slightly less in Alternative C than in Alternative B due to a lesser amount of acres treated, temporary roads constructed, and miles of restricted roads needed for access. Potential displacement would be short-term, during the length of the proposed sale activity (1 to 5 years). During this time, lynx using the area could be displaced from key habitats, which could alter their normal ability to find food, breed and raise young, or find shelter.

As in Alternative B, under Alternative C potential disturbance to lynx would be partially mitigated by Design Criteria (Table 2- 16) in place for grizzly bear that reduces ORD/TRDs and limits activity during the spring period (April 1 through June 15).

No new over-the-snow routes would be created under Alternative C. Other than the potential for short-term displacement described above, there would be no significant negative effects to lynx as a result of any planned winter logging operations.

Under Alternative C, there are approximately 7.4 miles of proposed temporary road construction. Temporary Road #191715D, which accesses Unit 71, is located through a sapling stand that presently provides winter snowshoe hare habitat. There would be a reduction of approximately 0.4 acres of lynx forage as a result of building this temporary road. The road is located within the WUI.

Existing open roads and closed roads (currently bermed or gated) would be used to access proposed treatment units in Alternative C. Under Alternative C, approximately 21.6 miles of gated or bermed roads would be used for accessing proposed cutting units; only slightly less than gated or bermed roads used under Alternative B. The use of normally restricted roads could cause short-term displacement of Canada lynx from habitats that are normally more secure when the road restrictions are in place. Design Criteria discussed under Alternative B to reduce the effects of the use of normally closed roads would apply to Alternative C, as well.

In Alternative C, there is 8.4 miles of road decommissioning proposed. This is twice the amount of road decommissioning as proposed under Alternative B and would help to improve long-term habitat security for Canada lynx.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative C would include a MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake.

Under Alternative C, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5

designation. On MA 15 and MA 15C lands, cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would likely translate to less regeneration cutting and road building on the forested slopes along the western side of Lindbergh Lake, increasing the potential for lynx security in those areas.

TABLE 3- 78. ALTERNATIVE C - EFFECTS TO LYNX HABITAT.

LAU	ACRES TREATED IN LAU	ACRES TREATED IN LYNX HABITAT WITHIN WUI	ACRES TREATED IN LYNX HABITAT OUTSIDE WUI	ACRES TREATED IN LYNX FORAGE ¹	ACRES TREATED IN LYNX DENNING	OTHER ² ACRES TREATED IN LYNX HABITAT (STEM EXCLUSION)
Buck	47	0	0	0	0	0
Elk	204	204	0	30	2	172
Glacier	1,043	885	158	4743	123	446
Holland	253	181	0	0	0	181
Lower Beaver	337	203	96	13	138	148
Upper Beaver	25	0	25	0	0	25
Total	1,909	1,473	279	517	263	972
¹ Treatment of lynx forage would only occur in the WUI; there is no proposed treatment of lynx forage outside of the WUI. Lynx forage structure would include both sapling (stand initiation hare habitat) and multistory structures. ² Stem Exclusion – structural stage is closed canopy with limited understory or a Multistory structural stage with many age classes but vegetation layers that <i>do not provide snowshoe hare habitat</i> . This structural stage may include denning habitat. ³ Includes 118 acres of summer snowshoe hare habitat that may provide winter snowshoe hare habitat within the temporal bounds of the project proposal.						

ALTERNATIVE D

DIRECT AND INDIRECT EFFECTS

Under Alternative D, there are 595 acres of Regeneration Treatment proposed (Clearcut/Seed Tree/Shelterwood) and 450 acres of Intermediate Treatment (Commercial Thin, Sanitation/Salvage, and Improvement Cut); total proposed commercial treatment is 1,045 acres. There are also 105 acres of non-commercial treatment proposed in Alternative D, including 95 acres of Pre-Commercial Thinning and 10 acres of Post and Pole Treatment. Total acres treated under Alternative D would be 1,150 acres; 993 acres of which are designated lynx habitat and critical habitat.

In a comparison of the action alternatives for the Glacier Loon Project, negative direct and indirect effects to Canada lynx would be least with Alternative D. This comparison is based largely on the overall amount of treatment in lynx habitat under each alternative. Table 3-77 summarizes the effects to lynx habitat with implementation of Alternative D.

FORAGE HABITAT

As described previously, lynx productivity is highly dependent on the quantity and quality of winter snowshoe hare habitat (USDA Forest Service 2007c). Winter foraging habitat has been identified as the most critical component dictating lynx population size and distribution. Under Alternative D, there would be a decrease of 138 acres of existing lynx forage due to proposed vegetative treatments, including regeneration and intermediate treatments, as well as non-commercial treatment and proposed slash disposal. The reduction of lynx forage habitat would occur in stand initiation hare habitat (95 acres) and multistory hare habitat (43 acres). The reduction of lynx forage would occur

within the WUI. This reduction in lynx forage within the WUI is allowed as an exception in the NRLMD (USDA Forest Service 2007c) and is discussed in more depth under the cumulative effects section of this analysis.

The reduction in lynx forage resulting from the implementation of proposed activities in Alternative D would not be permanent; natural regeneration and planted seedlings would eventually grow back and provide snowshoe hare habitat. However, it should be noted that where regeneration harvest is proposed, lynx foraging opportunities may not increase for 20 years or more; Squires et al. (2010) found that in Montana, hares are not using regenerated stands as early as originally thought (e.g., not in 15 years after logging or fire). Also, if the regenerated stands are pre-commercially thinned in the future, then an increase in winter forage habitat for lynx would not occur, or only occur briefly in summer feeding habitat.

DENNING HABITAT

Under Alternative D, there is proposed treatment in 40 acres of existing lynx denning habitat. The reduction of lynx denning habitat would occur both within and outside of the WUI. As discussed above, denning habitat for lynx is not a limiting factor at the broad scale. In the Glacier Loon Project, there are no proposed units located in old growth habitats or other older forest stands with large diameter down woody debris. These are the habitats that would provide the highest quality denning habitat for lynx.

STEM EXCLUSION LYNX HABITAT

As discussed above, stands of trees in designated lynx habitat with a relatively closed overstory canopy and limited understory vegetation are labeled as stem exclusion lynx habitat; they do not provide lynx forage (hare habitat) due to a lack of horizontal cover. Stem exclusion stands usually provide hiding cover for travel and could provide denning habitat. In Alternative D, there are treatments proposed in 815 acres of existing stem exclusion habitat. Of this total treatment in stem exclusion lynx habitat, 518 acres are proposed Regeneration Treatment, 287 acres would be Intermediate Harvest, and 10 acres would be proposed Post and Pole Treatment. In the Intermediate Harvest Units, there would be trees left in the overstory (approximately 50 to 150 trees per acre); some of these units would likely still provide hiding cover following treatment and could be used by lynx for movement between foraging and denning habitat. In the Regeneration Units (528 acres including the Post and Pole unit), there would be no hiding cover remaining following treatment; lynx movement patterns would probably change as they avoid openings in their travel across the Glacier Loon Area. Several Design Criteria (Table 2- 16) would be in place to help mitigate loss of hiding cover; Regeneration Units would be laid out so that no point in the unit is more than 600 feet from cover, and visual screening would be retained adjacent to open roads.

Stand exclusion habitat structure is generally not progressing towards hare habitat, so although there would be a loss of hiding cover over the short term (10 to 20 years), there is also an opportunity through harvest prescriptions to move the stands towards conditions that provide future forage and/or denning habitat for Canada lynx. Each of the prescribed treatments could potentially improve lynx habitat over the long-term. Intermediate treatments would open up the stands and stimulate an increase in horizontal cover (understory regeneration); remaining trees in the stand would have improved growing conditions and would increase in size. Many of the stands where Intermediate Harvest is proposed would have the potential to become multistory forage and/or denning habitat. As described above, most of the stands where regeneration treatment is proposed have a high percentage of lodgepole pine trees that have either already been attacked by mountain pine beetle or are very susceptible to attack. The proposed regeneration of these stands would remove most of the existing overstory structure and return the stands to a seedling/sapling structure within approximately 5 to 20 years.

LYNX HABITAT SECURITY

Adult mortality is an issue for Canada lynx (Squires et al. 2010); this includes starvation in winter and early spring, predation by lions during non-snow periods, and human conflict (e.g., accidental trapping or malicious shooting).

High human-activity levels could negatively affect lynx by causing displacement from preferred habitats (e.g., winter forage areas or denning habitat). Among the action alternatives, the potential for displacing Canada lynx during implementation of proposed activities is least in Alternative D, due to the lesser amount of acres treated, temporary road miles proposed, and miles of restricted roads needed for access. Potential displacement would be short-term, during the length of the proposed sale activity (1 to 5 years). During this time, lynx using the area could be displaced from key habitats, which could alter their normal ability to find food, breed and raise young, or find shelter.

Potential disturbance to lynx would be partially mitigated by Design Criteria in place for grizzly bear that limits activity during the spring period (April 1 through June 15). Road management in place for grizzly bear (USDA 1995b; USDI 1997) would also benefit Canada lynx by providing more acres of potentially secure habitat. In addition, standard contractual requirements used in all contracts provide for modification or termination of the contract to avoid impacts and protect threatened and endangered species. This allows for modification of the project should an unforeseen issue(s) be identified during operations.

Under Alternative D, no new over-the-snow routes would be created. Other than the potential for short-term displacement described above, there would be no significant negative effects to lynx as a result of any planned winter logging operations.

Under Alternative D, there are approximately 5.8 miles of proposed temporary road construction. Temporary roads would be constructed to the minimum standards necessary for log hauling. Temporary roads would be reclaimed following use. The reclamation work would include the removal of any culverts, installing erosion control features, re-vegetation with native shrubs or seed mix, re-contouring, and the placement of woody debris on the reclaimed road. There is always a potential for these temporary roads to be vectors of human use, but the potential is low if the reclamation work is successful. There are no temporary roads proposed in lynx forage under Alternative D.

Under Alternative D, approximately 16.0 miles of gated or bermed roads would be used for accessing proposed cutting units; significantly less than under Alternatives B or C. Use of gated or bermed roads would increase human activity levels in areas normally more secure for Canada lynx. Design Criteria described under Alternative B, for using restricted roads, would apply to Alternative D, as well.

In Alternative D, as in Alternative C, there are 8.4 miles of road decommissioning proposed; more than double the amount of decommissioning proposed in Alternative B. This would help to improve long-term habitat security for Canada lynx.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative D would include a MA change in the Flathead Forest Plan. The proposed MA change on 221 acres above Lindbergh Lake would probably translate into less regeneration cutting and road building on the forested slopes along the western side of Lindbergh Lake. This would be beneficial to Canada lynx and would likely mean an increased potential in this area for lynx habitat security.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

There is a history of timber management and road building on all ownership lands in the Glacier Loon Area; it is anticipated that timber management activities will continue into the future. Other on-going activities include hunting, trapping, firewood cutting, recreational activities, existing special use permits, road maintenance activities, noxious weed treatments, and residential development, and land conversion on private lands. Timber management and road building, along with conversion of private lands in the area, have an effect on the availability of forage and denning habitat for Canada lynx. In addition, the combination of each of the activities described above can affect the ability of

Canada lynx to move across the landscape securely. Landscapes in which hare habitat is more contiguous, or where good patches of hare habitat are surrounded by other patches of similar habitat quality, support more snowshoe hare (lynx forage) than landscapes that are more fragmented or include matrix habitats that are poorer quality (USDA Forest Service et al. 2000).

The Glacier Loon Area contains established human activities, including vegetation management, road management, private land development, and recreational use. Road construction and logging activity have occurred on Federal and private forested land throughout the Swan Valley. Most major logging activity on NFS lands, including road building, occurred almost a decade ago. Logging and road construction have continued on private timberlands up to the present time. There has been timber harvest to the northwest, in the Hemlock and Elk Creek Area, and other management activities to the east of the project area, across MT Highway 83, in the Meadow, Smith, and Buck Creek Areas.

Timber removal **occurred** on Legacy Lands throughout the Swan Valley as part of the Fiber Agreement between TNC and PCTC (including Fredswood, Mac-n-Cheese, Pickpocket, Krafty13, Elk Meadow, Elk Point, Last Gasp, Barber Chair, Beaver Highway and Two Bears harvests). In addition, south of the Glacier Loon Project Area, across the Summit Divide, is the Lolo National Forest where various forest management activities are occurring similar to the Flathead National Forest (e.g., Colt Summit Project). **Additionally, two other TNC harvests occurred within the lynx analysis units after the 2012 EA was published; the Two Bears project was located in the Lower Beaver LAU and the Last Gasp project was located in the Buck LAU. The Two Bears project was logged in December 2012 through February 2013. The Last Gasp project was logged in February and March 2013. Both activities have been completed. The Two Bear harvest occurred in 200 acres of early stand initiation, 50 acres of stem exclusion, and 64 acres of stand initiation. The activities would reduce stand initiation lynx foraging habitat by 64 acres. The Last Gasp project removed 35 acres of stand initiation and the remainder of the activity occurred in non-lynx habitat characterized by dry forest habitat types and low winter snow depths. As part of continued acquisition of parcels from TNC, the Forest Service acquired a section of land in 2013 located in the Elk LAU which had a prior 2011/12 TNC harvest called Krafty 13. The land acquisition into NFS ownership would reduce the likelihood of private land development and promote conservation of lynx and lynx habitat into the future.**

On June 30, 2008, The Nature Conservancy (TNC) and The Trust for Public Land (TPL) announced they reached agreement to purchase approximately 310,000 acres of PCTC lands in three phases over two years culminating in December 2010. The lands in the agreement include more than 65,630 acres in the Swan Valley. **By 2014, TNC had conveyed approximately 47,000 acres in the Swan Valley to the Forest Service. The Legacy Lands Acquisition included a timber supply agreement to provide timber to PCTC for 10 years through a timber reservation that TNC and TPL placed on deeds to honor the original purchase agreement with PCTC. On January 5, 2016, the U.S. Forest Service received a letter announcing that the fiber supply agreement between TNC and Plum Creek had been terminated and that there were no plans for future harvest on Legacy Lands (Project File Section AA).**

The Beaver Creek project is planned to occur in the Lower and Upper Beaver LAUs. The Beaver Creek project would affect approximately 590 acres of lynx foraging habitat in the Lower Beaver LAUs. The Beaver Creek project would also treat stem exclusion and regenerate stands contributing to early stand initiation habitat in both Lower and Upper Beaver LAUs. **Denning habitat would also be reduced as a result of the Beaver Creek activities in these LAUs by approximately 8% in the Lower Beaver LAU and 3% in the upper Beaver LAU. Human activity, sound from mechanized or motorized equipment may potentially displace lynx for short time periods in the immediate vicinity of the work activities. Lynx travel patterns within the project LAUs may change to avoid activity and in response to vegetation treatments. Combined with the impacts of the Glacier Loon project, foraging habitat and denning habitat would remain throughout the project LAUs. Considering cumulative effects with the Glacier Loon project, the project LAUs would continue to meet NRLMD direction and habitat conditions in the project LAUs including the Lower Beaver and Upper Beaver LAUs would continue to provide a mosaic of forest structural stages including lynx foraging habitat that is well-distributed throughout the LAUs capable of supporting lynx.**

In March 2007, the ROD for the NRLMD (USDA Forest Service 2007c) incorporated goals, objectives, standards, and guidelines into existing plans of all National Forests in the Northern

Rockies Lynx Planning Area, including the Flathead National Forest, where the Glacier Loon Project is proposed. The USFWS issued a BO on the effects of amending Land and Resource Management Plans of 18 National Forests with the NRLMD. The BO was identified as the first-tier of a tiered consultation framework, with the review of subsequent projects that may affect lynx as being the second-tier of consultation. Second-tier BOs would be issued as appropriate, where proposed actions would result in adverse effects to lynx that were not fully analyzed in the first-tier BO.

In the first-tier BO, the USFWS analyzed the effects of timber management/fuel reduction projects and provided an Incidental Take Statement (ITS) for those activities based on explicit estimates on the number of acres that would be impacted under the exceptions and exemptions that were provided by the Forest Service (e.g., acres of probable treatment in existing WUI at the time of analysis). These acres were allocated to each Forest subject to the NRLMD ROD. In the BO on the NRLMD, the USFWS anticipated fuels reduction treatment of 103,800 acres of lynx habitat within WUI's on the Flathead National Forest and 1,460 acres of pre-commercial thinning of snowshoe hare habitat for vegetation management for other resource benefits (under the exemptions and exceptions to standards VEG S1, S2, S5 and S6).

Proposed commercial and non-commercial treatments in lynx habitat in the Glacier Loon Project would be conducted under exceptions to Standards VEG S5 and VEG S6 (for treatments in the WUI). Under Alternatives B and C, 517 acres of existing lynx forage, both sapling and multistory structures (PCE 1a), would be negatively affected, primarily through the removal of the horizontal structure. In Alternative D, 138 acres of lynx forage would be negatively affected. The acreages under each of the action alternatives would occur solely within the WUI, using the exceptions described above in the NRLMD (e.g., anticipated reduction of 103,800 acres). The negative effects to lynx habitat described in this analysis were included as those anticipated and analyzed in the 2007 BO on the NRLMD (USDA Forest Service 2007c).

The USFWS determined in its BO (USDI 2007a) that the NRLMD would result in application of management direction on nearly 12.2 million acres of occupied lynx habitat, including all lynx habitat delineated in the recovery outline, and would substantially reduce or eliminate adverse effects to lynx from Forest Service land management activities. The standards for lynx in the NRLMD are intended to ensure that the appropriate mosaic of habitat is provided for lynx conservation on Federal lands. The Glacier Loon Project is consistent with NRLMD direction because:

- Each of the action alternatives would comply with VEG S1; there would be less than 30 percent of lynx habitat in each LAU in a stand initiation structural stage that does not provide winter snowshoe hare habitat (Table 3- 78); this structural stage has also been referred to as 'unsuitable' in the NRLMD.
- Each of the alternatives would comply with VEG S2; no more than 15 percent of lynx habitat on NFS lands would be regenerated within each LAU in a 10-year period. The Glacier Loon Project would contribute no more than a maximum of 2 percent in the Glacier LAU (e.g., 2 percent for Alternatives B and C and 1 percent for Alternative D), only 1 percent in the Lower Beaver LAU, and <1 percent in the Elk, Holland, and Upper Beaver LAUs. No regeneration treatment is proposed in the Buck LAU under any of the action alternatives.
- The NRLMD allows a limited range of fuel or timber management projects that can be conducted within the WUI. These activities fall under exceptions or exemptions from amendment standards. Proposed pre-commercial thinning for fuel reduction in Alternatives B and C, totaling 370 acres, and 95 acres in Alternative D, do not meet the VEG S5 standard but would fall within the exception of anticipated fuels reduction treatments of 103,800 acres of lynx habitat within WUI's on the Flathead National Forest; there is a current Forest balance of 101,291 acres (Table 3- 78). Standard VEG S5 addresses the reduction of winter snowshoe hare habitat within a stand initiation structural stage inside the WUI.
- Proposed fuel treatment in Alternatives B and C, totaling 147 acres, and 43 acres in Alternative D, do not meet the VEG S6 standard but would fall within the exception of anticipated fuels reduction treatments of 103,800 acres of lynx habitat within WUI's on the

Flathead National Forest. Standard VEG S6 addresses the reduction of snowshoe hare habitat within multi-story mature or late successional forests inside the WUI.

- Fuel treatment units have been designed in consideration of Guideline VEG G10, to promote lynx conservation.

TABLE 3- 79. MAXIMUM AMOUNT OF LYNX HABITAT IN LAUS IN A STAND INITIATION STRUCTURAL STAGE THAT WOULD NOT PROVIDE WINTER SNOWSHOE HARE HABITAT.				
LAU	EXISTING	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D
	RECENT STAND	RECENT STAND	RECENT STAND	RECENT STAND
	INITIATION ¹	INITIATION ¹	INITIATION ¹	INITIATION ¹
	(% OF LYNX HABITAT)	(% OF LYNX HABITAT)	(% OF LYNX HABITAT)	(% OF LYNX HABITAT)
Buck	11%	11%	11%	11%
Elk	15%	16%	16%	16%
Glacier	16%	20%	20%	18%
Holland	10%	13%	12%	12%
Lower Beaver	7%	9%	9%	8%
Upper Beaver	27%	27%	27%	27%
¹ Stand initiation structural stage that <i>currently does not provide</i> winter snowshoe hare habitat. It may provide summer forage. This structural stage has also been referred to as 'unsuitable' (NRLMD).				

This is a benefit for wildlife including Canada lynx; the land acquisition in the Swan Valley, including the Glacier Loon Area, would minimize the negative effects of human and related activities from the development of private lands, and insure that a larger portion of lynx habitat in the Swan Valley will be managed under NRLMD guidelines.

REGULATORY FRAMEWORK AND CONSISTENCY

The Canada lynx was classified as Threatened in Montana on March 24, 2000, and is currently protected under the ESA. Threatened status affords a species and its habitat special protection from adverse effects resulting from federally authorized or funded projects.

In March 2007, the ROD for the NRLMD incorporated goals, objectives, standards, and guidelines into existing plans of all National Forests in the Northern Rockies Lynx Planning Area, including the Flathead National Forest, where the Glacier Loon Project is proposed. In the NRLMD, a limited range of fuel or timber management projects that would be conducted within the WUI, and limited pre-commercial thinning for other resource benefits, fell under exceptions or exemptions from amendment standards VEG S1, S2, S5, and S6. To minimize the impact of this incidental take, terms and conditions in the Incidental Take Statement limited the number of acres per Forest that could be treated in ways that adversely affect lynx habitat. These acres were allocated to each Forest subject to the NRLMD ROD. The USFWS analyzed the effects of such projects on lynx in their first-tier BO and provided an Incidental Take Statement (ITS) for these activities. Forest allocations of activity acres approved in the BO for the 2007 decision are reported annually to the USFWS.

The Glacier Loon Project is consistent with NRLMD direction, as displayed in Table 3- 79 below.

TABLE 3- 80 . NORTHER ROCKIES LYNX MANAGEMENT DIRECTION STANDARD AND GUIDELINE COMPLIANCE	
STANDARDS AND GUIDELINES	PROJECT COMPLIANCE
ALL MANAGEMENT PRACTICES AND ACTIVITIES (ALL): THE FOLLOWING STANDARDS AND GUIDELINES APPLY TO ALL MANAGEMENT PROJECTS IN LYNX HABITAT WITHIN LAU'S IN OCCUPIED HABITAT.	
Objective ALL O1 Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.	Some connections between habitat patches would be affected, but no major ridgeline or riparian connections would be

TABLE 3- 80 . NORTHER ROCKIES LYNX MANAGEMENT DIRECTION STANDARD AND GUIDELINE COMPLIANCE	
STANDARDS AND GUIDELINES	PROJECT COMPLIANCE
	affected. A mosaic of stands would still exist as travel corridors and numerous sapling stands would contribute to connectivity for lynx. There would be no negative impacts on any lynx linkage area.
<u>Standard ALL S1</u> New or expanded permanent development and vegetation management projects must maintain habitat connectivity in an LAU and/or linkage area.	A mosaic of stand conditions would remain after project implementation. Habitat would continue to be distributed in a way to provide connectivity through the 6 project LAUs. No new permanent development is proposed.
<u>Guideline ALL G1</u> Methods to avoid or reduce effects on lynx should be used when constructing or reconstructing highways or forest highways across federal land. Methods could include fencing, underpasses, or overpasses.	Not Applicable to this project.
<u>Standard LAU S1</u> Changes in LAU boundaries shall be based on site-specific habitat information and after review by the Forest Service Regional Office.	Not applicable to this project.
VEGETATION MANAGEMENT ACTIVITIES AND PRACTICES (VEG): THE FOLLOWING STANDARDS AND GUIDELINES APPLY TO VEGETATION MANAGEMENT PROJECTS IN LYNX HABITAT WITHIN LAU'S IN OCCUPIED HABITAT.	
<u>Objective VEG O1</u> 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 and habitat components would be maintained.
<u>Objective VEG O2</u> 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, multistory conifer vegetation.	The mosaic would be provided over time, including areas of dense horizontal cover.
<u>Objective VEG O3</u> Conduct fire use activities to restore ecological processes and maintain or improve lynx habitat.	Not applicable to this project.
<u>Objective VEG O4</u> 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.	Not applicable to this project.
<u>Standard VEG S1</u> Where and to what this applies: Standard VEG S1 applies to all vegetation management projects that regenerate forests, except for fuel treatment projects within the wildland urban interface (WUI) as defined by HFRA, subject to the following limitation: Fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 may occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest). For fuel treatment projects within the WUI see guideline VEG G10. The Standard: 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.	Less than 30% of each LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat and the proposed project would not cause this standard to be exceeded in any LAU.

TABLE 3- 80 . NORTHER ROCKIES LYNX MANAGEMENT DIRECTION STANDARD AND GUIDELINE COMPLIANCE	
STANDARDS AND GUIDELINES	PROJECT COMPLIANCE
Standard VEG S2 Where and to what this applies: Standard VEG S2 applies to all timber Management projects that regenerate forests, except for fuel treatment Projects within the wildland urban interface (WUI) as defined by HFRA17, subject to the following limitation: Fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest). For fuel treatment projects within the WUI see guideline VEG G10. The standard: Timber management projects shall not regenerate more than 15 percent of lynx habitat on NFS lands within an LAU in a ten-year period.	The proposed project would not cause there to be regeneration treatment on more than 15% of lynx habitat on NFS lands within any LAU in a ten-year period.
Standard VEG S5 Where and to what this applies: Standard VEG S5 applies to all pre-commercial thinning projects, except for fuel treatment projects that use pre-commercial thinning as a tool within the wildland urban interface (WUI) as defined by HFRA, subject to the following limitation: Fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 may occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest). For fuel treatment projects within the WUI see guideline VEG G10. The Standard: Pre-commercial 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: 1. Within 200 feet of administrative sites, dwellings, or outbuildings; 2. For research studies or genetic tree tests evaluating genetically improved reforestation stock; 3. Based on new information that is peer reviewed and accepted by the regional level of the Forest Service, and state level of FWS, where a written determination states: that a project is not likely to adversely affect lynx; or that a project is likely to have short term adverse effects on lynx or its habitat, but would result in long-term benefits to lynx and its habitat; 4. For conifer removal in aspen, or daylight thinning around individual aspen trees, where aspen is in decline; 5. For daylight thinning of planted rust-resistant white pine where 80% of the winter snowshoe hare habitat is retained; 6. To restore whitebark pine <i>Exceptions 2 through 6 shall only be utilized in LAUs where Standard VEG S1 is met.</i>	The Glacier Loon Project proposes pre-commercial thinning as a fuel reduction tool and only within the WUI.
Standard VEG S6 Where and to what this applies: Standard VEG S6 applies to all vegetation management projects except for fuel treatment projects within the wildland urban interface (WUI) as defined by HFRA, subject to the following limitation: Fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 may occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest). For fuel treatment projects within the WUI see guideline VEG G10. The Standard: Vegetation management projects that reduce snowshoe hare habitat in multistory mature or late successional forests may occur only: Within 200 feet of administrative sites, dwellings, outbuildings, recreation sites, and special use permit improvements, including infrastructure within permitted ski area boundaries; or For research studies or genetic tree tests evaluating genetically improved reforestation stock; or For incidental removal during salvage harvest (e.g. removal due to location of skid trails). (NOTE: Timber harvest is allowed in areas that have potential to improve winter snowshoe hare habitat but presently have poorly developed understories that lack dense horizontal cover [e.g. uneven age management systems could be used to create openings where there is little understory so that new forage can grow]).	The Glacier Loon Project proposes vegetation management in snowshoe hare habitat in multistory mature forest only within the WUI as a fuel reduction tool.
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 for treatment should be given to stem-exclusion, closed-canopy structural stage stands to enhance habitat	This guideline has been incorporated into the proposed project because activities in stem exclusion

TABLE 3- 80 . NORTHER ROCKIES LYNX MANAGEMENT DIRECTION STANDARD AND GUIDELINE COMPLIANCE	
STANDARDS AND GUIDELINES	PROJECT COMPLIANCE
conditions for lynx or their prey (e.g. mesic, monotypic lodgepole stands). Winter snowshoe hare habitat should be near denning habitat.	habitat, including tree harvest, planting, and prescribed burning, would promote a high density of conifers, hardwoods, and shrubs to provide feeding habitat for lynx, in close juxtaposition to potential denning habitat.
<u>Guideline VEG G4</u> Prescribed fire activities should not create permanent travel routes that facilitate snow compaction. Constructing permanent firebreaks on ridges or saddles should be avoided.	This guideline has been incorporated into the proposed project. Prescribed fire would not create travel routes and no permanent fire breaks would be constructed.
<u>Guideline VEG G5</u> Habitat for alternate prey species, primarily red squirrel, should be provided in each LAU.	Habitat for alternate prey species is present in mature and old forests in each LAU. No treatment is proposed in old growth forest.
<u>Guideline VEG G10</u> Fuel treatment projects within the WUI as defined by HFRA should be designed considering Standards VEG S1, S2, S5, and S6 to promote lynx conservation.	Intermediate harvest treatments would encourage structural diversity. Regeneration of MPB affected stands would provide stand initiation hare habitat within approximately 10-20 years.
<u>Guideline VEG G11</u> 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.	There are no proposed activities in old growth forest, which has a high potential to provide quality denning habitat. There are other mature stands that provide denning habitat in the Glacier Loon area that would not be treated. Design Criteria include retention of down woody material in treated units. Denning is not estimated to be lacking within the LAU.
<u>Objective GRAZ 01</u> Manage livestock grazing to be compatible with improving or maintaining lynx habitat.	Not Applicable to this project.
<u>Guideline GRAZ 01</u> In aspen stands, livestock grazing should be managed to contribute to the long-term health and sustainability of aspen.	Not Applicable to this project.

TABLE 3- 80 . NORTHER ROCKIES LYNX MANAGEMENT DIRECTION STANDARD AND GUIDELINE COMPLIANCE	
STANDARDS AND GUIDELINES	PROJECT COMPLIANCE
<u>Guideline GRAZ 02</u> In riparian areas and willow carrs, livestock grazing should be managed to contribute to maintaining or achieving a preponderance of mid- or late-seral stages, similar to conditions that would have occurred under historic disturbance regimes.	Not Applicable to this project.
<u>Guideline GRAZ 03</u> In shrub-steppe habitats, livestock grazing should be managed in the elevation ranges of forested lynx habitat in LAUs, to contribute to maintaining or achieving a preponderance of mid- or late-seral stages, similar to conditions that would have occurred under historic disturbance regimes.	Not Applicable to this project.
<u>Guideline GRAZ 04</u> In aspen stands, livestock grazing should be managed to contribute to the long-term health and sustainability of aspen.	Not Applicable to this project.
<u>Guideline HU 01</u> Maintain the lynx's natural competitive advantage over other predators in deep snow by discouraging the expansion of snow-compacting activities in lynx habitat.	Cross-country over-snow travel is already allowed on all USFS land throughout this relatively accessible landscape so there would be no expansion of snow-compacting activity.
<u>Guideline HU 02</u> Manage recreational activities to maintain lynx habitat and connectivity.	Existing recreational activities are focused along trails and forest roads roads. These activities are not known to affect lynx connectivity or habitat (Squires et al. 2006; Ruggerio 2000).
<u>Guideline HU 03</u> Concentrate activities in existing developed areas, rather than developing new areas in lynx habitat.	No new recreation sites would be developed.
<u>Guideline HU 04</u> Provide for lynx habitat needs and connectivity when developing new or expanding existing developed recreation sites or ski areas.	Not Applicable to this project.
<u>Guideline HU 05</u> Manage human activities, such as special uses, mineral and oil and gas exploration and development, and placement of utility transmission corridors, to reduce impacts on lynx and lynx habitat.	Not Applicable to this project.
<u>Guideline HU 06</u> Reduce adverse highway effects on lynx by working cooperatively with other agencies to provide for lynx movement and habitat connectivity, and to reduce the potential of lynx mortality.	Not Applicable to this project.
<u>Guideline HU G1</u> When developing or expanding ski areas, provisions should be made for adequately sized inter-trail islands that include coarse woody debris, so winter snowshoe hare habitat is maintained.	Not Applicable to this project.
<u>Guideline HU G2</u> When developing or expanding ski areas, lynx foraging habitat should be provided consistent with the ski area's operational needs, especially where lynx habitat occurs as narrow bands of coniferous forest across mountain slopes.	Not Applicable to this project.
<u>Guideline HU G3</u> Recreation developments and operations should be planned in ways that both provide for lynx movement and maintain the effectiveness of lynx habitat.	Not Applicable to this project.
<u>Guideline HU G4</u> For mineral and energy development sites and facilities, remote monitoring should be encouraged to reduce snow compaction.	Not Applicable to this project.

TABLE 3- 80 . NORTHER ROCKIES LYNX MANAGEMENT DIRECTION STANDARD AND GUIDELINE COMPLIANCE	
STANDARDS AND GUIDELINES	PROJECT COMPLIANCE
<u>Guideline HU G5</u> For mineral and energy development sites and facilities that are closed, a reclamation plan that restores 40 lynx habitat should be developed.	Not Applicable to this project.
<u>Guideline HU G6</u> Methods to avoid or reduce effects on lynx should be used in lynx habitat when upgrading unpaved roads to maintenance levels 4 or 5, if the result would be increased traffic speeds and volumes, or a foreseeable contribution to increases inhuman activity or development.	Not Applicable to this project.
<u>Guideline HU G7</u> 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.	New permanent roads and trails would not be on ridge-tops and saddles, in areas important for lynx connectivity, or close to forested stringers.
<u>Guideline HU G8</u> Cutting brush along low-speed, low-traffic-volume roads should be done to the minimum level necessary to provide for public safety.	Funding constraints limit this to the minimum necessary for safety.
<u>Guideline HU G9</u> 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.	Public motorized use will not be permitted on restricted roads. All temporary roads will be reclaimed. No new permanent roads built for this project.
<u>Guideline HU G10</u> When developing or expanding ski areas and trails, consider locating access roads and lift termini to maintain and provide lynx security habitat, if it has been identified as a need.	Not Applicable to this project.
<u>Guideline HU G11</u> Designated over-the-snow routes or designated play areas should not expand outside baseline areas of consistent snow compaction, unless designation serves to consolidate use and improve lynx habitat. This may be calculated on an LAU basis, or on a combination of immediately adjacent LAUs. This does not apply inside permitted ski area boundaries, to winter logging, to rerouting trails for public safety, to accessing private inholdings, or to access regulated by Guideline HU G12. Use the same analysis boundaries for all actions subject to this guideline.	Not Applicable to this project.
<u>Guideline HU G12</u> Winter access for non-recreation special uses and mineral and energy exploration and development, should be limited to designated routes or designated over-the snow routes.	Not Applicable to this project.
<u>Objective LINK O1</u> In areas of intermingled land ownership, work with landowners to pursue conservation easements, habitat conservation plans, land exchanges, or other solutions to reduce the potential of adverse impacts on lynx and lynx habitat.	Not Applicable to this project.
<u>Standard LINK S1</u> When highway or forest highway construction or reconstruction is proposed in linkage areas, identify potential highway crossings.	Not Applicable to this project.
<u>Guideline LINK G1</u> NFS lands should be retained in public ownership.	Not Applicable to this project.
<u>Guideline LINK G2</u> <u>Livestock grazing in</u> shrub-steppe habitats should be managed to contribute to maintaining or achieving a preponderance of mid- or late-seral stages, similar to conditions that would have occurred under historic disturbance regimes.	Not Applicable to this project.

TABLE 3- 80 . NORTHER ROCKIES LYNX MANAGEMENT DIRECTION STANDARD AND GUIDELINE COMPLIANCE	
STANDARDS AND GUIDELINES	PROJECT COMPLIANCE
Objective GRAZ 01 Manage livestock grazing to be compatible with improving or maintaining lynx habitat	Not Applicable to this project. The project does not propose any grazing. Existing grazing in the project area is managed to be compatible with lynx habitat maintenance. Dense single-story or multistory stands providing lynx foraging opportunities are distributed throughout each project LAU. Existing grazing is not known to affect recruitment of dense stands of saplings for future lynx foraging habitat in the Lower Beaver LAU.
Guideline GRAZ 01 In fire-and harvest-created openings, livestock grazing should be managed so impacts do not prevent shrubs and trees from regenerating.	Based on the few animals grazed across a large permit area. Grazing in the project area would not prevent shrubs and trees from regenerating in fire and harvest-created openings.
Guideline GRAZ 02 In aspen stands, livestock grazing should be managed to contribute to the long-term health and sustainability of aspen.	The project does not propose any management in aspen stands. The project does propose to plant aspen stands which may benefit snowshoe hare densities in the future.
Guideline GRAZ 03 In riparian areas and willow carrs, livestock grazing should be managed to contribute to maintaining or achieving a preponderance of mid- or late-seral stages, similar to conditions that would have occurred under historic disturbance regimes.	Not Applicable to this project. The project does not propose any grazing. Ongoing grazing in the project LAUs is managed to prevent overuse of meadows, riparian areas and moist sites to maintain a preponderance of mid to late seral conditions in riparian areas.

CANADA LYNX CRITICAL HABITAT

ANALYSIS AREA

SPATIAL BOUNDS

In accordance with the revised draft Lynx Conservation Assessment and Strategy (LCAS 2000), 109 Lynx Analysis Units (LAU's) were identified and mapped on Flathead National Forest lands. These areas approximate the size of a female's home range and contain year-round habitat components (LCAS 2000). The LAU's are the geographic area used to analyze direct, indirect, and cumulative effects for Canada lynx. The proposed Glacier Loon Project is located across 6 LAU's: Buck, Elk, Glacier, Holland, Lower Beaver, and Upper Beaver (Appendix B- Lynx Habitat / LAU Map). In determining impacts to lynx critical habitat this analysis considered all designated lynx critical habitat in the 6 LAUs.

TEMPORAL BOUNDS

The length of time for proposed activities to occur is approximately 1-5 years. This is based on the probable contract length for the proposed project, the timeframes for related activities, and the reasonably foreseeable actions identified. Effects from activities would last approximately 1- 20 years. Specific duration of different direct, indirect or cumulative effects are discussed below.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included aerial photography, stand exams, Vector Map (VMAP) data, field surveys of downed logs, old growth surveys, project area field visits to verify lynx habitat classification, research literature, and GIS and dataset information for features such as general forest attributes, slope, aspect, habitat type, forest type, elevation, and mapped lynx habitat.

HABITAT STATUS

The conservation role of lynx Critical Habitat is to support viable core area lynx populations (USDI 2009c). In 2008, Critical Habitat was proposed for Canada Lynx. A Final Rule for Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx was effective on March 27, 2009. The designation of Critical Habitat for lynx was based on the best assessment of areas: (1) determined to be occupied at the time of listing; (2) that contained the physical and biological features in the appropriate spatial arrangement and quantity essential for the conservation of the species; and (3) that may require special management considerations or protection.

Northwest Montana is in Critical Habitat Unit 3: Northern Rocky Mountains. This unit includes most of northwest Montana as well as a small portion of northeastern Idaho and encompasses approximately 14,000 square miles (approx. 6,465,254 acres). The Unit 3 area is essential to the conservation of lynx because it appears to support the highest density of lynx populations in the Northern Rocky Mountain region of the lynx's range. It also likely acts as a source for lynx and provides connectivity to other portions of the lynx's range in the Rocky Mountains (USDI 2009b).

On September 12, 2014, the USFWS revised Critical Habitat in the contiguous United States. Northwest Montana is in Critical Habitat Unit 3: Northern Rocky Mountains. This unit includes most of

northwest Montana, as well as a small portion of northeastern Idaho, and encompasses approximately 9,783 square miles (approximately 6,261,095 acres). The Unit 3 area is essential to the conservation of lynx because it appears to support the highest density of lynx populations in the Northern Rocky Mountain region of the lynx's range. It also likely acts as a source for lynx and provides connectivity to other portions of the lynx's range in the Rocky Mountains (USDI Fish and Wildlife Service 2009, 2014).

As of the 2014 revision, on the Flathead National Forest, there are approximately 2,273,340 acres of designated Critical Habitat for lynx. The majority (approx. 92%) of the 6 LAUs representing the spatial bounds of this analysis are designated as Canada lynx Critical Habitat. In the Glacier Loon Project, all of the proposed units except for 9 units (157 acres) are located in lynx Critical Habitat. A summary of amounts of designated Critical Habitat in the Glacier Loon Project LAUs is located in Table 3- 80

TABLE 3- 81 DESIGNATED LYNX CRITICAL HABITAT IN THE GLACIER LOON PROJECT LAUS	
LYNX ANALYSIS UNIT (LAU)	CRITICAL HABITAT (ACRES)
Buck	17,037
Elk	28,404
Glacier	30,941
Holland	12,690
Lower Beaver	22,134
Upper Beaver	20,400
Total	133,193

By definition, Critical Habitat for Canada lynx contains the physical and biological features essential to conservation of the lynx, and is comprised of “primary constituent elements” (PCEs) in an appropriate quantity and spatial arrangement (USDI Fish and Wildlife Service 2008). Based on the current knowledge of the life history, biology, and ecology of the lynx, the PCE and its four components for lynx Critical Habitat are:

- 1) Boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:
 - a) *Presence of snowshoe hares and their preferred habitat conditions*, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface (PCE 1a);
 - b) *Winter snow conditions* that are generally deep and fluffy for extended periods of time (PCE 1b);
 - c) *Sites for denning* that have abundant coarse woody debris, such as downed trees and root wads (PCE 1c); and
 - d) *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 (PCE 1d).

Table 3- 81 summarizes the estimated distribution of stand conditions that provide PCEs within lynx Critical Habitat across the 6 project LAUs.

TABLE 3- 82 ESTIMATED EXISTING STAND CONDITIONS THAT CONTRIBUTE TO PCE1A AND PCE1D WITHIN CANADA LYNX CRITICAL HABITAT.

LAU NAME	LAU TOTAL ACRES	TOTAL CRITICAL HABITAT ACRES	PCE1A - STAND INITIATION CURRENTLY HARE HABITAT ¹ (% OF LAU CRITICAL HABITAT)	PCE1A -MULTISTORY CURRENTLY HARE HABITAT ² ACRES (% OF LAU CRITICAL HABITAT)	PCE1D MATRIX ³
Buck	24,693	17,472	1,818 (10%)	2,598 (15%)	4,484 (26%)
Elk	29,321	28,727	4,593 (16%)	6,379 (22%)	3,210 (11%)
Glacier	31,039	30,941	5,098 (16%)	5,098 (16%)	5,452 (18%)
Holland	15,974	13,519	1,751 (13%)	2,188 (16%)	2,577 (19%)
Lower Beaver	22,452	22,134	3,155 (14%)	5,917 (27%)	2,412 (11%)
Upper Beaver	20,471	20,400	1,632 (8%)	3,496 (17%)	8,745 (43%)
Total	143,950	133,193	18,047 (13%)	25,676 (20%)	26,880 (20%)

¹Stand initiation structural stage with dense young trees, shrubs or overhanging boughs that protrude above the snow.²Multistory structural stage with many age classes, vegetation layers, a dense understory of young trees and conifer boughs touching the snow surface that provides snowshoe hare habitat, which may also provide denning habitat.³Matrix: hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares.

Squires et al. (2008) found that female dens were primarily located in spruce-fir stands with abundant coarse woody debris and high horizontal cover; however denning did occur in stands with coarse woody debris but insufficient cover for snowshoe hares. Table 3- 82 summarizes the estimated denning habitat in designated critical habitat within the project LAUs. This habitat includes some multistory hare habitat and some stem exclusion habitat with high amounts of down woody debris. Only late-seral stands that had high amounts of coarse woody debris were included in this estimate. Other PCE1c conditions exist within the project area in the form of root wads, slash piles, blow down etc.; however, the estimated PCE1c is likely the best quality denning habitat available.

TABLE 3- 83 ESTIMATED STAND CONDITIONS THAT CONTRIBUTE TO PCE1C WITHIN CANADA LYNX CRITICAL HABITAT.

LAU NAME	LAU TOTAL ACRES	TOTAL CRITICAL HABITAT ACRES	PCE1C DENNING HABITAT ¹ ACRES
Buck	24,693	17,472	6,988 (40%)
Elk	29,321	28,727	4,309 (15%)
Glacier	31,039	30,941	2,787 (9%)
Holland	15,974	13,519	3,515 (26%)
Lower Beaver	22,452	22,134	2,437 (11%)
Upper Beaver	20,471	20,400	2,856 (14%)

¹Sites for denning that have abundant coarse woody debris, such as downed trees and root wads. Stands that include these features include both multistory forage and stem exclusion stands with high amounts of coarse woody debris.

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Under the No Action Alternative, there would be no vegetation treatments or associated activities proposed. There would be no direct effects to Canada Lynx Critical Habitat as a result of implementing this alternative; there would be no reduction of PCE1a or PCE1c from the management activities proposed in the project LAUs. Stands that may only provide summer forage for lynx now (early stand initiation), because they are too short to protrude above the snow in winter, would be expected to continue to grow, becoming good winter hare habitat (PCE1a). Red squirrel habitat (alternate prey for lynx) would be maintained in old growth and other mature forest stands across the project LAUs.

Indirectly, not implementing the proposed vegetative treatments could increase the risk of a wildfire burning more intensely in the project area in the future, which could result in changes in available PCE1a, PCE1c, and PCE1d. Fires have historically produced both positive and negative effects for lynx; loss of hiding cover and/or loss of PCE1a conditions would be a potential negative effect. On the positive side, PCE1a would be potentially increased as stands regenerate over time and stands regenerate from wildfire disturbance.

Private harvest activities by TNC have occurred on the conveyed lands within the 6 project LAUs. Effects of all these past projects (*i.e.* Fredswood, Mac-n-Cheese, Pickpocket, Elk Point, Elk Meadows, Krafty 13, Last Gasp, Barber Chair, Beaver Highway and Two Bears harvests) reduced lynx foraging habitat and recruited early stand initiation lynx habitat. No TNC treatments are currently active in the project LAUs.

Road construction and logging activity have occurred on Federal and private forested land throughout the Swan Valley. Most major logging activity on NFS lands, including road building, occurred almost a decade ago. Logging and road construction have continued on private timberlands up to the present time. There has been timber harvest on NFS lands to the northwest, in the Hemlock and Elk Creek Area, and other management activities to the east in the project LAUs, across MT Highway 83, in the Meadow, Smith, and Buck Creek Areas.

The Beaver Creek project would occur in the Lower and Upper Beaver LAUs. The project would affects approximately 590 acres of PCE1a, 611 acres of PCE1c, and 203 acres of PCE1d in the Lower Beaver LAU and 260 acres of PCE1c plus 756 acres of PCE1d in the Upper Beaver LAU.

Established human activities would continue including road maintenance, firewood cutting, trapping, and development on private lands. Alternative A would not contribute negative cumulative effects to Canada lynx in the Swan Valley.

ALTERNATIVES B, C, D – ACTION ALTERNATIVES DIRECT AND INDIRECT EFFECTS

The Final Rule for Revised Designation of Critical Habitat (March 27, 2009) described three types of Federal actions that may affect Critical Habitat:

- 1) Actions that would reduce or remove understory vegetation within boreal forest stands on a scale proportionate to the large landscape used by lynx.
- 2) Actions that would cause permanent loss or conversion of the boreal forest on a scale proportionate to the large landscape used by lynx.

- 3) Actions that would increase traffic volume and speed on roads that divide lynx Critical Habitat, or, in matrix habitat, activities that change vegetation structure or condition in such a way as to create a barrier or impede lynx movement.

CANADA LYNX CRITICAL HABITAT

All of the proposed units are located within designated lynx Critical Habitat except Units 32-40 (157 acres; 9 units); these units are located outside of Critical Habitat and also outside of designated lynx habitat.

For Lynx Critical Habitat, quantification at the LAU scale of the vegetation management effects is displayed in Table 3- 84, Table 3- 85, Table 3- 86. This analysis is separate from that applied to the lynx analysis as the focus is on impacts on the components of the PCE for lynx critical habitat. .

Within lynx Critical Habitat in the Glacier Loon area, there would be a decrease of between approximately 138 and 517 acres that currently provide conditions for PCE1a. Table 3- 83, Table 3- 84 and Table 3- 85 displays the amount of habitat providing PCE 1a that would be affected by the proposed activities for Alternatives B, C and D. PCE1a would be decreased by approximately 1-5% in the Glacier LAU, 0.2% in the Elk LAU, and 0.1% in the Lower Beaver LAU. Across alternatives, the total decrease in lynx forage would represent approximately 0.009 to 1% of estimated PCE1a conditions in the project LAUs. Reduction in PCE1a would not be permanent. Natural regeneration and planted seedlings would grow back and provide snowshoe hare habitat. However, it should be noted that where regeneration harvest is proposed, PCE1a stand conditions would return in approximately 20 years.

PCE1c would be reduced by 40-327 acres. As stated above in Table 3- 82 stand conditions with PCE1c attributes were considered for both multistory forage and stem exclusion habitats with high amounts of down woody debris. The reduction of PCE1c would range from approximately 1-16% of the Glacier LAU, 1-8% of Lower Beaver, and 0.04% of the estimated denning habitat in the Elk LAU. Project design criteria would retain 10 tons/acre of down woody debris where available in treatment units and retain large diameter snags under Forest Plan Amendment 21. These features would retain denning structures for lynx in treated stands. As treated stands regenerate, sufficient cover combined with lynx denning structures (fallen snags, root wads) would create denning habitat over time.

PCE 1b (deep fluffy snows) would not be affected by this proposal.

The effects on lynx Critical Habitat would occur on a small portion of Critical Habitat Unit 3. The sum of Critical Habitat in the Elk, Holland, Glacier, Buck, Lower and Upper Beaver LAUs comprises approximately 0.02% of Critical Habitat Unit 3. Table 3- 86 displays effects to PCEs relative to Critical Habitat within the 6 project LAUs as well as relative to Critical Habitat in Unit 3.

There would be no permanent loss (such as paving or building construction) of habitat or conversion of the boreal forest as a result of proposed activities. The physical and biological features would not be altered to an extent that would appreciably reduce the conservation value of Critical Habitat for lynx and the PCEs would continue to function at the scale of the LAU and across Critical Habitat Unit 3.

The proposed use of existing roads and temporary roads would not create barriers to, or impede movements of lynx.

TABLE 3- 84 ALTERNATIVE B (PROPOSED ACTION) – EFFECTS TO LYNX HABITAT

LAU	ACRES TREATED IN LAU	ACRES TREATED IN LYNX HABITAT WITHIN WUI	ACRES TREATED IN LYNX HABITAT OUTSIDE WUI	ACRES TREATED IN LYNX FORAGE ¹ (PCE 1A)	ACRES TREATED IN LYNX DENNING (PCE 1C)	OTHER ² ACRES TREATED IN LYNX HABITAT	ACRES TREATED IN MATRIX HABITAT (PCE 1D)
Buck	47	0	0	0	0	0	47
Elk	240	240	0	30	2	208	0
Glacier	1,058	900	158	474 ³	123	461	0
Holland	322	250	0	0	0	250	72
Lower Beaver	410	197	175	13	202	157	38
Upper Beaver	25	0	25	0	0	25	0
Total	2,102	1,587	358	517	327	1,101	157

¹Treatment of lynx forage would only occur in the WUI; there is no proposed treatment of lynx forage outside of the WUI. Lynx forage structure includes both sapling (stand initiation hare habitat) and multistory structures.

²Stem exclusion structural stage is closed canopy with limited understory or a Multistory structural stage with many age classes but vegetation layers that *do not provide snowshoe hare habitat*. This structural stage may include denning habitat.

³Includes 118 acres of summer snowshoe hare habitat that may provide winter snowshoe hare habitat within the temporal bounds of the project proposal.

TABLE 3- 85 ALTERNATIVE C - EFFECTS TO LYNX HABITAT.

LAU	ACRES TREATED IN LAU	ACRES TREATED IN LYNX HABITAT WITHIN WUI	ACRES TREATED IN LYNX HABITAT OUTSIDE WUI	ACRES TREATED IN LYNX FORAGE ¹ (PCE 1A)	ACRES TREATED IN LYNX DENNING (PCE 1C)	OTHER ² ACRES TREATED IN LYNX HABITAT (STEM EXCLUSION)	ACRES TREATED IN MATRIX HABITAT (PCE 1D)
Buck	47	0	0	0	0	0	47
Elk	204	204	0	30	2	172	0
Glacier	1,043	885	158	4743	123	446	0
Holland	253	181	0	0	0	181	72
Lower Beaver	337	203	96	13	138	148	38
Upper Beaver	25	0	25	0	0	25	0
Total	1,909	1,473	279	517	263	972	157

¹Treatment of lynx forage would only occur in the WUI; there is no proposed treatment of lynx forage outside of the WUI. Lynx forage structure would include both sapling (stand initiation hare habitat) and multistory structures.

²Stem Exclusion – as defined in structural stage is closed canopy with limited understory or a Multistory structural stage with many age classes but vegetation layers that *do not provide snowshoe hare habitat*. This structural stage may include denning habitat.

³Includes 118 acres of summer snowshoe hare habitat that may provide winter snowshoe hare habitat within the temporal bounds of the project proposal.

TABLE 3- 86. ALTERNATIVE D - EFFECTS TO LYNX HABITAT.

LAU	ACRES TREATED IN LAU	ACRES TREATED IN LYNX HABITAT WITHIN WUI	ACRES TREATED IN LYNX HABITAT OUTSIDE WUI	ACRES TREATED IN LYNX FORAGE ¹ (PCE 1A)	ACRES TREATED IN LYNX DENNING (PCE 1C)	OTHER ² ACRES TREATED IN LYNX HABITAT (STEM EXCLUSION)	ACRES TREATED IN MATRIX HABITAT (PCE 1D)
Buck	47	0	0	0	0	0	47

TABLE 3- 86. ALTERNATIVE D - EFFECTS TO LYNX HABITAT.

LAU	ACRES TREATED IN LAU	ACRES TREATED IN LYNX HABITAT WITHIN WUI	ACRES TREATED IN LYNX HABITAT OUTSIDE WUI	ACRES TREATED IN LYNX FORAGE1 (PCE 1A)	ACRES TREATED IN LYNX DENNING (PCE 1C)	OTHER2 ACRES TREATED IN LYNX HABITAT (STEM EXCLUSION)	ACRES TREATED IN MATRIX HABITAT (PCE 1D)
Elk	144	144	0	12	2	130	0
Glacier	477	349	128	113	38	326	0
Holland	249	177	0	0	0	177	72
Lower Beaver	208	85	85	13	0	157	38
Upper Beaver	25	0	25	0	0	25	0
Total	1,150	755	238	138	40	815	157
¹ Treatment of lynx forage would only occur in the WUI; there is no proposed treatment of lynx forage outside of the WUI. Lynx forage structure would include both sapling (stand initiation hare habitat) and multistory structures. ² Stem Exclusion – structural stage is closed canopy with limited understory or a Multistory structural stage with many age classes but vegetation layers that <i>do not provide snowshoe hare habitat</i> . This structural stage may include denning habitat.							

TABLE 3- 87. EFFECTS OF ACTION ALTERNATIVES ON THE PRIMARY CONSTITUENT ELEMENTS FOR DESIGNATED LYNX CRITICAL HABITAT.

PRIMARY CONSTITUENT ELEMENT		EFFECT WITHIN THE PROJECT LAUS
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 approximately 138-517 acres of hare habitat that would be affected by vegetation management activities. This hare habitat is a small percentage of the available hare habitat (PCE1a) in the six LAUs and less than 0.00006% of the Critical Habitat area in Unit 3.
PCE1b	Winter snow conditions that are generally deep and fluffy for extended periods of time.	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.	The approximate 40-327 acres of denning habitat that would be affected by vegetation management make up a small percentage of the available denning habitat (PCE1c) in the 6 project LAUs and less than 0.000003% of the Critical Habitat area in Unit 3.
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).

ALTERNATIVES B, C, AND D - ACTION ALTERNATIVES CUMULATIVE EFFECTS

There is a history of timber management and road building on all ownership lands in the Glacier Loon area; it is anticipated that timber management activities will continue into the future. Other on-going activities include hunting, trapping, firewood cutting, recreational activities, existing special use permits, road maintenance activities, noxious weed treatments, and residential development and land conversion on private lands. Timber management and road building, along with conversion of private lands in the area, have an effect on the availability of forage and denning habitat for Canada lynx. In addition, the combination of each of the activities described above can affect the ability of Canada lynx to move across the landscape securely. Landscapes in which hare habitat is more contiguous,

or where good patches of hare habitat are surrounded by other patches of similar habitat quality, support more snowshoe hare (lynx forage) than landscapes that are more fragmented or include matrix habitats that are poorer quality (LCAS 2000, Lewis et al. 2011, Squires et al. 2010, 2013).

On June 30, 2008, The Nature Conservancy (TNC) and The Trust for Public Land (TPL) announced they reached agreement to purchase approximately 310,000 acres of PCTC lands in three phases over two years culminating in December 2010. The lands in the agreement include more than 65,630 acres in the Swan Valley. By 2014, TNC had conveyed approximately 47,000 acres in the Swan Valley to the Forest Service. The Legacy Lands Acquisition included a timber supply agreement to provide timber to PCTC for 10 years through a timber reservation that TNC and TPL placed on deeds to honor the original purchase agreement with PCTC. On January 5, 2016, the U.S. Forest Service received a letter announcing that the fiber supply agreement between TNC and Plum Creek had been terminated and that there are no plans for future harvest on Legacy Lands.

In the 6 LAUs affected by the Glacier Loon project, effects of these past private land harvest projects on lynx habitat were characterized using stand attributes in recent Vmap data, NAIP imagery and field verification. These data sources were to characterize the area within the 6 LAUs including NFS, private and legacy lands. The lynx model was used to quantify lynx foraging habitat on private lands within the Critical Habitat boundary of the 6 LAUs. The composition of lynx habitat on these private lands was incorporated into the habitat baseline in Table 3- 81 above. Distribution of canopy cover was judged adequate to facilitate lynx movement throughout the private lands within the 6 LAUs.

Private harvest activities by TNC have occurred on the conveyed lands within the 6 project LAUs. Effects of all these past projects (i.e., Fredswood, Mac-n-Cheese, Pickpocket, Elk Point, Elk Meadow, Krafty 13, Barver Chair and Beaver Highway harvests) to lynx habitat were characterized using stand attributes in recent Vmap data, NAIP imagery and field verification and incorporated into the habitat baseline in Table 3- 81 above. No TNC treatments are currently active in the project LAUs.

After completion of the Glacier Loon environmental analysis and the September 2012 Biological Assessment, the Forest Service received harvest plans for the Two Bear project located in the Lower Beaver LAU and the Last Gasp project partially located in the Buck LAU. The Two Bears harvest plan included 203 acres of over-story removal (OSR) and 111 acres of commercial thinning (CT). Within the Buck LAU, the Last Gasp harvest plan included 92 acres of OSR with lynx Critical Habitat. Legacy lands were previously managed as industrial forest lands and contain little mature timber. TNC OSR activities selectively removed intermittent mature trees in old regeneration units. Commercial thinning reduced stand densities by removing merchantable trees.

Based on the prescriptions, Vmap, and field validation, the Two Bear harvest occurred in 200 acres of early stand initiation, 50 acres of stem exclusion, and 64 acres of stand initiation (PCE1a). The activities would reduce stand initiation lynx foraging habitat by 64 acres. The Last Gasp project removed 35 acres of stand initiation (PCE1a) and the remainder of the activity occurred in matrix (PCE1d) habitat characterized by dry forest habitat types and low winter snow depths. Stand conditions would still allow for lynx travel and foraging adjacent to the TNC activities. In combination with the Two Bears and Last Gasp harvests, sufficient habitat suitable for lynx travel and foraging would remain within the 6 Glacier Loon project LAUs.

The Beaver Creek project would affect approximately 590 acres of PCE1a, 871 acres of PCE1c and 993 acres of PCE1d in the Upper and Lower Beaver LAUs. The Glacier Loon project would contribute treatment of approximately 13 acres of PCE1a in the Lower Beaver LAU. In combination with the Two Bears, Last Gasp and Beaver Creek projects, sufficient habitat suitable for lynx travel and foraging would remain within the 6 Glacier Loon project LAUs including the Upper and Lower Beaver LAUs. Although there would be local negative effects to snowshoe hare habitat (PCE 1a) and denning habitat (PCE1d), at the landscape scale, considering the large amount of Critical Habitat in Unit 3 (Northern Rocky Mountains), sufficient densities of snowshoe hares would be produced to support lynx presence. Ruggiero et al. (2000) recommended maintaining some minimum density of snowshoe hares across a broad landscape, e.g., >0.5 hare/ha (0.2 hares/ac), to support a self-sustaining population of lynx. Griffin (2004), and Mills et al. (2005) estimated density and relative abundance of snowshoe hares throughout Montana. Hare densities generally were low, ranging between 0.1–0.6 hares/ ha (0.04–0.02 hares/ ac). In western Montana, Griffin and Mills (2004) found the highest

snowshoe hare densities in regenerating forest stands with high sapling density and in uncut, mature multi-story stands with abundant saplings. Given that hares are a forest stand disturbance dependent species and the legacy of forest management across ownerships within the project LAUs that have maintained a mosaic of stands, hare densities would remain sufficient within remaining patches of hare habitat while regenerating forest structure would provide preferred hare habitat into the future. The Primary Constituent Elements (PCE's) would continue to be available within Canada lynx Critical Habitat across the FNF and proposed actions would not cause a permanent loss or conversion of the boreal forest on a scale proportionate to the large landscapes used by lynx.

REGULATORY FRAMEWORK AND CONSISTENCY

On October 18, 2017, the USFWS issued a Biologic Opinion for consultation regarding the effects of the NRLMD on designated Critical Habitat. The USFWS concluded (pg.31), "After reviewing the current status of designated lynx critical habitat, the environmental baseline for the action area, the effects of the action, the cumulative effects, and best available information, it is the Service's biological opinion that the effects of the NRLMD are not likely to result in the destruction or adverse modification of designated Canada lynx critical habitat."

WOLVERINE

INTRODUCTION

The wolverine (*Gulo gulo luscus*) is a proposed Threatened species on the Flathead National Forest. Among other species and habitats, the wolverine is an indicator that the needs of other species that use remote mountainous areas are met, particularly those associated with cirque basins, avalanche chutes, and deep snow. The wolverine occurs on the Flathead National Forest, in northwest Montana, and is connected to the populations that extend into Canada and Alaska. The USFWS in December 2010 (USDI 2010), after review of all available scientific and commercial information, found the North American wolverine occurring in the contiguous United States is a Distinct Population Segment (DPS) and that addition of this DPS to the Lists of Endangered and Threatened Wildlife and Plants was warranted but precluded by higher priority actions to amend the Lists.

Federal actions concerning the wolverine date back to 1995 and culminated in a proposal to list the wolverine DPS as threatened on February 4, 2013 (USDI 2013b). After further review of all available scientific and commercial information, the USFWS subsequently withdrew that proposal, and published their determination on August 13, 2014 (USDI 2014b), that adding the North American wolverine occurring in the contiguous United States as a DPS to the Lists of Endangered and Threatened Wildlife and Plants was not warranted (USDI 2014b). On April 14, 2016 the Court remanded the matter to the U.S. Fish and Wildlife Service for further consideration consistent with order CV 14-246-M-DLC (Consolidated with Case Nos. 14-247-M-DLC and 14-250-M-DLC). On May 24, 2016, the USFWS again listed wolverine as a proposed species on the Flathead National Forest.

Wolverines occur naturally in low densities, and current population levels and trends are not definitely known (USDI 2013b). However, there is evidence that their population is increasing (USDI 2014b) and that wolverines are expanding both within areas currently occupied, as well as suitable habitat not currently occupied (USDI 2014b).

SPATIAL BOUNDS

The Glacier Loon Fuels Project Area, approximately 37,320 acres, was the area considered for the evaluation of direct, indirect, and cumulative effects on sensitive wildlife species. This project area is large enough to include the home ranges of several individuals or pairs of a species, and is representative of the effects of fire, natural tree mortality, timber harvest, road management, and other potential effects, across the landscape. The actions proposed that could directly, indirectly, or cumulatively affect sensitive species are contained within this area.

TEMPORAL BOUNDS

The length of time for effects analysis is approximately 1 to 5 years. This is based on the probable contract length for the Glacier Loon Project, the timeframes for related activities, and the reasonably foreseeable actions identified. Effects from activities would last approximately 1-20 years. Specific duration of different direct, indirect or cumulative effects are discussed below.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included open road densities, aerial photography, carnivore survey data, project area field visits, research literature, and GIS and dataset information for general forest attributes.

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology of the wolverine, certain elements are thought to be essential to the conservation of the species. These elements are denning habitat security, isolation from human impacts and activities, a diverse prey base, and ungulate carrion. Effects to these elements as a result of project implementation are the measurement indicators used in this analysis.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Wolverines occur in Montana in coniferous forest and alpine tundra. Wolverine habitat typically encompasses large areas of rugged, remote terrain, and populations naturally exist at relatively sparse densities. Wolverines are generally associated with remote wilderness areas, and are considered sensitive to human development, especially with respect to selection of denning sites (Banci 1994). Wolverines are solitary except during breeding. Wolverine home ranges are very large relative to other species their size, more on the order with that required by larger carnivores. Wolverine home ranges vary from less than 37 square miles to greater than 347 square miles (Banci 1994). Denning occurs at high elevations, frequently above 8,000 feet, in cirque basins and other high elevation, steep slope habitats. Wolverine dens are usually associated with large accumulations of snow around log jams, rocks, or boulders. Den site elevations are generally found at higher elevations well away from development or human activity.

Wolverine do not "hunt" in the usual sense, but are opportunistic, eating anything edible they can catch, find, or steal. Ungulate carrion seems to be particularly important to wolverine in the winter and movements to lower elevations during the winter months probably occur so wolverine can take advantage of ungulate mortalities on winter ranges. Additionally, the wolverine is a proficient predator capable of killing large ungulates, primarily in deep snow. More commonly, they prey on smaller species such as snowshoe hares, cottontails, ground squirrels, porcupines, marmots, skunks, and weasels (Banci 1994). They also opportunistically consume berries, insects, fish, birds, and eggs.

Historically, the upper slopes of both the Swan Range and the Mission Mountains provided wolverine denning habitat. The Swan Valley has historically provided winter range for white-tailed deer. A sufficient prey base for wolverine was available.

The USFWS (USDI 2013a) believes that densities and population levels in the northern Rocky Mountains are not lower today than they were historically.

"The northern Rocky Mountain population (north of Wyoming) was reduced to historic lows or possibly even extirpated during the early 1900s, and then increased dramatically in the second half of the 1900s as predator control efforts subsided and trapping regulations became more restrictive (Aubry et al. 2007). This increase likely indicates a population rebound from historic lows in this period."

Krebs et al. (2004) conducted a synthesis for wolverine vital rates and sources of mortality across North America. Trapping was the greatest source of man-caused mortalities and starvation was the greatest source of natural mortality. Trapping is managed by MFWP and is not currently permitted for wolverine in Montana.

EXISTING CONDITION

One of the greatest changes for wolverine has been the increase in human-activity levels in potential denning habitat. This increase in activity could limit reproduction in some areas (Banci 1994). Female wolverines appear to be extremely sensitive to human disturbance at the natal den site and have

been known to move kits in response to disturbance, potentially increasing kit mortality. Given the wolverine's low fecundity, any reproductive losses are significant.

Deep, persistent, and reliable spring snow cover (e.g., mid-April to mid-May) is the best overall predictor of wolverine occurrence in the contiguous United States (Aubry et al. 2007; Copeland et al. 2010). The USFWS used several citations to state that persistent, stable snow greater than 5 feet deep appears to be a requirement for natal denning. They described climate change as being a current threat to wolverine.

Hillis et al. (2002) mapped wolverine natal den habitat in Region One using three criteria;

1. Minimum elevation - the minimum elevation west of the Continental Divide used was 6,200 feet.
2. Degree of concavity - slope concavity is a feature unique to glaciated landscapes and thus a good predictor of cirque basins.
3. Degree of slope - maximum slope was limited to 30 percent.

Cirque basins identified by this method were then buffered for 2 miles above 6,200 feet. The result revealed a mix of potentially suitable natal den habitat (cirques and avalanche chutes) across the landscape. Nearly 75 percent of the identified natal den habitat on the Flathead National Forest was shown to be protected by designated wilderness. The Forest Plan was reviewed to identify those MAs (not designated wilderness) that precluded snowmobiles. When those restrictions were considered, the percentage of natal den habitat protected increased from 73.1 percent to approximately 90 percent (Hillis et al. 2002).

The USFWS (USDI 2013b) determined the best available science for wolverine natal denning habitat to be a composite of two models produced by Inman (2012) and Copeland (2010a). The Copeland (2010a) model was used for this analysis. This model includes all known wolverine natal dens in the wolverine distinct population segment. On average, most denning occurs at higher elevations within the area defined by the model. Wolverine year-round habitat use also takes place almost entirely within the area defined by deep persistent spring snow (Copeland et al. 2010, pp. 242-243). Wolverines rarely, or never, den in lower elevation forested habitats, although they may occupy these habitats occasionally (Magoun et al. 1998). See Map 3-7 for a display of snow pack data for wolverines.

High elevation cirque basins have traditionally received little human activity in late winter with the exception of downhill ski areas. Kennedy, however, demonstrated that the recent popularity of backcountry snowmobiling, and the advent of more powerful snowmobiles, has resulted in substantially increased late-winter disturbance into areas suitable for denning female wolverines. Trapping could also be a threat to wolverines as they are easily trapped (Ruggiero et al. 1994).

Even in areas that have not been subjected to human encroachment, wolverines naturally exist at very low densities. It is known that wolverine occur in low densities in the Upper Swan Valley and recent carnivore surveys in the Glacier Loon Area detected wolverine (Project File Exhibit H-8).

Krebs et al. (2007) examined wolverine habitat use on multiple-use lands in British Columbia. Females were negatively associated with recently logged areas and areas with large amounts of high elevation winter recreation (helicopter and back-country skiing). The habitat use models suggested habitat associations of female wolverines are complex; they likely involve responses to food, predation risk, and human activity (Krebs et al. 2007). Wolverines have also been documented to use space near areas of high human activity. In one study, wolverines did not strongly avoid developed habitat within their home ranges (May et al. 2006). Wolverines have been documented to persist and reproduce in areas with high levels of human use and disturbance, including developed alpine ski areas and areas with motorized use of snowmobiles (Heinemeyer et al. 2012). Wolverines may respond positively to human activity and developments that are a source of food. They scavenge food at dumps in and adjacent to urban areas, at trapper cabins, and at mines (Banci 1994).

The effective population for wolverines in the Rocky Mountains was calculated to be 35 (Schwartz et al. 2009). This effective population size is exceptionally low, which means that this is a species that

seems to be able to persist at extremely low numbers. The fragmented nature and distribution of wolverine habitat in the lower United States results in a contiguous United States population that is more vulnerable to extirpation because of lack of connectivity between subpopulations. This contributes to inbreeding and reduces the chances of recolonization of habitat patches after local extinction. In the contiguous United States, 250 to 300 wolverines account for probably less than 2 percent of the entire *G. g. luscus* population. The USFWS (USDI 2010) concluded that the wolverine population in the contiguous United States is both discrete and significant under DPS policy.

Wolverine populations in the northern Rocky Mountains appear to be connected to each other at the present time through dispersal routes that correspond to habitat suitability (Schwartz et al. 2009). Linkage zones are defined as “places where animals can find food, shelter, and security while moving across the landscape between suitable habitat.” Wolverines prefer to travel in habitat that is most similar to habitat they use for home-range establishment, i.e., alpine habitats that maintain snow cover well into the spring. There is no evidence that wolverine dispersal is affected by infrastructure development (Schwartz et al. 2009). In the contiguous United States, wolverines must cross unsuitable habitats to achieve connectivity among subpopulations, which is required to avert further genetic drift and continued loss of genetic diversity (Copeland et al. 2007).

During the winters of 2012 through 2016, winter carnivore monitoring was conducted within the Swan, Clearwater, and Blackfoot Valleys. Monitoring included snow track transects that were presumed lynx, wolverine, or fisher tracks and were backtracked until hair or scat was collected for species genetic identification. During the winters of 2013 through 2017, bait stations were set up to attract and collect hair samples from carnivores in the area. The DNA results have not yet been summarized from the winter of 2016; however, monitoring from 2012 through 2015 detected 22 unique wolverine genotypes, 11 of which were detected in the Swan Valley and wolverine presence is confirmed in the Glacier Loon project area (Southwestern Crown Carnivore Monitoring Team 2015).

In summary, based on the best available science, the USFWS concluded that wolverines do not avoid human development of the types that occur within suitable wolverine habitat and that wolverines may disperse or move across areas of human development (USDI 2013a). Wolverines are not thought to be dependent on vegetation or habitat features that may be manipulated by land management activities. They have been documented using both recently logged areas and burned areas (USDI 2013a).

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Under Alternative A, there would be no fuel reduction or forest health activity on NFS lands in the Glacier Loon Area. There would be no negative direct effects to the wolverine associated with this alternative. Effective wolverine habitat is not associated with a specific vegetative type. In the absence of the proposed treatments, natural vegetative succession or an increase in wildfire potential would not produce significant indirect effects on the wolverine or wolverine habitat. Alternative A would not contribute significantly to cumulative effects on wolverine in the Glacier Loon Area.

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

NATAL SECURITY

Denning occurs at high elevations, frequently above 8,000 feet. There would be no commercial or non-commercial treatments, and no temporary road construction, in potential natal den areas. There would be no negative direct or indirect effects to wolverine natal denning security.

Under each of the action alternatives, winter harvest is required in several lower elevation units in order to meet Region 1 soil quality standards (Units 2, 5, 10, 11, 16, 17, 20, 22, 34, and 59). Each of these proposed units is outside of deep, persistent snow areas and far removed (e.g., 1-2 miles or more) from potential wolverine natal denning areas. There would be no negative direct or indirect effects to wolverine natal denning security as a result of proposed activities.

PREY BASE

As described above, ungulate carrion is an important food for wolverine, as well as a variety of small mammal species. Proposed vegetative treatments in Alternatives B, C, and D would affect ungulates in the area (Please refer to the Big Game MIS Section of this document). Existing understory vegetation and overstory tree canopies would be reduced to varying degrees as a result of proposed commercial and non-commercial treatments; the greatest reductions would occur in Alternatives B and C. Although there would be no change expected in overall ungulate population numbers in the Upper Swan Valley as a result of the proposed treatments, the vegetative treatments would alter white-tailed deer and elk use patterns in the Glacier Loon Area as the ungulates adjust their behavior to avoid human presence or disturbance in the short-term, and as they adjust to changes in forage and cover availability over the short and long-term.

There is no treatment proposed in old growth habitats in any of the Glacier Loon Alternatives; old growth habitats would have a high potential to provide ungulate and small mammal habitat. Under each of the action alternatives, there are proposed treatments adjacent to wetland complexes, which also have a high potential for providing small mammal habitat, as well as ungulate habitat. Activities proposed in Alternative B would have the greatest potential to affect prey species within wetland complexes (612 acres); Alternative C would have slightly less potential for negative effects to prey species in wetland complexes (597 acres); Alternative D would have the least potential effect (320 acres).

OVERALL HABITAT SECURITY

Wolverines are generally associated with remote, isolated areas away from human development. Many of the proposed treatment units are in the lower valley to mid-elevation slopes; adjacent to private property or other high-human use areas. Although wolverine use of lower elevation habitat is uncommon, field surveys for wolverine have detected wolverine on the mid-elevation slopes above the western shore of Lindbergh Lake (Project File Exhibit H-8). It is possible that short-term displacement of wolverine could occur in proposed treatment areas on the mid to upper slopes as a result of proposed activities in Alternatives B, C, or D. This short-term displacement would probably not be significant.

As described above, deep, persistent, and reliable spring snow cover is the best overall predictor of wolverine occurrence in the contiguous United States (Aubry et al. 2007; Copeland et al. 2010). In Alternatives B, C, and D, there are 123 acres of proposed treatment in areas that have had persistent snow 1 out of 7 years (Units 77, 78, and 81, portions of 82, 88, 89, 90, and 92). Regeneration treatment is proposed in these units; no overstory cover or hiding cover would be retained on the 123 acres. The stands proposed for treatment have a high percentage of lodgepole pine trees that are presently dead or dying as a result of mountain pine beetle; the current amount of canopy cover would decrease regardless of whether the stands are treated or not. Hiding cover would also decrease naturally, but less hiding cover would remain following proposed treatment than would exist naturally without proposed regeneration. Areas of persistent snow 1 of 7 years are not necessarily high quality wolverine habitat; the Glacier Loon Watershed includes areas where snow is persistent on a more consistent basis (Project File Exhibit H-7).

As wolverine move between their natal den areas and lower elevation habitats in search of food, they need secure, connected habitats. Each of the action alternatives would have an effect on habitat connectivity and hiding cover. Under Alternative B, there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 1,453 acres; under Alternative C the decrease would be very similar, 1,310 acres; Alternative D would have the least negative impact of the action alternatives, with a decrease of 888 acres of hiding cover.

Temporary road construction is proposed under each of the action alternatives. Alternative B has the largest amount of proposed temporary road construction (11.5 miles), followed by Alternative C (7.4 miles). Alternative D has the least proposed temporary road construction (5.8 miles). Temporary roads would be reclaimed following use. Despite the reclamation of temporary roads, there is obvious evidence of ground disturbance and clearing of vegetation that remains after a temporary road is reclaimed. It is possible for these reclaimed areas to be an attractant to forest users. The goal of reclaiming the temporary roads is to discourage motorized use. There is always a potential for these temporary roads to be vectors of human use, but the potential is low, if the reclamation work is successful.

Under Alternative B, there is 4.1 miles of road decommissioning proposed; in Alternatives C and D, there is 8.4 miles of road decommissioning proposed. Road decommissioning would increase long-term habitat security for wolverine and wolverine prey species.

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no change to existing MA designations under Alternative B.

Implementation of Alternatives C and D would include a MA change in the Flathead Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake. The proposed MA change on 221 acres above Lindbergh Lake would likely translate into less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake; this would result in greater habitat security for wolverine and wolverine prey species on the western slopes above Lindbergh Lake.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Historically, prior to settlement of the Swan Valley, wolverine had unlimited access to a variety of habitats and most likely traveled from high elevation summer habitats to low elevation winter big game ranges. Management actions, such as road building, and other human developments, such as residential development, winter recreational activities (e.g., snowmobiling), campgrounds, hiking trails, and trapping, have had far reaching effects by increasing human presence in once remote areas. This increase in human-activity levels in once remote areas has fragmented wolverine habitat and probably created barriers to travel.

Future road building, snowmobile use, and other human activities in the area would have cumulative effects on the effectiveness of wolverine habitat. Management for grizzly bear security core areas in the Upper Swan Valley on NFS lands undoubtedly benefits wolverine, as does the increases in public land ownership through land acquisition. Road closures designed for grizzly bear security on NFS lands also provides wolverine security. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project.

The Glacier Loon Project would not contribute significantly to cumulative effects for wolverine in the Glacier Loon Area. The greatest potential threats to wolverine are the increase in human-activity levels in potential denning habitat (e.g., snowmobiling in high elevation cirque basins) and the threat from trapping. Inman et al. (2012) describes how the wolverine is vulnerable to conservation challenges, such as roads, rural sprawl, recreation and climate change. Within the project area, high elevation areas are within the Mission Mountains Wilderness and snowmobiling is not permitted. Secure habitat for wolverine also occurs in other portions of the Glacier Loon Area on unroaded (or restricted access) mid- to upper-elevation slopes outside of designated wilderness. Adverse cumulative effects to wolverine would not be expected as a result of the proposed project.

It is thought that wolverines are conserved through extensive unroaded areas and forest management standards associated with access management in roaded areas, and by providing a connected forest matrix (USDA 2006). With limited forest management where the primary habitat of this species is located, there appears to be little risk of population loss; species viability would be

maintained.

DETERMINATION

The Glacier Loon Project was analyzed for effects to wolverines based on vegetation changes, movements across the landscape, and disturbance from other associated human activities. The determination for Alternative A is “No Effect.” Alternatives B, C, and D of the Glacier Loon Project would not result in a jeopardy determination for the wolverine (Project File Section AA). The determination is based on the following: No activities would overlap temporally with wolverine natal denning, activities would be primarily limited to low to mid elevations and would not likely displace wolverine during the summer months, effects to wolverine prey base would be minimal, and some displacement may occur due to wolverine primarily in the winter months.

REGULATORY FRAMEWORK AND CONSISTENCY

The wolverine is currently a proposed threatened species on the Flathead National Forest. Section 7(a) 2 of the ESA requires that federal agencies must ensure that their activities are not likely to jeopardize the continued existence of any species or result in the destruction or adverse modification of designated critical habitat. On May 20, 2014 the USFS submitted a Biological Assessment to the USFWS analyzing routine forest projects and the impacts to wolverine. The Assessment determined that forest management and fuels reduction were not a threat to the species (Project File Section AA). On May 23, 2014, the USFWS concurred with the analysis and determined that routine USFS projects would not jeopardize wolverine (Project File Exhibit H-160; [Project File Section AA](#)). In addition to analyzing wolverine as a sensitive species, the programmatic consultation was reviewed and the project was determined to be consistent with the effects considered by this consultation ([Project File Section AA](#)). The Glacier Loon project would not jeopardize wolverine.

SENSITIVE WILDLIFE

INTRODUCTION

Sensitive wildlife species are those species that may show evidence of a current or predicted downward trend in population numbers or in habitat suitability that could substantially reduce species distribution. The Regional Forester has identified 14 wildlife species as sensitive, including the recently de-listed gray wolf, and the latest addition, bighorn sheep.

Bighorn sheep, flammulated owl, harlequin duck, northern leopard frog, peregrine falcon, and Townsend's big-eared bat are sensitive wildlife species that would not be affected by this project and will not be discussed further in this report, (Project File Exhibit H-17).

ANALYSIS AREA

SPATIAL BOUNDS

The Glacier Loon Fuels Project Area, approximately 37,320 acres, was the area considered for the evaluation of direct, indirect, and cumulative effects on sensitive wildlife species. This project area is large enough to include the home ranges of several individuals or pairs of a species, and is representative of the effects of fire, natural tree mortality, timber harvest, road management, and other potential effects, across the landscape. The actions proposed that could directly, indirectly, or cumulatively affect sensitive species are contained within this area.

TEMPORAL BOUNDS

The length of time for effects in this cumulative effects analysis is approximately 1 to 5 years. This is based on the probable contract length for the proposed project, the timeframes for related activities, and the reasonably foreseeable actions identified.

BALD EAGLE

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included stand exams, VMAP Data, project area field visits, research literature, and GIS and dataset information for features such as general forest attributes, habitat type, and forest type.

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology of the bald eagle, certain elements are thought to be essential to the conservation of the species. These elements include the presence of large bodies of water and large snags (nesting/roosting). The effects analysis for bald eagle focused on the presence of large water bodies and potential nesting trees and the potential effects the proposed action could have on these habitat characteristics.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Bald eagles are associated with large bodies of water or major river drainages. In Montana, bald eagles nest in stands containing large trees (>30 inches DBH) 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 2010). The lakes or rivers with the greatest potential to provide bald eagle nesting sites, historically or currently, in the Glacier Loon Area, would be Lindbergh Lake and the shoreline of the Swan River.

Bald eagles are opportunistic feeders, preying on fish, waterfowl, and small mammals; stealing food from other predators; and scavenging carrion. It can be assumed that the lands surrounding Lindbergh Lake and the Swan River provided ample forage opportunities for bald eagles.

EXISTING CONDITION

In Montana, the bald eagle was removed from the Endangered Species list in August 2007. In the 2009 nesting season, there were 233 active bald eagle nests in western Montana, fledging over 200 young (USDA 2015). Well distributed across lower-elevation areas, as of 2009, there were 12 active bald eagle nest territories on or adjacent to the Flathead National Forest. The bald eagle population has continued to grow in subsequent years (USDA 2015).

There is a statewide effort to monitor bald eagle nests on an annual basis, and the Flathead National Forest has participated in bald eagle nest monitoring for over a decade. There are several known and monitored bald eagle nests in the Swan Valley. Although Lindbergh Lake is reported to have had successful, productive bald eagle nests in the past, currently there are no known bald eagle nests in the Glacier Loon Project Area. It should be noted that lakeshores in the vicinity that provided potential bald eagle nesting habitat in the past have been built up and experience high levels of human activity now. Bald eagle nesting habitat has decreased in the Upper Swan Valley due to lakeshore development and recreational activities along the shorelines and on the lakes themselves.

Bald eagles are known to pass through the Glacier Loon Area, but there are no known concentrated feeding sites or roosting areas. Bald eagles use the Swan Valley for foraging and as a migratory route.

ENVIRONMENTAL CONSEQUENCES

The Glacier Loon Project consists of a No Action Alternative and three action alternatives. A cumulative effect considers and describes proposed activities in addition to the past, current, and reasonably foreseeable activities. Cumulative effects are discussed throughout this section under the specific alternatives. For a detailed discussion of all known past, present, and foreseeable activities see the Cumulative Effects Worksheet for Sensitive Species (Project File Exhibit H-24).

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

The No Action Alternative would have no direct or indirect effect on bald eagle roosting, foraging, or nesting sites.

The Glacier Loon Area contains established human activities and developments including roads, timber management, numerous recreational opportunities, and residential development. It is expected that these activities would continue on public and private lands. **TNC harvest activities have occurred within the project area and reduced forest cover and snags on Legacy Lands.** Potential foraging

habitat for bald eagles would still be available. The overall effect to bald eagle nesting habitat would be low since the Glacier Loon Area does not currently contain any known nest sites or known primary use areas (areas within 0.25 – 0.5 miles of a nest site). Activities on adjacent private lands, along lakeshores where eagles could potentially nest, could affect bald eagle production in the future. Alternative A would not contribute to these effects.

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

NESTING HABITAT

There is no known bald eagle nesting sites in the Glacier Loon Area. There would be no direct or indirect effects to known nesting habitat. There is potential nesting habitat along the western shoreline of Lindbergh Lake that could be affected by proposed activities in Alternative B. Units 85 and 87, in Alternative B, are located close to the shoreline of Lindbergh Lake and have large diameter trees that could potentially provide nesting habitat for bald eagles. Alternatives C and D do not include Units 85 and 87 and would not have treatments that could affect bald eagle nesting habitat. In addition, spring timing restrictions in place for grizzly bear security would help to mitigate potential effects to bald eagles that might nest along the shoreline of Lindbergh Lake.

FEEDING/ROOSTING HABITAT

There are no known concentrated feeding sites or roosting sites in the Glacier Loon vicinity. Typically, bald eagles select the larger, more dominant trees as individual roost trees. There is no proposed treatment in old growth habitat under any of the alternatives. Old growth habitat areas have the greatest potential for providing high quality roost trees. Implementation of the Glacier Loon Project would not significantly alter the number or availability of potential roost trees in the Glacier Loon Area. There would be no measurable direct or indirect effect to bald eagle roosting or feeding sites.

MORTALITY RISK

Possible mortality factors include hazardous structures, such as power lines, collision with vehicles, and disturbance during incubation and nesting periods, illegal killing, and use of certain pesticides that can cause reproductive failure. Implementation of the Glacier Loon Project would not increase the risk of mortality. Log haul would be spread out over time and space and local highways that would be used for log haul already receive large amounts of traffic. There would be no significant increase in road kills as a result of project implementation.

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no MA change under Alternative B.

Implementation of Alternatives C and D would include a MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake. Under Alternative C and Alternative D, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5 designation. On MA 15 and MA 15C lands, cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would probably translate into less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake. This would be beneficial for bald eagle because there would be less chance of disturbance to potential bald eagle nesting, roosting, or feeding sites.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

As described above under the No Action Alternative, the Glacier Loon Area contains established human activities and developments. TNC harvest activities have occurred within the project area and reduced forest cover and snags on Legacy Lands. These lands were managed as former industrial timber lands and did not contain a high abundance of roost or nesting trees. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project. It is expected that human activities on private lands would continue. Potential foraging habitat for bald eagles would still be available across the Glacier Loon Area and on adjacent private lands. The overall effect to bald eagle nesting habitat from activities in the Glacier Loon Area would be low since the area does not currently have any known nest sites. If a nest is discovered, it would be protected in accordance with the Montana Bald Eagle Management Guidelines (2010). Activities on private lands adjacent to lake shorelines in the Glacier Loon Area and the Upper Swan Valley could affect bald eagle production. Alternatives B, C, and D would not contribute significantly to these effects.

The Montana Species of Concern Review Committee (2012) recently described how the bald eagle has had large population increases, robust productivity, and has reoccupied most of Montana in recent years. The population continues to increase, has expanded well beyond predictions, and seems biologically secure.

DETERMINATION

In accordance with FSM 2673.42, a determination has been made as to the degree of impact the activities proposed might have on sensitive species. Based on available information on the bald eagle's distribution, habitat requirements, and management strategies, as well as project design and location, the determination for Alternative A is **"No Impact"** and the determination for either Alternative B, C or D is **"May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species."**

BLACK-BACKED WOODPECKER

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included stand exams, VMAP Data, project area field visits, research literature, and GIS and dataset information for features such as general forest attributes, habitat type, and forest type.

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology of the black-backed woodpecker, certain elements are thought to be essential to the conservation of the species. These elements include the presence of dead and dying, insect-infested trees (forage), and large snags (nesting). The effects analysis for the black-backed woodpecker focused on the presence of insects and potential nesting trees and the potential effects the proposed action could have on these habitat characteristics.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Black-backed woodpeckers forage in areas with concentrations of dead or decaying trees and logs, often in recently burned forests. The trees in which they feed have frequently only been dead for 2 to 3 years, since these trees harbor the most insects. They use live or dead trees (usually 8 to 12 inches DBH) for nesting. Black-backed woodpecker populations have always been transitory. When an epidemic, windstorm, or fire occurred in the past, black-backed woodpeckers would move into that area. As time went on and the insect numbers decreased, the woodpeckers would move on to another area. There was probably more feeding habitat historically, prior to aggressive fire suppression efforts and salvage of fire-killed or insect-infested trees.

EXISTING CONDITION

Black-backed woodpeckers are known to occur throughout the Swan Valley, usually in low numbers. Mature and old growth forest stands in the Upper Swan Valley and in the Glacier Loon Area provide potential habitat conditions for a low-density population.

Samson (Samson 2005; USDA Forest Service 2007a) found that black-backed woodpecker habitat was abundant and well distributed across the Northern Region and by Forest. In addition, habitat amounts are expected to increase as fires and insect outbreaks continue to increase in size and in a pattern distinctly different from that evident historically (Gallant et al. 2003; Hessburg et al. 2003). No scientific evidence exists that the black-backed woodpecker population is decreasing in numbers (Samson 2005).

Black-backed woodpeckers forage in areas with concentrations of dead or decaying trees and logs, often in recently burned forests. The trees in which they feed have frequently only been dead for 2 to 3 years, since these trees harbor the most insects. They use live or dead trees (usually 8 to 12 inches DBH) for nesting. Black-backed woodpecker populations have always been transitory. When an epidemic, windstorm, or fire occurred in the past, black-backed woodpeckers would move into that area. As time went on and the insect numbers decreased, the woodpeckers would move on to another area. There was probably more feeding habitat historically, prior to fire suppression activities. Hutto (2008) reports that the black-backed woodpecker is “extremely specialized on severely burned forests.” He found that “96 percent of their detections on Landbird plots were in burned forest conditions, where this species was 16 times more likely to occur than anywhere else.”

Between 2001 and 2004, approximately 200,000 acres burned in over 70 fires across the Flathead National Forest. These fires created pulses of habitat suitable for relatively high densities of black-backed woodpeckers. Less than 5 percent of this habitat had salvage harvest, leaving the vast majority of habitat available in large tracts. Between 2007 and 2012, approximately 138,632 acres burned (USDA 2013).

Hutto (2007), in a study of bird use of habitats burned in the 2003 fires in northwest Montana, found that within burned forests, there was one dominant variable that influenced the distribution of birds, and that is fire severity. Some species, including the black-backed woodpecker, were relatively abundant only in the high-severity patches. Dudley and Saab (2007) estimated an average home range size of 511 acres of this high-quality habitat per nesting pair.

Hutto's preliminary 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. There is currently no recent post-fire habitat (within the last 10 years) for black-backed woodpecker in the Glacier Loon project area. Considering the 138,632

acres burned between 2007 and 2012, approximately 4.5% was post-fire salvage logged within four years of the fire on Flathead National Forest Lands (USDA 2013).

Black-backed woodpeckers also do occur in unburned landscapes (Bull et al. 1986). During extended periods of wet, cool summers when few fires burn, black-backed woodpeckers appear to disperse and forage on small bark beetle outbreaks at low densities (Saab et al. 1998). Hoyt and Hannon (2002) reported black-backed woodpeckers in old forest stands long distances from any burned areas, suggesting the species is not “restricted” to post-burn areas.

Nappi and Drapeau (2009) suggested that old growth habitats may allow population persistence between fires in regions with longer fire cycles. Mid-successional forest habitat may also provide feeding habitat. Portions of the project area have high levels of dead standing trees as a result of mountain pine beetle, root disease, Douglas-fir beetle, and other insect or disease mortality and these may provide both feeding and nesting habitat

While black-backed woodpeckers are highly specialized to select burned forest, some information exists that beetle killed trees may provide some potential food source for black-backed woodpeckers (Rota et al. 2014; Saab et al. 2014). This potential food source is not likely high quality, but may be utilized by some woodpeckers during long cycles between fires (Rota et al. 2014).

Habitat models based on forest and regional scales suggest that habitat exceeds amounts needed for a minimum viable population (Samson 2005). Evidence suggests that the black-backed woodpecker is increasing in numbers in the United States (Dixon et al. 2000). Virtually all climate model projections indicate that warmer springs and summers would occur over the region in coming decades. Westerling et al. (2006) states;

“These trends will reinforce the tendency toward early spring snowmelt and longer fire seasons. This will accentuate conditions favorable to the occurrence of large wildfires, amplifying the vulnerability the region has experienced since the mid-1980’s.”

These models and trends indicated a surplus of black-backed habitat above historical levels. Black-backed woodpecker populations fluctuate naturally due to variation in insect epidemics and wildfires over time, moving into and out of habitat areas as habitat suitability changes. In northwest Montana, it is likely that black-backed woodpecker populations increased between 2003 and 2008 due to the large number of acres that experienced high-intensity burns during this time period (USDA 2016). Evidence suggests the black-backed woodpecker is increasing in numbers in the United States (Dixon et al. 2000).

For additional information on the status of the black-backed woodpecker on the Flathead National Forest, and the status at broader scales, reference the document, Flathead National Forest Evaluation and Compliance with NFMA Requirements to Provide for Diversity of Animal Communities (Project File Section AA).

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Alternative A would maintain the existing situation. There would be no direct physical change to the landscape; insects and disease would continue to cause tree mortality in the Glacier Loon Area and black-backed woodpeckers would respond to insect outbreaks. **TNC harvest activities have occurred within the project area and reduced forest cover and snags on Legacy Lands.** Indirectly, if a wildfire occurs in the future in the Glacier Loon Area and spreads to become a large fire on the landscape because of fuel buildup in the area, it would not be a negative circumstance for the black-backed woodpecker since this woodpecker responds positively to wildfire events. The probability of this

condition occurring could be greater under the No Action Alternative.

Timber harvest on NFS lands and on private and State lands in the Swan Valley would continue, probably salvaging a portion of the potential feeder and nesting trees for black-backed woodpeckers. High levels of human activity would continue, with the potential for potential feeder trees to be taken out as firewood. There would be no proposed road decommissioning with the No Action Alternative. Although there could be an increase in firewood cutting from open roads, no additional access for such activities would occur as a result of Alternative A.

Fire suppression efforts would continue, and to the extent that they are successful, black-backed woodpecker population levels would remain low. Since 2001, there have been a number of large wildfires on the Flathead National Forest and throughout western Montana. For the next 2 to 3 years, and possibly longer, black-backed woodpecker numbers in the Flathead should remain high.

Alternative A would not contribute significantly to negative cumulative effects on black-backed woodpecker.

ALTERNATIVES B AND C DIRECT AND INDIRECT EFFECTS

Since implementation of Alternative B or C would have similar effects on the black-backed woodpecker, the two alternatives will be analyzed together.

FORAGE AND NESTING HABITAT

A direct effect to the black-backed woodpecker as a result of implementing Alternative B or C would be the reduction of potential feeder trees and nesting trees in the regeneration and intermediate treatment units. Under Alternative B, there would be 1,749 acres of potential habitat treated; under Alternative C there would be slightly less - 1,556 acres. Many of the current potential feeder trees for black-backed woodpecker in the Glacier Loon Area are existing lodgepole pine trees that have been attacked by mountain pine beetle; in proposed regeneration and intermediate harvest units, these are the trees that would most likely be removed.

There would be no proposed treatment in old growth under Alternatives B and C; these stands would have a high potential for providing both nesting and feeding habitat. In addition, there are mixed species stands adjacent to the project area, which are not proposed for treatment. There are mountain pine beetle-affected lodgepole pine trees in these stands that could potentially provide feeding and nesting habitat for black-backed woodpecker. There are also other predominately lodgepole pine forest stands, dead or dying from mountain pine beetle, located throughout the Swan/Seeley Valley.

Design Criteria (Table 2- 16) for Alternatives B and C include the retention of a minimum average of 6 snags per acre that are 12 to 20 inches DBH; all snags greater than 20-inches DBH would be left, as well. If existing snag densities are below these densities, substitute live trees would be left. Although the snag retention Design Criteria are sufficient for many wildlife needs, they would not retain sufficient insect-infested trees to support an historical insect epidemic level population of black-backed woodpeckers in the project area.

An indirect negative effect to black-backed woodpecker could potentially be the decreased chance of a large stand-replacing wildfire. Larger wildfires on the landscape would be beneficial to black-backed woodpeckers, since the fires increase the amount of potential feeding and nesting habitat.

TEMPORARY ROADS

Temporary road construction is proposed under Alternatives B and C. Approximately 11.5 miles of temporary road would be needed to access proposed units under Alternative B, and approximately 7.4 miles of temporary road in Alternative C. Where newly constructed temporary road occurs, some snags could be cut down; there would be a small decrease in the amount of potential feeder or nesting tree habitat to the black-backed woodpecker as a result of temporary road construction.

SECURITY/MORTALITY RISK

Under Alternatives B and C, it is possible that project implementation would directly affect individual black-backed woodpeckers through disturbance or incidental mortality if nesting trees are cut down during the nesting period. The Design Criteria for project implementation outside of the spring period (for grizzly bear) would help to mitigate this mortality risk by decreasing the potential for direct disturbance or mortality during the spring season. This timing restriction would apply to all units except Units 1-14, 19-26, 30-34, 90, 92, 94, 200, and 205.

The amount of open roads in an area could directly affect the black-backed woodpecker by providing human access for activities like firewood gathering, which would directly affect the amount of dead trees in an area (e.g., forage and nesting areas for the woodpecker). Road closures in place for the grizzly bear have improved security for potential black-backed woodpecker habitat in the Glacier Loon Area and throughout the Swan Valley. Temporary roads would have a potential to be a vector for human activity; all temporary roads in the Glacier Loon Project Area would be **rehabilitated** following use.

Other roads that are managed as closed roads would be used for accessing units. As described, an increase in public access increases the risk of losing high quality snags to firewood cutters. Public use of closed roads would not be permitted.

ROAD DECOMMISSIONING

In Alternative B, there is 4.1 miles of road decommissioning proposed. This would help to increase long-term habitat security for wildlife species, including black-backed woodpecker. Under Alternative C there would be 8.4 miles of road decommissioning; this increase in proposed road decommissioning would be more beneficial for black-backed woodpecker than the lesser amount proposed in Alternative B.

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no MA change under Alternative B.

Implementation of Alternative C would include a MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake. Under Alternative C, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5 designation. On MA 15 and MA 15C lands, cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would probably translate into less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake. This would likely mean that the potential for these 221 acres to support more snag habitat over a longer period of time would be greater; this would be beneficial for the black-backed woodpecker.

ALTERNATIVE D

DIRECT AND INDIRECT EFFECTS

Alternative D is analyzed separately because the potential effects to black-backed woodpecker as a result of implementing Alternative D would be less than effects from either Alternative B or C, due to the smaller scale of the treatment, as described below.

FORAGE AND NESTING HABITAT

Under Alternative D, there would be 1,045 acres of potential habitat treated (e.g., Regeneration and Intermediate Treatment Units). A direct effect to the black-backed woodpecker as a result of implementing Alternative D would be the reduction of potential feeder trees and nesting trees in these units. There would be no proposed treatment in old growth; these stands have a high potential for

providing both nesting and feeding habitat. In addition, there are other forest stands adjacent to the project area, which are not proposed for treatment and have mountain pine beetle-affected lodgepole pine trees that could potentially provide feeding and nesting habitat for black-backed woodpecker.

Design Criteria for Alternative D are the same as those described above for Alternatives B and C; they include the retention of a minimum average of 6 snags per acre that are 12 to 20-inches DBH, and all snags greater than 20-inches DBH. If existing snag densities are below these densities, substitute live trees would be left.

TEMPORARY ROADS

Approximately 5.8 miles of temporary road would be needed to access proposed units under Alternative D. Where newly-constructed temporary road occurs, some snags could be cut down; there could be a small decrease in the amount of potential feeder or nesting tree habitat to the black-backed woodpecker as a result of temporary road construction. Temporary roads also have a potential to be a vector for human activity; all temporary roads in the Glacier Loon Project Area would be **rehabilitated** following use.

SECURITY/MORTALITY RISK

Under Alternative D, it is possible that project implementation would directly affect individual black-backed woodpeckers through disturbance or incidental mortality if nesting trees are cut down during the nesting period. The potential would be less for Alternative D than for Alternatives B and C because fewer acres would be affected. The Design Criteria for project implementation outside of the spring period (for grizzly bear) would help to mitigate this mortality risk by decreasing the potential for direct disturbance or mortality during the spring season.

ROAD DECOMMISSIONING

Under Alternative D, approximately 8.4 miles of road decommissioning is proposed. This would increase long-term habitat security for many wildlife species, including black-backed woodpecker.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative D would include the same MA change in the Forest Plan as described above for Alternative C. The proposed MA change on 221 acres above Lindbergh Lake would translate into less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake. This would likely mean that the potential for these 221 acres to support more snag habitat over a longer period of time would be greater; this would be beneficial for the black-backed woodpecker.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Fire suppression has been the greatest factor limiting the distribution of potential black-backed woodpecker habitat. Prior to 2001, there were few wildfires of considerable size since 1926. Then, across the Flathead National Forest and most of western Montana, large acreages of black-backed woodpecker habitat were created by wildfires. Between 2001 and 2004, approximately 200,000 acres in over 70 fires burned on the Flathead National Forest, creating a substantial amount of black-backed woodpecker habitat. Less than 5 percent of this habitat was salvage harvested, leaving the vast majority of potential black-backed woodpecker habitat intact. The 11,000-acre Crazy Horse Fire in 2003, located to the west of the project area, in the Upper Swan Valley, created thousands of snags with only a portion of the snags removed through salvage on about 600 acres. In 2006, about 1,800 acres containing thousands of trees were burned in the Holland Peak Fire, northeast of the Glacier Loon Area. Most of these snags remained on site.

As discussed in Westerling et al. (2006), virtually all climate model projections indicate that warmer springs and summers will occur over the region in coming decades:

“These trends will reinforce the tendency toward early spring snowmelt and longer fire seasons. This will accentuate conditions favorable to the occurrence of large wildfires, amplifying the vulnerability the region has experienced since the mid-1980’s.”

An increase in acres of wildfire would likely benefit black-backed woodpecker.

As described previously, open roads and increased human use could affect the availability of snag habitat and negatively affect black-backed woodpeckers. Road closures in place for the grizzly bear have improved security for potential black-backed woodpecker habitat in the Glacier Loon Area and throughout the Swan Valley. **TNC harvest activities have occurred within the project area and reduced forest cover and the potential of severe wildfire on Legacy Lands. Road closures have remained in place limiting public motorized access. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project’s layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project.**

Although the proposed project would harvest insect-affected trees in the Glacier Loon Area and decrease forage and nesting habitat for the black-backed woodpecker, broad scale analysis has demonstrated that there appears to be little risk of population loss (USDA 2006, 2015a). It is unlikely that Alternatives B, C, or D would contribute significantly to negative cumulative effects on black-backed woodpeckers.

DETERMINATION

In accordance with FSM 2673.42, a determination has been made as to the degree of impact the activities proposed might have on sensitive species. Based on available information on the black-backed woodpecker’s distribution, habitat requirements, and management strategies, as well as project design and location, the determination for Alternative A is **“No Impact”** and the determination for each of the action alternatives is **“May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species.”**

COMMON LOON

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included project area field visits, monitoring reports for common loon, research literature, and GIS and dataset information.

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology of the common loon, the effects analysis focused on the potential for nest site disturbance or modification of potential habitat.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

The southern edge of the loon’s breeding range extends into the United States across many of the eastern states and into the Rocky Mountains. The original extent of the population is unknown, although populations have declined with the settlement of the west.

Loons in Montana are associated with larger bodies of water (lakes >15 acres). They are disturbed

easily, so high quality habitat includes the more secluded lakes or larger lakes with portions of the shoreline that remain relatively undisturbed during the spring and summer months. In the vicinity of the Glacier Loon Project Area, lakes that are known to have had loon pairs nesting on them in the past are Lindbergh, Cygnet, and Loon. Other small lakes and potholes in the area provide feeding and loafing sites. Historically, lakes in the area would have had more nesting potential for loons due to the decreased level of human activity on the lakes themselves and along the shoreline.

EXISTING CONDITION

There are less potential nesting sites for the common loon than in the past. Many of the lakes that, in the past, are known to have provided nesting territories for one or more pairs now cannot support even one pair. In the Glacier Loon Project Area, Loon Lake has been a successful breeding lake for the common loon, and has been monitored for approximately 10 years. Although other lakes in the Glacier Loon Area have apparently had nesting loon pairs historically (e.g., Cygnet Lake, Lindbergh Lake), monitoring efforts have not documented successful nesting attempts for common loon for over a decade.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

There would be no proposed fuels treatment or forest health activities under this alternative. The occurrence and abundance of different forest conditions would fluctuate and change over time as the area progresses through various successional stages. There would be no direct effects to the vegetation along lakeshores in the Glacier Loon Area, as a result of implementing the No Action Alternative. Security for the common loon would likely remain the same where shoreline is NFS ownership.

There would be no changes in the level of general motorized access; there would be no proposed road decommissioning with the No Action Alternative.

Indirectly, the likelihood of stand-replacement fires could be increased under Alternative A as compared to the action alternatives, with an increased risk of the loss of vegetation along lake shorelines. However, the level of effects would depend on the size and intensity of the wildfire, which would depend on the actual location, intensity, moisture and weather conditions associated with a presently unknown future fire event.

Human occupancy of private lands in the Swan Valley is likely to increase, as is overall human activity in the Glacier Loon Area. This increase in human use would likely increase the potential for disturbance of nesting loons. However, there is nothing about the No Action Alternative that would be likely to interact cumulatively, causing significant negative effects on the common loon.

ALTERNATIVES B AND C DIRECT AND INDIRECT EFFECTS

Since implementation of Alternative B or C would have similar effects on the common loon, the two alternatives will be analyzed together.

Loons are completely dependent on water. The only known nesting habitat for common loons in the Glacier Loon Project Area is Loon Lake (on Kraft Creek Road). Although Lindbergh Lake and Cygnet Lake apparently had nesting loons in the past, monitoring and habitat enhancement efforts for over a decade have failed to produce a successful nesting attempt by loons, probably due to high human activity levels on and around the lake during the loon nesting season.

A potential direct effect on loons would be possible disturbance of an individual or pair that was using this lake for nesting, feeding, or loafing. Disturbance of loons that are feeding or loafing would be short-term and probably insignificant. Disturbance during nesting activity could be more serious for the common loon, possibly causing nest failure for one or more seasons. Both Alternatives B and C propose treatment in Unit 15 (75 acres), adjacent to Loon Lake. Although there would be a buffer along the shoreline and the unit boundaries would be set back from the shoreline, it should be noted that after many years of successful chick rearing on Loon Lake (including 2 chicks in 2000 and 1 chick in 2001), Loon Lake was not used for nesting by common loons from 2002 until 2009. In 2009, there was an unsuccessful nesting attempt; finally in 2010 to 2016 the lake again produced loon chicks. Although there is no clear cause for the lake being unproductive for so many years, the timing coincided with vegetation management adjacent to portions of the lake.

Design Criteria in place for grizzly bear security in important spring habitats could help to mitigate disturbance from activities in Unit 15 from April 1 through June 15. Logging activities after June 15 would **not likely disturb nesting; however activities may** still have the potential to interrupt chick rearing and cause chick mortality for the year(s) that proposed activities occur. The removal of vegetation screening near the lake would likely decrease the lake's potential to provide loon nesting habitat for at least 8 to 10 years. Loon Lake and Pierce Lake are the only known lakes in the Swan Valley where successful nesting and rearing of common loon chicks is currently occurring.

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no MA change under Alternative B.

Implementation of Alternative C would include a MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake. Under Alternative C, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5 designation. On MA 15 and MA 15C lands, cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would probably translate into less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake. This would be beneficial for common loons located on Lindbergh Lake.

ALTERNATIVE D DIRECT AND INDIRECT EFFECTS

Alternative D is analyzed separately because the potential effects to the common loon as a result of implementing Alternative D would be less than effects from either Alternative B or C.

Under Alternative D there is no proposed treatment adjacent to Loon Lake; Unit 15 has been dropped from Alternative D. The closest proposed activity (approximately 1,000 feet away) would be Unit 17 and the construction of a temporary road into Unit 17. Winter logging is required for Unit 17 under Alternative D; this would greatly decrease the potential for disturbance from actual logging activity in the area. The proposed temporary road used to access Unit 17 would probably be constructed in the summer, so there would still be a potential to disturb loons on Loon Lake, however the potential for chick mortality or nest abandonment would be low due to the distance of the disturbance from Loon Lake, in combination with timing restrictions in place for grizzly bear (e.g. no activity from April 1 thru June 15).

There would be no vegetation removal near the lake shore under Alternative D; the ability for Loon Lake to provide common loon nesting habitat would remain unchanged.

Similar to Alternative C, implementation of Alternative D would include a MA change in the Flathead Forest Plan. The proposed MA change on 221 acres above Lindbergh Lake would be beneficial for common loons located on Lindbergh Lake.

EFFECTS OF MANAGEMENT AREA CHANGE

Similar to Alternative C, implementation of Alternative D would include a MA change in the Flathead Forest Plan. The proposed MA change on 221 acres above Lindbergh Lake would be beneficial for common loons located on Lindbergh Lake.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Threats to the common loon include human-caused disturbance (e.g., recreational or management activities) on breeding lakes or vegetation manipulation along the shoreline of breeding lakes (USDA 2006). In the western United States, small population size and marked sensitivity to human disturbance are important factors. The greatest single barrier to loon productivity in the Swan Valley is the lack of undisturbed (low human-activity levels, abundant vegetative screening) shoreline habitat for nesting.

TNC harvest activities have occurred within the project area and reduced forest cover and snags on Legacy Lands. These activities have not occurred adjacent to loon nesting habitat in the project area and have not contributed cumulative effects to loons or loon habitat. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project.

Activities proposed in Alternatives A and D would only minimally affect common loon and would not contribute to ongoing cumulative effects in the Glacier Loon Area. Activities proposed in Alternatives B and C would negatively affect the common loon; effects include short-term displacement during actual implementation, and a potential decrease in nesting habitat and consequently chick productivity in the Glacier Loon Area for 8 to 10 years. The effects to common loon would not be permanent.

The global population of the common loon is considered secure; however, many local populations are small and isolated, and are vulnerable to extirpation primarily due to habitat loss and human encroachment (MFWP 2005). Northwestern Montana supports the highest density of nesting common loons in the lower 48 states west of the Mississippi River (MFWP 2005). Current statewide cooperative annual surveys (1994 - 2010) indicate approximately 117 to 194 adults in Montana, averaging 40 to 70 territorial pairs annually (Hammond 2008) and producing 33 to 54 chicks annually (Montana Common Loon Working Group 2007). The loon chick fledging rate in northwest Montana suggests a slightly increasing population. Statewide, evaluation of the last 14 years of Loon Day results indicates a relatively stable to increasing loon population with some degree of fluctuation across their habitat. On the Flathead National Forest, 25 lakes are known to be occupied or to have suitable nesting conditions.

Although activities proposed in Alternatives B and C could negatively affect nesting loons on Loon Lake, the cumulative effect would not be significant at a population level.

DETERMINATION

In accordance with FSM 2673.42, a determination has been made on the impact the activities proposed may have on sensitive species. Based on available information on the common loon's distribution, presence/absence from the project area, habitat requirements, and management strategies, as well as project design and location, the determination for the No Action Alternative is **"No Impact;"** the determination for Alternatives B, C, and D is **"May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species."** Alternative D would have the least potential for disturbance of nesting loons.

FISHER

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included aerial photography, VMAP Data, project area field visits, monitoring information, research literature, and GIS and dataset information for features such as general forest attributes, habitat type, forest type, and mapped riparian areas.

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology of fisher, certain elements are thought to be essential to the conservation of the species. These elements include the presence of denser canopy cover forest, snag and down woody habitat characteristics, and adjacent riparian habitats. These elements of fisher habitat, and the anticipated effects to these elements from project implementation, are the measurement indicators used in this analysis.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Fishers are large, weasel-like predators that occupy a variety of upland and lowland forests, with an affinity for forested riparian habitats. **Fishers occur most commonly in landscapes dominated by mature forest cover, and they prefer late-seral forests over other habitats (Lofroth et al. 2010; Powell et al. 1994).** However, in two studies in the Northern Rockies, fishers have also been observed using young to medium-age stands of conifers (Jones 1991; Roy 1991). In central Idaho, for example, fishers preferred “mature forest” (13.5 to 18.5 inches DBH) and “old growth forest” (>18.5 inches DBH) in summer, but have been detected in “young forest” (4.5 to 13.5 inches DBH) in winter (Jones 1991). While these younger stands may not provide the structural diversity necessary for denning or resting (although they may) especially in stands that are regenerating after fire or timber harvest in which large live and dead trees were retained, prey availability may be high enough to support fishers, particularly in winter months (Jones 1991).

The highest quality fisher habitat is dense (60 to 80+ percent cover) coniferous and mixed coniferous/deciduous forest with an available water source (Ruggiero et al. 1994). Fisher rarely stray far from streams (within 328 feet [100 meters]) or other wet sites (Powell et al. 1994), and they need good snow interception in the winter months (Allen 1983). Sites used by the fisher for shelter or sleeping include hollow logs, tree cavities, brush piles, and used burrows and/or dens. In a study done in Idaho, the average diameter of trees used by fisher as resting sites was 22 inches (Jones 1991). Maternity dens tend to be hollow cavities high in trees. The fisher preys on small mammals (snowshoe hare, grouse, voles, squirrels, mice, etc.) and carrion.

During the late 19th and early 20th Century, trapping, logging, and the conversion of forested areas to agricultural lands contributed to the fisher being extirpated from much of its range in the United States and eastern Canada. The fisher appeared to be eliminated from Montana at one time, as there were no trapping records in Montana from 1920 to 1960. Within Montana and Idaho, over a million acres of mature coniferous forest burned in the early part of the 20th Century. This may have played a role in the decline of fisher populations.

In the Northern Rockies, fishers have existed under a disturbance regime that has created numerous openings in a matrix of mature forested habitats. The denser, coniferous stands near water, which are

preferred by fisher, would have experienced longer intervals between fires than drier, more open forest lands. The increased pulse of large logs on the ground that would have followed a fire or insect event would have been beneficial.

EXISTING CONDITION

The fisher was petitioned for listing as a Threatened or Endangered Species in 2009. On April 16, 2010, the USFWS found that the petition presented substantial scientific or commercial information indicating that listing a distinct population segment of fisher in the Northern Rocky Mountains of the United States may be warranted. Therefore, with the publication of that notice, the USFWS initiated a review of the status of the species to determine if listing the fisher in the Northern Rocky Mountains of the United States was warranted. After review of all available scientific and commercial information, the USFWS found that listing the fisher in the U.S. Northern Rocky Mountains, which includes portions of Montana, Idaho, and Wyoming, as threatened or endangered was not warranted at this time. The fisher was not listed as endangered or threatened (USDI 2011a). **Fishers were petitioned again for listing in September 2013. The status of this petition is currently pending. In July 2017, the USFWS released a Species Status Assessment for the Northern Rocky Mountains Fisher (USFWS 2017). The USFWS states that potential stressors such as forestry have varying but low effects to the Northern Rocky Mountain Fisher and their habitat patches (pg. 4). The assessment states (pg. 60), “the effects of present and future forest management may be influenced by factors such including location, scale and juxtaposition of treatments to previous disturbances.”**

Fishers are common in the Northeastern and Midwestern portions of the United States, but rarer in the west. Restrictions on harvesting, and re-introduction programs in the late 1950s, have contributed to population recovery in portions of the fisher's historic range. In the Rocky Mountains, they occur in Idaho, Wyoming, and Montana. Since 1968, fisher occurrence has been verified in the Flathead, Mission, Swan, and Whitefish Ranges (Vinkey 2003). Fishers are **suspected** to occur in the Glacier Loon Area (Project File Exhibit H-24), but probably at very low population densities. It is believed that fisher population density is usually low, due to a relatively large home range, which can vary from 16 to 32 square miles (USDA 1994). **Monitoring for fisher has been ongoing from 2012 through the winter of 2017 using a combination of methods including track transects, fisher hair snares and bait stations. No fisher have been detected in the Swan Valley by this monitoring (SWCC monitoring Team progress report, 2015).**

Habitat associations vary across the range of fishers. In the Northern Rockies, evidence suggests fishers are most commonly associated with mesic mixed conifer forest types (Heinemeyer 1993; Jones 1991; Powell et al. 1994). In the Cabinet Mountains of Montana, fishers selected mixed conifer and cedar/hemlock forests and avoided subalpine and hardwood stands; north slopes were selected, whereas south slopes were avoided (Heinemeyer 1993; Roy 1991). In central Idaho, Jones (1991) found that fishers selected sites that were dominated by grand fir, Engelmann spruce, and cedar/hemlock, and avoided drier sites (ponderosa pine, upland subalpine fir, and xeric grand fir), although these sites were rare in the study area, occupying only a small proportion of the sampled area. Schwartz et al. (2013) found that fisher were selecting for habitat at two scales:

1. A stand scale as indicated by stands that have large mean and maximum DBH trees (as well as a large variation in tree size), and
2. A landscape scale as indicated by the preference for landscapes with a high proportion of large trees.

The authors suggested that that while fishers can be detected in riparian stringers that bisect open landscapes, this habitat may not be sufficient for persistence (Schwartz et al. 2013).

Fisher occurrence in the Rocky Mountain region was positively correlated with canopy cover up to an apparent threshold of 60 percent. Previously, it was thought that fishers in western North America may favor riparian forests (Lofroth et al. 2010). The majority of fisher locations from studies in the Northern Rockies were near riparian areas: 65 percent of locations were within 200 meters of water in the Cabinet Mountains (Heinemeyer 1993), and 70 percent of locations were within 328 feet (100

meters) of riparian areas in central Idaho (Jones 1991). Other research, has found that fisher use forest outside of riparian areas. Although riparian forests were important to fishers in some locales in British Columbia primarily for denning habitat (e.g., black cottonwood [*Populus balsamifera trichocarpa*] forests), Raley et al. (2012) did not detect consistent use or selection for riparian forests. Although riparian habitats may be especially useful for fishers, many upland habitats also offer a combination of the habitat characteristics associated with fisher use.

Hillis and Lockman (2003) mapped fisher habitat in Region One, where fishers are generally limited to west of the Continental Divide, fisher habitat was defined as low-to-mid elevation, mesic, mature, and old forests, within 328 feet (100 meters) of streams. To address patch size and habitat connectivity relevant for fishers, they excluded any patch of habitat that was less than 160 acres and more than 600 feet from the nearest patch of adjacent cover (Jones 1991; Ruggiero et al. 1994). That habitat was compared against levels of habitat that would have been available in pre-fire suppression/pre-logging periods. What they found was that fisher habitat occurs at historically normal levels at both the Flathead National Forest and Region One scales. More recently, Samson (2006) showed that on the Forests and the Region as a whole, forested ecosystems are more extensive now than in historic times. Research on fisher is ongoing. Multiple agencies and organizations, including the Forest Service, are currently conducting surveys to detect fisher in the Rocky Mountains. Fishers are more difficult to monitor than most species, and monitoring results are often inconclusive (USDA 2016). Fisher research is ongoing in the Region. The goals of current research and monitoring are to:

- Delineate the geographic range of fisher;
- Determine which Rocky Mountain fisher populations have native genes; and
- Index the abundance of fisher in the different populations.

Fishers are thought to need good snow interception in the winter months (Allen 1983). Sites used by the fisher for shelter or sleeping include hollow logs, tree cavities, brush piles, and used burrows and/or dens. In a study done in Idaho, the average diameter of trees used by fisher as resting sites was 22 inches (Jones 1991). Maternity dens tend to be hollow cavities high in trees. The fisher preys on small mammals (snowshoe hare, grouse, voles, squirrels, mice, etc.) and carrion.

In the Northern Rockies, fishers have existed under a disturbance regime that has created numerous openings in a matrix of mature forested habitats. While fire can result in destruction of some late successional habitat, it is also responsible for maintenance and creation of habitat features important to fisher (Hayes et al. 2006). The denser, coniferous stands near water, which are preferred by fisher, would have experienced longer intervals between fires than drier, more open forest lands. The increased pulse of large logs on the ground that would have followed a fire or insect event would have been beneficial.

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). Fishers generally avoid areas with low canopy cover and conversely prefer large areas of contiguous interior forest with vegetative and structural aspects that lead to abundant prey.

Fishers are thought to be among the most habitat-specialized mammals in North America (Hayes et al. 2006). Fragmentation can affect fishers' use of the landscape because moderate to high amounts of contiguous cover are a consistent predictor of fisher occurrence at large spatial scales. In California, Zielinski et al. (2013) examined fisher scat densities as an index of use when comparing two fuels reductions means classified as restorative and extractive. The research found low fisher scat densities in areas with regeneration treatments and relatively high scat densities (used as an index of fisher habitat use) in areas that used thinning, underburning and individual tree selection to accomplish fuel reduction means. Hayes et al. (2006) discuss how fisher may still use forest stands where small patch cuts or light harvest may have little negative impact on fisher if adequate late successional forest habitat is available.

Due to numerous wetlands in the Swan Valley and the availability of moist forest conditions, fisher habitat appears to be extensive and well distributed in the valley's lower elevation zones and along the west side of the Swan Valley at the low to mid-elevations of the Mission Mountains (USDA 1994).

Although fisher in the Swan Valley are not likely to be restricted to stream course zones, riparian habitats in the valley are important and provide key travel and movement corridors with dense multi-storied coniferous forests and snag and down woody debris structures (Aubry et al. 2012). Riparian habitats in the Swan Valley are also more likely to provide the dense canopy cover and complex structure (e.g., snags, broken tops, down woody material) that fisher are associated with. Moist old growth habitats in the Swan Valley would also be very important for the fisher, for the same reasons. Reproductive dens are typically in the oldest and largest trees available (Naney et al. 2012).

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

No fuels reduction or forest health activities would be implemented in the Glacier Loon area under this alternative. There would be no direct effect to canopy cover on NFS lands, and any existing or potential den sites would be maintained. Human activity and associated disturbance would be least under this alternative. **Harvest on legacy lands has occurred by TNC within the project area. These past harvests were completed on former industrial timber company lands which held little or no forest that provided large tree, multi-story, complex forest stands that comprise fisher habitat. These projects did not change public access from the existing condition.**

Indirectly, under the No Action Alternative, it could be anticipated that larger more intense fires could occur within the project area than would have occurred under more historic fire and fuel loading conditions. Though precise impacts of such fires would be dependent on location of the fire start, weather conditions at the time, fuel conditions at the fire origin, and many other factors, to the degree that such fires were stand replacing, they would tend to reduce the amount of fisher habitat available.

ALTERNATIVE B DIRECT AND INDIRECT EFFECTS

CANOPY COVER

A direct effect to fisher from implementation of Alternative B would be the reduction of canopy cover. Jones (1991) found that fisher selected for stands that had an average of 60 percent or greater canopy cover; they avoided stands with less than 40 percent canopy cover. In the proposed Clearcut, Seed Tree, and Shelterwood Units in Alternative B (773 acres), the stands would become unsuitable fisher habitat following treatment. In stands that are proposed for commercial intermediate treatment (e.g., Sanitation Salvage, Improvement Cut, Commercial Thin), the existing canopy cover would be reduced. Generally, in the Commercial Thin and Improvement Cut Units (968 acres), the canopy cover following treatment would not provide suitable habitat for fisher. In the Sanitation/Salvage Units (8 acres), the remaining canopy cover would still be sufficient for fisher use; at least it would not be an avoidance area. In the proposed non-commercial treatment areas (Pre-Commercial Thin/Post and Pole), the effects to fisher would be minimal; these stands do not currently provide fisher habitat due to the size of the trees.

RIPARIAN AND OLD GROWTH HABITATS

Old growth and riparian habitats have a high potential of providing high quality fisher habitat. There is no treatment proposed in old growth habitat under Alternative B; any old growth habitats presently providing suitable fisher habitat would continue to do so (see Old Growth Associated Species). Under Alternative B, there would be treatments proposed in or adjacent to riparian habitat. Riparian habitat would include rivers, streams, lakes, small wetlands, and ponds or potholes. There are management guidelines and BMPs in place (e.g., INFISH) that mitigate effects to riparian habitat. Riparian Habitat Conservation Areas restrict activities within a designated distance from streams,

lakes, and wetlands. The riparian guidelines in place for Alternative B would help protect important riparian habitats for fisher. However, it should be mentioned that riparian habitats, when referring to wildlife habitat, encompass more acreage than the wetland itself and probably extend beyond the guidelines established for aquatic riparian values. In other words, there would still be direct and indirect effects to riparian habitats or wetland complexes that are important for fisher in the Glacier Loon Area. Direct and indirect effects would include the loss of both canopy cover and hiding cover adjacent to riparian habitats, and displacement from riparian habitats while activities are occurring in close proximity.

Important riparian habitat for fisher in the Glacier Loon Project Area includes portions of Sections 26 and 36 (T20N R17W), portions of Section 6 (T19N R16W), and portions of Sections 11 and 12 (T19N R17W). Under Alternative B, there would be 101 acres treated in Section 26 (Units 15 - 17), 224 acres treated in Section 36 (Units 19 - 31, 205), 64 acres treated in Section 6 (Units 41, 42, 206-210), and 223 acres treated in Sections 11 and 12 (Units 50 - 54, 213 - 217); a total of 612 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats. Canopy cover would be decreased and/or eliminated across these 612 acres within and adjacent to existing wetland complexes. In some of the units, notably the proposed regeneration harvest where lodgepole pine is the dominant species, a decrease in canopy cover will occur naturally, regardless of whether proposed fuels reduction or forest health treatments are implemented, due to on-going mountain pine beetle mortality in the stand. Hiding cover would probably decrease naturally in these stands as well, although to a lesser extent because dead trees, snags, blowdown, etc., would provide a measure of hiding cover.

SNAG/DOWN WOODY HABITAT

Snags and down woody material are important components of fisher habitat and are used for resting, denning, and shelter. They are also important components for fisher prey habitat. Old growth habitats and riparian habitats frequently have abundance of larger snags and down woody material. Wisdom et al. (2008) found a strong relationship between snag density and seral stage; snag density was highest in late-seral stands. There would be no proposed treatment under Alternative B in old growth habitats; as described above, there would be treatment in and adjacent to riparian habitats with implementation of Alternative B.

Commercial harvest activities proposed under Alternative B would reduce the amount of snags and down woody material on 1,749 acres. Wisdom et al. (2008) found that snag densities were 19 times higher in unharvested stands compared to harvested stands. Although snags are not usually targeted for removal, they are sometimes removed inadvertently to increase logging efficiency, or if they are deemed a hazard to the woods workers, they are removed for safety reasons. If snags are recently dead, they could be removed for commercial reasons. In treatment units proposed near private property, where the main purpose is fuel reduction, snags could be removed to meet the objective of reducing the potential fuels in an area. Down woody material suitable for wildlife use is usually reduced during logging activity as a result of heavy equipment use, purposeful removal to reduce fuels, or removal to facilitate reforestation. Over time (which could be 50 to 100 years or more depending on existing snag/down woody habitat), the amount and condition of snags and down woody material would be expected to return to pre-harvest levels.

Non-commercial treatments would consist of a Post and Pole Treatment and Pre-Commercial Thinning. Under Alternative B, the amount of non-commercial treatment proposed would be 353 acres. Direct and indirect effects from the proposed non-commercial treatments would be minimal. The trees in these stands, and the available down woody material, are small and do not provide snag/down woody habitat.

As mitigation for snag and down woody associated wildlife species, including fisher, snags and down woody material would be retained in all treatment units. The prescriptions for treatment would be designed to retain a minimum average of 6 snags per acre that are 12 to 20 inches DBH; all snags greater than 20 inches DBH would be left. If existing snag densities are below these densities, substitute live trees would be left. All standing dead cull western larch, ponderosa pine, and Douglas-fir trees 16 inches DBH or greater would be retained if possible. Generally, snags to be left would be

further than 150 feet from open roads and private land boundaries. Snags that pose a safety hazard to the Contractor's operation would be removed. In addition to these snag retention criteria, the minimum retention for down woody material would be approximately 10 tons per acre, where available. To achieve the tonnage required, down woody material which includes the longest material available (e.g., 16 feet long or longer) with the largest diameters available (e.g., 15 inches DBH or greater), would be retained, in sufficient amounts to achieve the required tons per acre. It should be noted that if the snag/down woody material that is left is not in an area with >40 percent canopy cover it is highly unlikely that the snag or down woody structure would be usable by fisher.

OVERALL HABITAT SECURITY

Although fishers are uncommon in the Glacier Loon Area, they have been detected here and in adjacent watersheds. It is possible that short-term displacement of fisher could occur in proposed treatment areas; this short-term displacement would probably not be significant. As described above, decreases in canopy cover or snag and down woody structure, especially in wetland areas, would likely displace fisher long-term, until the habitat is suitable for fisher again (60 to 100+ years).

Temporary road construction is proposed under each of the action alternatives. Alternative B has the largest amount of proposed temporary road construction (11.5 miles). It is possible for temporary roads to be an attractant to forest users. Temporary roads in the Glacier Loon Project Area would be reclaimed following use. The goal of reclaiming the temporary roads is to discourage motorized use. There is always a potential for these temporary roads to be vectors of human use, but the potential is low, if the reclamation work is successful.

Under Alternative B, there are 4.1 miles of road decommissioning proposed. Road decommissioning would help to increase long-term habitat security for fisher and fisher prey species.

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no MA change under Alternative B.

ALTERNATIVE C DIRECT AND INDIRECT EFFECTS

CANOPY COVER

In the proposed Clearcut, Seed Tree, and Shelterwood Units in Alternative C (685 acres), the stands would become unsuitable fisher habitat following treatment. In stands that are proposed for commercial intermediate treatment, the existing canopy cover would be reduced. Generally, in the Commercial Thin, Modified Commercial Thin, and Improvement Cut Units (860 acres), the canopy cover following treatment would not provide suitable habitat for fisher. In the Sanitation/Salvage Units (11 acres), the remaining canopy cover would still be sufficient for fisher use; at least it would not be an avoidance area. In the proposed non-commercial treatment areas (Pre-Commercial Thin/Post and Pole), the effects to fisher would be minimal; these stands do not currently provide fisher habitat due to the size of the trees.

RIPARIAN AND OLD GROWTH HABITATS

There is no treatment proposed in old growth habitat under Alternative C; any old growth habitats presently providing suitable fisher habitat would continue to do so (see Old Growth Associated Species). Under Alternative C, there would be treatments proposed in or adjacent to riparian habitat; a total of 597 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats. Canopy cover would be decreased and/or eliminated across these 597 acres within and adjacent to existing wetland complexes.

SNAG/DOWN WOODY HABITAT

Old growth habitats and riparian habitats frequently have abundance of larger snags and down woody material. There would be no proposed treatment under Alternative C in old growth habitats; as

described above, there would be treatment in and adjacent to riparian habitats with implementation of Alternative C.

Commercial harvest activities proposed under Alternative C would reduce the amount of snags and down woody material on 1,556 acres. Under Alternative C, the amount of non-commercial treatment proposed would be 353 acres. Direct and indirect effects from the proposed non-commercial treatments would be minimal.

As described in Alternative B, Design Criteria (Table 2- 16) for the Glacier Loon Project would include snag and down woody material retention standards. However, if the snag/down woody material that is left is not in an area with >40 percent canopy cover, it is highly unlikely that the snag or down woody structure would be usable by fisher.

OVERALL HABITAT SECURITY

Under Alternative C, it is possible that short-term displacement of fisher could occur in proposed treatment areas; this short-term displacement would probably not be significant. Decreases in canopy cover or snag and down woody structure, especially in wetland areas, would likely displace fisher long-term (60 to 100+ years).

Under Alternative C, there would be 7.4 miles of temporary road construction. Temporary road construction would affect canopy cover in the area where the road is constructed and would cause short-term displacement during construction and use of the road. The temporary roads would be reclaimed, which would keep them from becoming new motorized travel routes.

Under Alternative C, there are 8.4 miles of road decommissioning proposed. Road decommissioning under Alternative C would increase long-term habitat security for fisher and fisher prey species.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative C would include a MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake. Under Alternative C, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5 designation. On MA 15 and MA 15C lands, cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would probably translate into less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake; this would result in greater habitat security for fisher and fisher prey species.

ALTERNATIVE D DIRECT AND INDIRECT EFFECTS

CANOPY COVER

Proposed treatments in each of the action alternatives would reduce existing canopy cover. The reduction of canopy cover would be greatest with Alternative B, less with Alternative C, and least with Alternative D. In the proposed Clearcut, Seed Tree, and Shelterwood Units in Alternative D (595 acres), the stands would become unsuitable fisher habitat following treatment. In stands that are proposed for commercial intermediate treatment (e.g., Sanitation Salvage, Improvement Cut, Commercial Thins, the existing canopy cover would be reduced. Generally, in the Commercial Thins, and Improvement Cut Units (445 acres), the canopy cover following treatment would not provide suitable habitat for fisher. In the Sanitation/Salvage Units (5 acres) the remaining canopy cover would still be sufficient for fisher use; at least it would not be an avoidance area. In the proposed non-commercial treatment areas (Pre-Commercial Thin/Post and Pole), the effects to fisher would be minimal.

RIPARIAN AND OLD GROWTH HABITATS

Old growth and riparian habitats have a high potential of providing high quality fisher habitat. There is no treatment proposed in old growth habitat under Alternative D; each of the action alternatives has proposed treatments in and adjacent to riparian complexes. The amount of acres treated in wetland areas would be greatest with Alternative B, less with Alternative C, and least with Alternative D. Under Alternative D, there would be 320 acres of proposed treatment in or adjacent to riparian habitat. In some of the units, notably the proposed regeneration cuts where lodgepole pine is the dominant species, a decrease in canopy cover would occur naturally, regardless of whether proposed fuels reduction or forest health treatments are implemented, due to ongoing mountain pine beetle mortality in the stand. Hiding cover would probably decrease naturally in these stands as well, although to a lesser extent because dead trees, snags, blowdown, etc. would provide a measure of hiding cover.

SNAG/DOWN WOODY HABITAT

Snags and down woody material are important components of fisher habitat and are used for resting, denning, and shelter. They are also important components for fisher prey habitat. Old growth habitats and riparian habitats frequently have abundance of larger snags and down woody material. Wisdom et al. (2008) found a strong relationship between snag density and seral stage; snag density was highest in late-seral stands. There would be no proposed treatment under Alternative D in old growth habitats; as described above for Alternatives B and C, there would be treatment in and adjacent to riparian habitats with implementation of Alternative D.

Alternative D would have the least potential negative effects of the action alternatives on snag and down woody habitat; commercial harvest activities proposed under Alternative D, would reduce the amount of snags and down woody material on 1,045 acres. Non-commercial treatment would consist of Post and Pole Treatments and Pre-Commercial Thinning. Direct and indirect effects from the proposed non-commercial treatments would be minimal. The trees in these stands, and the available down woody material, do not provide snag/down woody habitat.

As mitigation for snag and down woody associated wildlife species, including fisher, snags and down woody material would be retained in all treatment units. Similar to Alternatives B and C, the prescriptions for treatment would be designed to retain a minimum average of 6 snags per acre that are 12 to 20-inches DBH and all snags greater than 20-inches DBH. If existing snag densities are below these densities, substitute live trees would be left. All standing dead cull western larch, ponderosa pine, and Douglas-fir trees 16-inches DBH or greater would be retained if possible. In addition to these snag retention criteria, the minimum retention for down woody material would be approximately 10 tons per acre, where available. To achieve the tonnage required, down woody material, which includes the longest material available (e.g., 16-feet long or longer) with the largest diameters available (e.g., 15-inches DBH or greater), would be retained, in sufficient amounts to achieve the required tons per acre. It should be noted that if the snag/down woody material that is left is not in an area with >40 percent canopy cover it is highly unlikely that the snag or down woody structure would be usable by fisher.

OVERALL HABITAT SECURITY

It is possible that short-term displacement of fisher could occur in proposed treatment areas; this short-term displacement would probably not be significant. As described above, decreases in canopy cover or snag and down woody structure, especially in wetland areas, would likely displace fisher long-term, until the habitat is suitable for fisher again (60 to 100+ years).

Temporary road construction is proposed under each of the action alternatives. Alternative D has the least amount of proposed temporary road construction (5.8 miles). It is possible for temporary roads to be an attractant to forest users. Temporary roads in the Glacier Loon Project would be reclaimed following use. The goal of reclaiming the temporary roads is to discourage motorized use.

Under Alternative D, there would be 8.4 miles of road decommissioning proposed. Road decommissioning would help to increase long-term habitat security for fisher and fisher prey species.

EFFECTS OF MANAGEMENT AREA CHANGE

Similar to Alternative C, implementation of Alternative D would include a MA change in the Flathead Forest Plan. The proposed MA change on 221 acres above Lindbergh Lake would mean that the potential for these 221 acres to support more secure fisher habitat would be greater.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

The Swan Valley has a well-developed system of glacial potholes, wet meadows, seeps, and riparian connections throughout the valley floor along both sides of the Swan River. The ecological contribution that these wetland habitats contribute to various wildlife species, including fisher, is very important (Swan Ecosystem Center 2004). There has been a loss of ecological integrity to many of these complexes, as a result of residential development, forest management, permanent road construction, drought, and both fire suppression on the one hand and large-scale wildfire on the other. All of these factors combined have undoubtedly affected the amount and the connectivity of potential fisher habitat in the upper Swan Valley.

Harvest on legacy lands has occurred by TNC within the project area. These past harvests were completed on former industrial timber company lands which held little or no forest that provided large tree, multi-story, complex forest stands that comprise fisher habitat. These projects did not change public access from the existing condition. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project. The fisher population was reduced dramatically in the 1800s and early 1900s through over trapping, predator and pest control, and alterations of forested habitats by logging, fire, and farming. The extent of past timber harvest is one of the primary causes of fisher decline across the United States (Ruggiero et al. 1994). Timber harvest could fragment fisher habitat, reduce it in size, or change the forest structure to be unsuitable for fishers. Habitat loss and fragmentation appear to be significant threats to the fisher (Lofroth et al. 2010; Ruggiero et al. 1994).

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). Fishers generally avoid areas with significant human disturbance and conversely prefer large areas of contiguous interior forest with vegetative and structural aspects that lead to abundant prey. No treatment is proposed in old growth habitats. Retaining these important habitats for fisher would help to mitigate negative impacts from implementation of the Glacier Loon Project. Extensive roadless and wilderness habitat reduces the risks of mortality attributed to humans and reduces the potential negative effects of fragmenting small populations. These attributes are present on the Flathead National Forest, in the Swan Valley, and in the Glacier Loon Area. Road closures for grizzly bear security have also benefited the fisher.

Riparian habitats, old growth habitats, and snag and down woody habitats are important for fisher survival. Riparian standards and guidelines, direction for snag and down woody retention, and old growth management standards are contained in the Flathead Forest Plan and are required Design Criteria for fuels reduction and forest health projects like the Glacier Loon Project. The direction for riparian, snag/down woody, and old growth habitats benefits fisher and fisher prey species.

Hillis and Lockman (2003) mapped fisher habitat in Region One, where fishers are generally limited to west of the Continental Divide. Fisher habitat was defined as low-to-mid elevation, mesic, mature and old forests, within 328 feet (100 meters) of streams. To address patch size and habitat connectivity relevant for fishers, they excluded any patch of habitat that was less than 160 acres and more than 600 feet from the nearest patch of adjacent cover (Jones 1991; Ruggiero et al. 1994). That habitat was compared against levels of habitat that would have been available in pre-fire suppression/pre-logging periods. What they found was that fisher habitat occurs at historically normal levels at both the Flathead National Forest and Region One scales. More recently, Samson (2006) showed that on the Forests and the Region as a whole, forested ecosystems are more extensive now than in historic

times. Research on fisher is ongoing. Multiple agencies and organizations, including the Forest Service, are currently conducting surveys to detect fisher in the Rocky Mountains. Fishers are more difficult to monitor than most species and monitoring results are often inconclusive (USDA 2006)(Project File Exhibit T-10). The goals of current research and monitoring are to:

- Delineate the geographic range of fisher;
- Determine which Rocky Mountain fisher populations have native genes; and
- Index the abundance of fisher in the different populations.

Jones (1991), Vinkey (2003), Lofroth et al. (2010) and others have concluded that fishers are extremely vulnerable to trapping, both intentional and incidental trapping with overtrapping in the early history of the United States contributing to the reduction in size and extirpation across the species' range. Montana has a quota system for fishers. The total fisher quota is seven, and fisher trapping is only open in Regions 1 and 2; the Flathead National Forest is in Trapping District One, encompassing most of northwest Montana. This area has a quota of two fishers, and one fisher was harvested in 2009. Regulated trapping in Montana is managed by MDFW&P.

While other factors outside of the Forest Service's control (such as trapping, predator/pest control, or alteration of private forest habitats) could be associated with fisher population decline, management actions taken on the Flathead National Forest would provide the habitat composition and structure for fisher across the Forest. There would continue to be adequate old growth, riparian habitat, and mid-to late-seral forest matrix habitat to maintain connectivity of functional home ranges (USDA 2006). There appears to be little risk of population loss across the Forest and Region due to forest management activities (USDA 2006).

DETERMINATION

In accordance with FSM 2673.42, a determination has been made as to the degree of impact the activities proposed could have on sensitive species. Based on available information on the fisher's distribution, and on project design, Alternative A would have **“No Impact”** on fisher. The action alternatives **“May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species.”**

GRAY WOLF

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included open road densities, aerial photography, VMAP Data, project area field visits, research literature, and GIS and dataset information for features such as white-tailed deer winter range, deer summer range, and general forest attributes like habitat type, forest type, elevation, and slope.

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology of the gray wolf, certain elements are thought to be essential to the conservation of the species. These elements include an adequate prey base, secure den sites, rendezvous areas, and whelping sites, and a low mortality risk. These elements of gray wolf habitat, and the anticipated effects to these elements from project implementation, are the measurement indicators used in this analysis.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Historically, the gray wolf is known to have been a resident of the Swan Valley. The wolf moved freely throughout the valley in the absence of human development, feeding mostly on ungulate species that inhabited the valley. As human activity levels in the Swan Valley increased, mortality risk for the gray wolf increased as well.

EXISTING CONDITION

In 2008, the wolf was delisted and relisted with a lawsuit that reversed the USFWS decision to delist. In 2009, this species was again removed from the endangered species list, but again relisted as Endangered in 2010 by a US District Court ruling. Congressional action in April 2011 again delisted gray wolves in Montana, Idaho, and parts of three other states and returned management back to the states.

At the end of 2010, there were a minimum of 244 packs and 1,651 wolves in the Northern Rockies Distinct Population Segment (Sime et al. 2010). Statewide for Montana during 2010, 108 verified packs of 2 or more wolves yielded a minimum estimate of 566 wolves; 35 packs qualified as a Breeding Pair. This was an increase from an estimate of 524 wolves and 101 packs across the state in 2009. There was a minimum estimate of 326 wolves in 68 packs in the Montana portion of the recovery area (Sime et al. 2010). That is an increase from 308 wolves in 64 packs at the end of the year in 2009. The Montana minimum count decreased by 73 wolves from 2013 to 2014 (Bradley et al. 2014). The minimum count of wolves in Montana is estimated to be approximately 554 (Bradley et al. 2014).

Wolves are currently listed as a game species and managed by MFWP. Statewide documented wolf harvest included 94 wolves harvest in the 2013/2014 season and 119 taken in the 2014/2015 season. There were an additional 57 wolves killed to reduce livestock depredations. The total number of documented wolf mortalities in the state during 2014 was 308. The Montana Wolf Plan identifies the state's shared legal requirement with the states of Idaho and Wyoming to maintain a minimum total of 30 breeding pairs in the region (MFWP 2002). Montana itself has had more than 15 breeding pairs since 2002 (Bradley et al. 2014). Recovery goals have been exceeded across the entire recovery area.

The project area occurs in Wolf Management Unit 130. Hunting and trapping for wolves is currently permitted in the management unit. In 2013, eighteen wolves were harvested in HD 130 which includes the Swan Valley. The growth rate is slowing down, in part because of the dampening effect of the combination of public harvest and agency control, and because the best habitat is already occupied (Bradley et al. 2013; MFWP 2013; Sime et al. 2010). Approximately five packs have territories that occur within the Swan Valley.

On the Flathead National Forest, there are approximately 15 packs located on or near the forest. There is known wolf use of the Swan Range, Mission Mountains, and Swan Valley. Wolves are known to move through forest stands in the Glacier Loon vicinity. There are no known or suspected denning sites, whelping areas, or rendezvous sites in the Glacier Loon Project Area.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

There would be no activities proposed with this alternative; there would be no direct effects to gray

wolf or gray wolf habitat because of no proposed treatment in the Glacier Loon Area. Trees affected by insects and disease would continue to die and fall over. Overstory cover would decrease, creating openings in the forest canopy. As more sunlight reaches the forest floor, ground vegetation would increase, as well as conifer regeneration. As ungulate use patterns change in response to changes in cover and forage, wolves would vary their use patterns as well.

Indirectly, as a result of not implementing the proposed project, there could be an increased risk of a more intense wildfire. A large intense wildfire could potentially decrease overall cover for ungulate species, at least short-term. This would potentially cause a short-term decrease in wolf prey species. The potential for a wildfire to occur, and the intensity of a potential fire, would be dependent on many factors, including weather at the time, location of the fire start, and fuel loadings in the path of the wildfire.

Harvest on legacy lands has occurred by TNC within the project area. The harvest decreased forest cover within the project area decreasing security for wolves. TNC activities were consistent with SVGBCA guidelines which retained visual screening from open roads and maintained road closures to motorized use on within the project area. Continued likely increases in human occupancy of private lands in the Swan Valley are likely to lead to more human use and possible associated disturbance of or conflicts with gray wolf, even under the No Action Alternative. However, the No Action Alternative is unlikely to cumulatively increase impacts to gray wolf beyond that which would intrinsically exist.

ALTERNATIVE B - PROPOSED ACTION DIRECT AND INDIRECT EFFECTS

In a comparison of the action alternatives, the direct and indirect effects to gray wolf would be greatest with Alternative B, slightly less with Alternative C, and least with Alternative D. This is due mainly to the scope of treatment (e.g., overall acres effected, miles of temporary road, etc.) in the different alternatives.

Key components of wolf habitat are:

1. Sufficient, year-round prey base of ungulates and alternate prey,
2. Suitable and somewhat secluded denning and rendezvous sites, and
3. Security; sufficient space with minimal exposure to humans (Sime et al. 2007; USDI 1987).

PREY BASE

White-tailed deer make up the greatest proportion of the wolf diet in northwestern Montana, followed by elk and moose (Kunkel 1997). Mule deer and smaller mammals or birds could also be preyed upon opportunistically throughout the year. The Swan Valley has historically provided spring, summer, fall, and winter range for white-tailed deer, mule deer, and elk. None of the proposed activities in Alternative B are located in areas mapped as mule deer and elk winter habitat (MA 13) in the Forest Plan. There are approximately 21 acres of proposed treatment in designated white-tailed deer winter habitat (MA 9). In Alternative B, there are 1,359 acres of proposed treatment (commercial and non-commercial) on lands designated in the Forest Plan as having an emphasis on white-tailed deer summer range. Riparian habitats are also an important component of deer habitat. Under Alternative B, there would be a total of 612 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats. The gray wolf prey base would be displaced from habitats in the Glacier Loon Area during project implementation (1 to 5 years).

Use patterns for gray wolf prey would change over the short-term and long-term as the prey avoid openings and use areas with sufficient hiding cover. Currently, approximately 70 percent of the Glacier Loon Project Area provides hiding cover for wildlife species. Under Alternative B, there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 1,453 acres; hiding cover post-treatment would be approximately 66 percent. Hiding cover would take approximately 10 to 20 years to recover, depending on stand conditions.

KEY HABITAT AREAS (DENNING SITES, RENDEZVOUS AREAS, AND WHELPING SITES)

There are no known or historical den sites, rendezvous areas, or whelping sites in the area proposed for treatment under Alternative B. Wolves commonly den in undisturbed sites, usually within 400 yards of water. As described above, under Alternative B, there would be a total of 612 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats. There would be the potential to disturb an unknown den site in these areas. The contract for operations would include provisions to cease activity or otherwise protect any denning, rendezvous, or whelping site that could be discovered.

HABITAT SECURITY

Wolves in the Glacier Loon Area would be displaced during project implementation. In addition to the actual logging activity (vegetative treatments), approximately 11.5 miles of temporary road would be constructed to access units. Temporary roads would be reclaimed following use. The reclamation work would include the removal of any culverts, erosion control features, seeding, re-contouring, and the placement of woody debris on the reclaimed road. Despite the reclaiming of temporary roads, there is obvious evidence of ground disturbance and clearing of vegetation that remains after a temporary road is reclaimed. It is possible for these reclaimed areas to be an attractant to forest users. The goal of reclaiming the temporary roads is to discourage motorized use. There is always a potential for these temporary roads to be vectors of human use, but the potential is low, if the reclamation work is successful.

There are no proposed treatments in old growth under Alternative B. Old growth habitats have a high potential for providing cover, forage, and security for gray wolf, and gray wolf prey. There are large blocks of unroaded land and wilderness adjacent to the Glacier Loon Project Area that could provide secure habitat for the gray wolf. In addition, Design Criteria (Table 2- 16) in place for grizzly bear would benefit gray wolf. For instance, in order to avoid the potential disturbance of grizzly bears in important spring habitat, management activities that are planned in spring habitat, which is generally defined as areas below 5,200 feet, would not occur within the Spring Period (April 1 through June 15). This timing restriction would be beneficial to gray wolf and gray wolf prey species. Road closures in effect for grizzly bear in the Glacier Loon Area would provide security for gray wolf, as well.

Because wolves are adaptable animals, the expected increase in activity level within the project area would only result in temporary displacement of wolves from habitats that they might otherwise use. Wolves occupying the project area would likely move to adjacent areas further from human development and disturbance.

Approximately 20 percent of wolves in the Northern Rocky Mountain Recovery Area have been radio-collared. Research results indicate that 26 of 100 wolves die annually; people cause virtually all of these deaths outside wilderness. Implementing Alternative B would not significantly increase the mortality risk for the gray wolf. Any increased chance for an encounter between wolves and humans because of the proposed project would present a low risk of mortality for the wolf, since the encounter would center around land management activities and not livestock depredation or other high risk activities commonly associated with wolf mortality.

ROAD DECOMMISSIONING

In Alternative B, there is 4.1 miles of road decommissioning proposed. This would help increase long-term habitat security for gray wolf.

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no change to existing MA designations under Alternative B.

ALTERNATIVE C DIRECT AND INDIRECT EFFECTS

The direct and indirect effects to gray wolf would be slightly less with Alternative C than for Alternative

B.

PREY BASE

Important habitats for gray wolf prey species, predominately white-tailed deer, are winter range, summer range, riparian/wetland areas, and areas with sufficient hiding cover to connect these habitats. Under Alternative C, there would be 21 acres of proposed treatment in designated white-tailed deer winter habitat (MA 9), 1,358 acres of proposed treatment on white-tailed deer summer range, and a total of 597 acres of treatment adjacent to wetland habitats. The gray wolf prey base would be displaced from these habitats in the Glacier Loon Area during project implementation (1 to 5 years).

Use patterns for gray wolf prey would change over the short-term and long-term, as the prey avoids openings and use areas with sufficient hiding cover. Currently, approximately 70 percent of the Glacier Loon Project Area provides hiding cover for wildlife species. Under Alternative C, there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 1,310 acres; hiding cover post-treatment would be approximately 67 percent. Hiding cover would take approximately 10 to 20 years to recover, depending on stand conditions.

KEY HABITAT AREAS (DENNING SITES, RENDEZVOUS AREAS, AND WHELPING SITES)

There are no known or historical den sites, rendezvous areas, or whelping sites in the area proposed for treatment under Alternative C. Wolves commonly den in undisturbed sites, usually within 400 yards of water; there would be a total of 597 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats under Alternative C. There would be the potential to disturb an unknown den site in these areas. The contract for operations would include provisions to cease activity or otherwise protect any denning, rendezvous, or whelping site that would be discovered.

HABITAT SECURITY

Wolves in the Glacier Loon Area would be displaced during project implementation. In addition to the actual logging activity (vegetative treatments), approximately 7.4 miles of temporary road would be constructed to access units under Alternative C.

There are no proposed treatments in old growth under Alternative C. There are large blocks of unroaded land and wilderness adjacent to the proposed project that could provide secure habitat for the gray wolf, and design criteria in place for grizzly bear would benefit gray wolf (e.g., spring habitat restrictions). Road closures in effect for grizzly bear in the Glacier Loon Area would provide security for gray wolf, as well.

The expected increase in activity level within the project area would only result in temporary displacement of wolves from habitats that they might otherwise use. Wolves occupying the project area would likely move to adjacent areas further from human development and disturbance. Implementing Alternative C would not significantly increase the mortality risk for the gray wolf.

ROAD DECOMMISSIONING

In Alternative C, there is 8.4 miles of road decommissioning proposed. This would increase long-term habitat security for gray wolf. Switalski et al. (2011) demonstrated extensive use of decommissioned roads by wildlife.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative C would include a MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake.

Under Alternative C, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5 designation. On MA 15 and MA 15C lands cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would probably translate into less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake. This would likely mean that the potential for the area above Lindbergh Lake to provide secure habitat for gray wolves would be greater.

ALTERNATIVE D DIRECT AND INDIRECT EFFECTS

In a comparison of the action alternatives, the direct and indirect effects to gray wolf would be least with Alternative D. This is due mainly to the scope of treatment (e.g., overall acres affected, miles of temporary road, etc.) in the different alternatives.

PREY BASE

White-tailed deer make up the greatest proportion of the wolf diet in northwestern Montana, followed by elk and moose (Kunkel 1997). Mule deer and smaller mammals or birds could also be preyed upon opportunistically throughout the year. Important habitats for gray wolf prey species are winter range, summer range, riparian/wetland areas, and areas with sufficient hiding cover to connect these habitats. Under Alternative D, there would be 21 acres of proposed treatment in designated white-tailed deer winter habitat, 591 acres of proposed treatment on white-tailed deer summer range, and a total of 320 acres of treatment adjacent to wetland habitats. The gray wolf prey base would be displaced from these habitats in the Glacier Loon Area during project implementation (1 to 5 years).

Use patterns for gray wolf prey would change as prey species avoid openings and use areas with sufficient hiding cover. Under Alternative D, there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 888 acres. Hiding cover post-treatment would be approximately 68 percent - a decrease of 2 percent, compared to 3 percent for Alternative C, and 4 percent for Alternative B. Hiding cover would take approximately 10 to 20 years to recover, depending on stand conditions.

KEY HABITAT AREAS (DENNING SITES, RENDEZVOUS AREAS, AND WHELPING SITES)

There are no known or historical den sites, rendezvous areas, or whelping sites in the area proposed for treatment under Alternative D. The contract for operations would include provisions to cease activity or otherwise protect any denning, rendezvous, or whelping site that may be discovered.

HABITAT SECURITY

Approximately 5.8 miles of temporary road would be constructed to access units. Temporary roads would be reclaimed following use. Despite the reclamation of temporary roads, there would be obvious evidence of ground disturbance and clearing of vegetation that remains after a temporary road is reclaimed. It is possible for these reclaimed areas to be an attractant to forest users. The goal of reclaiming the temporary roads is to discourage motorized use. There is always a potential for these temporary roads to be vectors of human use, but the potential is low, if the reclamation work is successful.

There are no proposed treatments in old growth under Alternative D. Old growth habitats have a high potential for providing cover, forage, and security for gray wolf, and gray wolf prey. There are large blocks of unroaded land and wilderness adjacent to the Glacier Loon Project Area that could provide secure habitat for the gray wolf. In addition, design criteria in place for grizzly bear would benefit gray wolf (e.g., spring closures). Road closures in effect for grizzly bear in the Glacier Loon Area would provide security for gray wolf, as well.

Because wolves are adaptable animals, the expected increase in activity level within the project area would only result in temporary displacement of wolves from habitats that they might otherwise use. Wolves occupying the project area would likely move to adjacent areas further from human development and disturbance. Implementing Alternative D would not significantly increase the mortality risk for the gray wolf. Any increased chance for an encounter between wolves and humans because of the proposed project would present a low risk of mortality for the wolf since the encounter

would center around land management activities and not livestock depredation or other high risk activities commonly associated with wolf mortality.

ROAD DECOMMISSIONING

In Alternative D, there is 8.4 miles of road decommissioning proposed. This would increase long-term habitat security for gray wolf.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative D would include a MA change in the Forest Plan. The proposed MA change on 221 acres above Lindbergh Lake would probably translate into less regeneration cutting and road building on the forested slopes along the western side of Lindbergh Lake. This would likely mean that the potential for the area above Lindbergh Lake to provide secure habitat for gray wolves would be greater.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

The project proposal would not significantly contribute to negative cumulative effects to the gray wolf, due, in large part, to its location in an area where wolves are already accustomed to human activity.

Under each of the alternatives, although hunting patterns would undoubtedly change as a result of proposed vegetation management, existing wolf prey base would be maintained. There would be no direct or indirect effects to known or suspected denning, whelping, or rendezvous sites; potential denning, whelping, and rendezvous habitat is not considered limiting across the Swan Valley.

Road closures in the Swan Valley that have been implemented to increase grizzly bear security have increased wolf security as well. The recent acquisition of lands by the Forest Service (e.g., Montana Legacy Project) has helped to maintain natural landscape linkages and to reduce the risk of private land development. **Harvest on legacy lands has occurred by TNC within the project area. The harvest decreased forest cover within the project area decreasing security for wolves from humans. TNC activities were consistent with SVGBCA guidelines which retained visual screening from open roads and maintained road closures to motorized use on within the project area. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project.**

As discussed previously, any increased chance for an encounter between wolves and humans because of the proposed project would present a low risk of mortality for the wolf since the encounter would center around land management activities and not livestock depredation or other high risk activities commonly associated with wolf mortality. There are no livestock (cattle) grazing concerns associated with this project. Mortality risk for gray wolf, as a result of the implementation of any of the proposed alternatives, would be low.

The cumulative effect of private land development in or near the project area with the project itself and coupled with previous land management projects would not likely measurably affect the gray wolf on a population basis. Population viability is not a concern for gray wolves in Montana or across the Flathead National Forest (USDA 2006). Wolves have an extremely high fecundity rate and are highly mobile. Even with a hunting season that harvested 72 wolves, a minimum of 166 pups were documented in 2009 and Montana's population continued to increase. Despite the first legal hunt for wolves in the state, there was a 4 percent increase from 2008, compared to 18 percent the previous year. The growth rate is slowing down, in part because of the dampening effect of the combination of public harvest and agency control, and because the best habitat is already occupied (Sime et al. 2010). There appears to be little risk of population loss and species viability would be maintained (USDA 2006).

DETERMINATION

In accordance with FSM 2673.42, a determination has been made on the impact the activities proposed could have on sensitive species. Based on available information on gray wolf distribution, presence/absence from the project area, habitat requirements, and management strategies, the determination for the No Action Alternative is **“No Impact.”** The determination for the action alternatives is **“May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species.”**

NORTHERN BOG LEMMING

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included stand exams, Vector Map (VMAP) Data, project area field visits, research literature, and GIS and dataset information for features such as riparian land types, and general forest attributes (e.g., habitat type and forest type).

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology of the northern bog lemming, effects analysis for the bog lemming focused on the presence of characteristic habitats and the potential effects the proposed action could have on these habitats.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

The northern bog lemming, a small, grayish brown, vole-like rodent, is boreal in distribution and occurs in North America from near tree line in the north and then south into Washington, Idaho, Montana, Minnesota, and New England. Historically, following glacial retraction, this species has become a glacial relict with localized primary habitat (Reichel et al. 1993).

This lemming is typically found in open (little tree or brush cover) sphagnum bogs and fens. The northern bog lemming is rarely trapped and is one of the least known mice in North America, with very little being known about the northern bog lemming life history (Reichel et al. 1993). It is thought that northern bog lemmings have a small home range of less than 1 acre (USDA 2006).

EXISTING CONDITION

In the northwest, the northern bog lemming is known from very few locations [8 locations in Washington, 4 locations in Idaho, with 21 occurrences in Montana (Reichel et al. 1993) MFWP 2009]]. In Montana, the northern bog lemming is at the southern margin of its global distribution in the Rocky Mountains. The 21 widely scattered locations in western Montana are primarily on USDA Forest Service managed lands (MNHP-MFWP). The best habitat predictor for potential northern bog lemming sites in Montana is the presence of large, thick moss mats, particularly sphagnum moss (Reichel et al. 1993). The Montana Natural Heritage Program attempted to locate northern bog lemmings in eight locations in the Swan Valley in 1993, but no lemmings were caught despite 1,670 “trap nights” with snap traps (Reichel et al. 1993). The MFWP is evaluating track-plate and other survey methods for this species (USDA 2006).

Northern bog lemmings are very difficult to monitor and survey because they have natural population

fluctuations, their habitat is difficult to travel across, they occupy burrows up to 1 foot deep in riparian vegetation, and survey methods are difficult; live trapping has a low success rate, snag traps are destructive sampling of a sensitive species, and small radio-telemetry packages are expensive and still rely on capturing live northern bog lemmings first.

There are only two known northern bog lemming locations on the Flathead National Forest; one occurrence on the Tally Lake Ranger District, and the other occurrence on the Swan Lake Ranger District, in the Swan Valley. In the Swan Valley, in 2006, a researcher reported that two bog lemmings were caught along the edge of Meadow Lake, south of Bunyan Lake and west of Lindbergh Lake, within the Glacier Loon Project Area.

Possible threats to bog lemmings include livestock grazing, road construction, adjacent vegetation management, invasion by exotic plants, and potential changes in the water regimes feeding the wetlands. Management recommendations for northern bog lemming include the following: Avoidance of timber harvest activities within 100 meters (approximately 330 feet) of sphagnum or other fen/bog moss mats, minimize domestic livestock grazing in drainages with sphagnum mats present, and restrict management activities in areas where they could destroy moss mats (Reichel et al. 1993).

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

The No Action alternative would have no direct or indirect effect on northern bog lemming habitat.

Harvest on legacy lands has occurred by TNC within the project area. The harvest has not occurred in or near northern bog lemming habitat. The Glacier Loon Area contains established human activities and developments including roads, timber management, numerous recreational opportunities, and residential development. It is expected that these activities will continue on public and private lands. The overall potential effect to the northern bog lemming and bog lemming habitat in the Glacier Loon Project Area would be low because there are no roads or grazing permits adjacent to known bog lemming habitat. Activities on adjacent private lands, in close proximity to bog/fen habitat, could affect northern bog lemming production in the future. Alternative A would not contribute to these effects.

ALTERNATIVES B, C, D DIRECT AND INDIRECT EFFECTS

Possible threats to bog lemmings include livestock grazing, road construction, adjacent vegetation management, invasion by exotic plants, and potential changes in the water regimes feeding the wetlands. As described above, management recommendations for northern bog lemming include the avoidance of timber harvest activities within 100 meters (approximately 330 feet) of sphagnum or other fen/bog moss mats, minimizing possible effects from domestic livestock grazing in drainages with sphagnum mats present, and the restriction of management activities in areas where they could destroy moss mats (Reichel et al. 1993).

Each of the action alternatives includes one unit (Unit 94) in the vicinity of known northern bog lemming habitat; as described above, a researcher trapped two northern bog lemmings in a bog area along the edge of Meadow Lake, in the extreme southern portion of the Glacier Loon Project Area. Unit 94 is outside of the area where northern bog lemmings would be expected to occur.

The risk of direct mortality to northern bog lemmings, or displacement of the lemmings from their natural habitat as a result of the proposed seed tree treatment in Unit 94, would be low because:

- Proposed activities are outside of existing northern bog lemming habitat;

- Unit boundaries for Unit 94 would be further than 100 meters from known or suspected northern bog lemming habitat;
- Northern bog lemmings have small (< 1 acre) home ranges and would not be expected to occur in the location of Unit 94;
- Forest-wide INFISH direction, Montana SMZ laws, and Forest Plan standards and guidelines for riparian area conservation contain provisions for management, including placing buffers around streams, ponds, springs/seeps, and bogs/fens;
- There is no domestic livestock grazing in the Meadow Lake Area;
- A hydrologic analysis has been done for the proposed Glacier Loon Project and no issues or concerns about negative effects from Unit 94 on the hydrology of the area surrounding Meadow Lake have been displayed;
- There is no proposed road construction (temporary or permanent) proposed in the Meadow Lake Area;
- Noxious weed treatment would occur throughout the Glacier Loon Project Area to reduce the potential for noxious weed infestations.

EFFECTS OF MANAGEMENT AREA CHANGE

There is no proposed Forest Plan Management Area (MA) change in Alternative B. Implementation of Alternatives C and D would include a MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake. There would be no effect, either positive or negative, on northern bog lemming populations due to this proposed management area change because the area where the change is proposed does not contain northern bog lemming habitat.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

As described above under the No Action Alternative, the Glacier Loon Area contains established human activities and developments. It is expected that these activities would continue. **Harvest on legacy lands has occurred by TNC within the project area. The harvest has not occurred in or near northern bog lemming habitat.** The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project. Known and unknown bog lemming habitat in bogs/fens would still be available across the Glacier Loon Area. The overall effect of the proposed Glacier Loon Project in combination with past, present, and foreseeable activities would be low since there is very little known or suspected northern bog lemming habitat, the known habitat in the Glacier Loon Area would not be affected by the proposed activities in the Glacier Loon Project, and future management in the Meadow Lake area or other potential northern bog lemming habitat on NFS lands in the Swan Valley would include design criteria to protect northern bog lemmings and/or potential northern bog lemming habitat. Protection of known habitat would be the most critical factor that the Forest Service has control over and surveys of potential northern bog lemming habitat continue across the Flathead National Forest and northwestern Montana. Activities on private lands near bog/fen habitat in the Glacier Loon Area and the upper Swan Valley could affect northern bog lemmings or potential northern bog lemming habitat; Alternatives B, C, and D would not contribute significantly to these effects.

DETERMINATION

In accordance with FSM 2673.42, a determination has been made as to the degree of impact the activities proposed might have on sensitive species. Based on available information on the northern bog lemmings distribution, habitat requirements, and management recommendations, as well as

project design and location, the determination for Alternative A is **“No Impact”** and the determination for Alternative B, C, or D is **“May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species.”**

WESTERN BOREAL TOAD

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included aerial photography, amphibian survey data, project area field visits, research literature, and GIS and dataset information for riparian habitats and general forest attributes.

MEASUREMENT INDICATORS

Based on current knowledge of the life history, biology, and ecology for the western boreal toad, certain elements are thought to be essential to the conservation of the species. These elements are secure breeding and nursery habitat. Effects to these elements as a result of project implementation are the measurement indicators used in this analysis.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Adult western toads are largely terrestrial, will travel considerable distances from water (e.g., up to 2.5 miles for adults), and are found in a variety of habitats from valley bottoms to high elevations. They breed in lakes, ponds, slow streams, and roadside ditches, where they prefer shallow areas with mud bottoms.

Historical data indicate that boreal toads were widely distributed and very common in Montana and other western states, but the species has apparently undergone severe population declines in the past 25 years (Currim 1996). Surveys in the late 1990s indicate that they are absent from many historic locations and that they now occupy less than 10 percent of suitable habitat (Maxell 2000). Factors associated with population declines range from natural population fluctuations to the effects of human-induced factors, such as pollution, pesticides, habitat destruction/alteration, increases in UV radiation, and the introduction of predators or competitors.

The Swan Valley has a well-developed system of glacial potholes, wet meadows, seeps, and riparian connections (Swan Ecosystem Center 2004). Historically, there would have been abundant western toad habitat in the Upper Swan Valley.

EXISTING CONDITION

Cumulative impacts related to forest management, residential development, and drought, have affected the hydrologic integrity of some of the riparian systems in the Upper Swan Valley. Over time the overall abundance of potential breeding habitat across the Swan Valley may not have changed much, but pre-settlement riparian habitats were undoubtedly more secure for the western toad.

Disturbance of wet areas that are important to the western toad, and lands adjacent to wet areas, has increased. Timber management, road building, livestock grazing, residential development, agriculture, and recreational activities have decreased the amount of functional breeding habitat for the western

toad throughout the upper Swan Valley. Roads can be obstacles for toads as they are slow moving and vulnerable to being run over by vehicles and may be more susceptible to predation when crossing roads.

Western toads were once common and widespread in western Montana, but are now becoming uncommon and local. Amphibian surveys have documented the occurrence of western toads in the Glacier Loon Area and throughout the Upper Swan Valley. The ponds, wetlands, and streams occurring in or adjacent to the proposed project area provide potential breeding habitat for the western toad.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Under the No Action Alternative, there would be no fuels reduction or forest health treatments. There would be no direct effects on the western toad and less overall human disturbance in the Glacier Loon Area as a result of implementing Alternative A.

Indirectly, there could be an increased risk of a stand-replacement fire occurring in or adjacent to the project area. Depending on the specific location and extent of a stand-replacement fire, there is the possibility that vegetation could change enough to trigger hydrologic effects that could affect boreal toad habitat. However, specific effects are not possible to predict. A wildfire event would not necessarily be a negative effect for western boreal toads; a study of boreal toads in Glacier National Park found that they dramatically increased in numbers after fires in 2001 and 2003 (Guscio 2007).

Harvest on legacy lands has occurred by TNC within the project area. The harvest activities have reduced canopy cover and abundance of down woody debris on Legacy Lands within the project area. These activities have retained a mosaic of forest conditions throughout the harvest areas including dense pockets of young trees and opening with relatively little canopy.

There are currently established human activities and developments in the Glacier Loon Area and throughout the Upper Swan Valley that have a potential to negatively affect the western toad. These activities include timber management, road building and maintenance, residential development, agricultural use, and recreational activities. Some of these activities have decreased the amount of functional breeding habitat or decreased the security for western toad on non-breeding habitat in the Upper Swan Valley.

Alternative A would not contribute significantly to these cumulative effects because there would be no additional cumulative effects to breeding habitat as a result of the No Action Alternative and no significant direct or indirect effects.

ALTERNATIVE B - PROPOSED ACTION DIRECT AND INDIRECT EFFECTS

In a comparison of the action alternatives, the direct and indirect effects to the western boreal toad would be greatest with Alternative B, slightly less with Alternative C, and least with Alternative D; this is due to the amount of proposed activity in Alternative B overall, and the amount of proposed treatments in wetland areas.

RIPARIAN HABITATS

Wetland complexes provide important breeding habitat for the toad. Riparian habitat would include lakes, streams, small wetlands, and ponds or potholes. There are management guidelines and BMPs in place (e.g., INFISH) that mitigate effects to riparian habitat. Riparian Habitat Conservation Areas restrict activities within a designated distance from streams, lakes, and wetlands (See Fisheries

Section). The riparian guidelines in place for Alternative B would help protect important riparian breeding habitat for boreal toad. Roadside ditches that hold water long enough into the summer to provide breeding sites would not be protected unless they were associated with streams or other protected sites.

Direct and indirect effects to toads would also include the loss of both thermal (summer cooling) cover and hiding cover adjacent to riparian habitats, and displacement from riparian habitats while activities are occurring in close proximity. Important riparian habitat for western boreal toad in the Glacier Loon Project Area includes portions of Sections 26 and 36 (T20N R17W), portions of Section 6 (T19N R16W), and portions of Sections 11 and 12 (T19N R17W). Under Alternative B, there would be 101 acres treated in Section 26 (Units 15-17), 224 acres treated in Section 36 (Units 19-31, 205), 64 acres treated in Section 6 (Units 41, 42, 206-210), and 223 acres treated in Sections 11 and 12 (Units 50-54, 213-217); a total of 612 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats.

Proposed harvest treatments in Alternative B and the associated temporary road construction (11.5 miles) could alter existing breeding and non-breeding habitat for the western toad in the Glacier Loon Area. If adult western toads are present during actual logging activity or during temporary road construction, individual mortality could occur.

ROAD DECOMMISSIONING

In Alternative B, there is 4.1 miles of road decommissioning proposed. Short-term, culvert removal and water bar work could displace or kill any toads in the immediate area. Long-term, there would be an increase in habitat security for the western boreal toad.

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no change to existing MA designations under Alternative B.

ALTERNATIVE C DIRECT AND INDIRECT EFFECTS

RIPARIAN HABITATS

Under Alternative C, there would be 101 acres treated in Section 26 (Units 15-17), 223 acres treated in Section 36 (Units 19-31, 205), 64 acres treated in Section 6 (Units 41, 42, 206-210), and 209 acres treated in Sections 11 and 12 (Units 50-54, 213-217); a total of 597 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats.

Proposed harvest treatments in Alternative C and the associated temporary road construction (7.4 miles) could alter existing breeding and non-breeding habitat for the western toad in the Glacier Loon Area. If adult western toads are present during actual logging activity or during temporary road construction, individual mortality could occur.

ROAD DECOMMISSIONING

In Alternative C, there is 8.4 miles of road decommissioning proposed. Short-term, culvert removal and water bar work could displace or kill any toads in the immediate area. Long-term, there would be an increase in habitat security for the western boreal toad.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative C would include a MA change in the Flathead Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake.

Under Alternative C, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5 designation. On MA 15 and MA 15C lands cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the

primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would likely translate to less regeneration cutting and road building on the forested slopes along the western side of Lindbergh Lake. This would likely mean that the potential for these 221 acres to support more secure western toad habitat would be greater.

ALTERNATIVE D DIRECT AND INDIRECT EFFECTS

RIPARIAN HABITATS

Under Alternative D, there would be a total of 320 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats; this is about half the amount of treatment in wetland areas, compared to Alternatives B and C.

Alternative D has the least amount of temporary road construction (5.8 miles). As described for Alternatives B and C, proposed harvest treatments and the associated temporary road construction could alter existing breeding and non-breeding habitat for the western toad in the Glacier Loon Area. If adult western toads are present during actual logging activity or during temporary road construction, individual mortality could occur.

ROAD DECOMMISSIONING

In Alternative D, 8.4 miles of road decommissioning is proposed. Short-term, decommissioning work could displace or kill toads in the immediate area. Long-term, there would be an increase in habitat security for the western boreal toad.

EFFECTS OF MANAGEMENT AREA CHANGE

Similar to Alternative C, implementation of Alternative D would include a MA change in the Forest Plan. The proposed MA change on 221 acres above Lindbergh Lake would mean that the potential for these 221 acres to support more secure western toad habitat would be greater.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

As described above in the No Action Alternative, there are currently established human activities and developments in the Glacier Loon Area and throughout the Upper Swan Valley that have a potential to negatively affect the western toad. These activities include timber management, road building and maintenance, residential development, agricultural use, and recreational activities. Some of these activities have decreased the amount of functional breeding habitat or decreased the security for western boreal toad on non-breeding habitat in the Upper Swan Valley. **Harvest on legacy lands has occurred by TNC within the project area. The harvest activities have reduced canopy cover and abundance of down woody debris on Legacy Lands within the project area. These activities have retained a mosaic of forest conditions throughout the harvest areas including dense pockets of young trees and opening with relatively little canopy. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project.**

Individual toad mortality in the Glacier Loon Area would be infrequent; not affecting the species at the population level. The western toad is widespread across the Flathead National Forest in apparently suitable habitat. This species has had extensive survey efforts on the Flathead National Forest, having been found in nearly half of the 6th-code watersheds (USDA 2006). In 837 site-visits, more than 150,000 tadpoles and nearly 500 adult toads were observed (USDA 2006). While other factors outside of Forest Service control may be associated with toad population declines (such as pollution,

bacterial or fungal infection, climate change, increases in UV radiation), based on the above analysis, management actions taken on the Flathead National Forest would continue to provide sufficient habitat composition, structure and processes for the western toad (USDA 2006). There appears to be little risk of population loss across the Flathead National Forest; species viability would be maintained.

DETERMINATION

In accordance with FSM 2673.42, a determination has been made as to the degree of impact the activities proposed might have on sensitive species. Based on available information on the western toad's distribution, habitat requirements, and project design and location, the No Action Alternative would have **"No Impact"** on the western toad. Alternatives B, C, and D **"May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species."**

OLD GROWTH ASSOCIATED WILDLIFE

INTRODUCTION

Old growth is defined in Amendment 21 of the Forest Plan as “a community of forest vegetation that has reached a late stage of plant succession.” The generic description is as follows:

- The age of the dominant cohort of trees is significantly older than the average time interval between natural disturbances (interval will vary depending upon forest cover type and habitat type);
- Forest composition and structure are different from younger stands;
- Rates of change in composition and structure of the stand are slow relative to younger forests;
- There is a significant showing of decadence (wide range of defect and breakage in both live and dead trees).

In The Dictionary of Forestry (Helms 1998), old growth forests are described as having:

- Large trees for the species and site;
- Accumulations of large dead standing and fallen trees;
- Decay or breakage of tree tops, boles, or roots;
- Multiple canopy layers;
- A wide variation in tree size and spacing; and
- Canopy gaps and understory patchiness.

The characteristics of old growth forest described above provide habitat for many plant and animal species. Old growth forests are an important component of biological diversity. For the purpose of this discussion, old growth associated species includes any wildlife species that use the various attributes of old growth forests for some or all of their ecological needs. These needs could include nesting, denning, security, or foraging habitat. For some species, closed canopy old growth provides snow capture and reduces snow depths, insulates the animals from cold winds, and provides protection from predators. Some species, such as the fisher, are strongly tied to canopy cover and mature forest structure for the majority of their habitat needs. More open canopies, or open understories, provide foraging opportunities for prey and predator species alike. Wildlife may use interior old growth habitat as shelter from sun, heat, dryness, or wind and old growth cover may provide protection from predators. Some old growth associated wildlife species need only a portion of their home range to be in old growth; examples include the Canada lynx, northern goshawk, and American marten. Other species such as southern red-backed voles, chestnut-backed chickadee, Swainson's thrush, and northern flying squirrels, have relatively small home range sizes (less than 100 acres), with the necessary proportion of this home range being in old growth unknown.

The following table displays 31 old growth associated species that may be found in the Swan Valley, along with their associations with various old growth habitat characteristics (USDA 1999b).

TABLE 3- 88 HABITAT REQUIREMENTS OF OLD GROWTH ASSOCIATED WILDLIFE SPECIES. (BASED ON WARREN 1998 AND LRMP AMENDMENT 21 FEIS).

SPECIES	COVER TYPE IN AFFECTED AREA	CANOPY	EDGE	LARGER PATCHES	SNAG	DOWN LOG	OCCURRENCE
American Marten	Mixed mesic, lodgepole, spruce/fir forests	Closed	-	+	X	X	Known current
Bald Eagle (S)	Mixed mesic forests, near large lake or river	Open		+	X		Known current
Black-backed Woodpecker (S)	Lower Montane & Montane; post-fire or insect-epidemic forests	Open			X		Known current
Boreal Owl	Mixed mesic and spruce/fir forest mosaic	Closed			X	X	Known current
Brown Creeper	Mixed mesic, lodgepole, and spruce/fir forests	Closed	-		X		Known current
Canada Lynx (T1)	Mixed mesic, lodgepole, and spruce/fir forests; gentle terrain		+2	+	X3	X	Known current
Chestnut-Backed Chickadee	Mixed mesic and spruce/fir forests, especially cedar-hemlock	Closed	-4		X		Known current
Fisher (S5)	Mixed mesic and lodgepole forests	Closed				X	Known current
Flammulated Owl (S, F ⁶)	Lower Montane and Montane, single-story.	Open			X		Known current
Golden-crowned Kinglet	Mixed mesic, lodgepole, and spruce/fir forests	Closed		+	X		Known current
Hairy Woodpecker	Mixed mesic, lodgepole, and spruce/fir forests	Open			X	X	Known current
Hammond's Flycatcher (F)	Mixed mesic and spruce/fir forests	Closed					Known current
Harlequin Duck (S)	Swift mountain streams, riparian old growth (weak association)	Open				X	Known current
Hermit Thrush	Dry mixed mesic and spruce/fir forests	Open		+			Known current
Lewis' Woodpecker	Lower Montane ponderosa pine and old burns	Open			X		Known current
Northern Flying Squirrel	Mixed mesic and lodgepole forests			+	X	X	Known current
Northern Goshawk	Single or multistory old growth; clear forest floor	Closed		+	X		Known current
Pileated Woodpecker	Mixed mesic forests	Closed		+	X	X	Known current
Pine Grosbeak	Mixed mesic, lodgepole, and spruce/fir forests						Known current
Pygmy Nuthatch	Large single-story ponderosa pine and mixed mesic forests	Open			X		Known current
Red-Breasted Nuthatch	Mixed mesic, lodgepole, and spruce/fir; relatively dry	Open		+	X		Known current
Silver-haired Bat	Mixed mesic and lodgepole forests; caves and snags				X		Suspected
Southern Red-backed Vole	Mixed mesic, lodgepole, and spruce-fir forest				X	X	Known current
Swainson's Thrush (F)	Mixed mesic and lodgepole forest with shrub understory			+			Known current
Tailed Frog	Cold, high gradient headwater streams					X	Known current

TABLE 3- 88 HABITAT REQUIREMENTS OF OLD GROWTH ASSOCIATED WILDLIFE SPECIES. (BASED ON WARREN 1998 AND LRMP AMENDMENT 21 FEIS).							
SPECIES	COVER TYPE IN AFFECTED AREA	CANOPY	EDGE	LARGER PATCHES	SNAG	DOWN LOG	OCCURRENCE
Three-toed Woodpecker	Mixed mesic, lodgepole, and spruce/fir forests; post-fire				X		Known current
Townsend's Warbler	Mixed mesic and lodgepole forest; dense understory	Closed	-	+			Known current
Varied Thrush	Mixed mesic and spruce/fir forests, especially cedar-hemlock	Closed		+			Known current
Vaux's Swift (F)	Mixed mesic and spruce/fir forests; large hollow snags				X		Known current
White-breasted Nuthatch	Large single-story ponderosa pine	Open			X		Known current
Winter Wren	Mixed mesic and spruce/fir forests, especially cedar-hemlock		-	+	X		Known current
¹ T = Threatened ² + = Positive correlation (where known) ³ X = Important Habitat Component ⁴ - = Negative correlation (where known) ⁵ S = Sensitive ⁶ F = Forest-dwelling Neotropical migrant with apparently declining populations							

ANALYSIS AREA

SPATIAL BOUNDS

The effects analysis area for direct, indirect, and cumulative effects to old growth associated wildlife species is the Glacier Loon Project Area (37,320 acres). This area is large enough to include the home ranges of old growth associated species, and is representative of the effects of fire, natural tree mortality, timber harvest, and road management across the landscape. At the same time, this analysis area is small enough to not obscure the effects of the alternatives. A multi-scale assessment has also been conducted to address habitat diversity concerns.

TEMPORAL BOUNDS

The length of time for effects from the proposed fuels reduction and forest health treatments is approximately 1 to 5 years. This is based on the probable contract length for the proposed project, and the timeframes for related activities.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included stand exams, field surveys of snags and down woody logs, old growth surveys, project area field visits, research literature, and GIS and dataset information for features, such as general forest attributes, habitat type, and forest type.

MEASUREMENT INDICATORS

The effects analysis will focus on:

1. Effects to old growth habitat, and
2. Potential effects to old growth associated wildlife species.

AFFECTED ENVIRONMENT

HISTORIC CONDITION

Historically, old growth forests in the Swan Valley ranged from open, patchy stands, maintained by frequent low-severity fire, to a mosaic of dense and open stands maintained by mixed-severity fires (Arno, Scott, et al. 1995; Freedman et al. 1985a). Old growth structure and composition, and the amount of old growth in a watershed, varied strongly with topography and elevation, and were shaped by a complex disturbance regime of fire, insects, and disease. Historically, old growth was most likely to develop in the valley bottoms and along streams, where fires burned less frequently and usually with less intensity. Drier site old growth, with ponderosa pine as the dominate tree species, occurred on more well-drained soils, often on the flats between stream bottoms. These stands were maintained by lower intensity ground fires that were not lethal to the ponderosa pine, but which inhibited the growth of less fire-tolerant species beneath the ponderosa pine. Because severe, stand-replacing fires burn at irregular intervals in response to weather patterns and fuel accumulations, variations in the amount of old growth in a local area could be expected over time.

Historical Range of Variability (HRV) is a way of describing the normal fluctuations that occurred in ecosystems over time and can be a basis for defining the limits of acceptable ecosystem change (Morgan et al. 1994; USDA 1999b). The 75 percent range around the median of the historical variability is assumed to provide an acceptable level of habitat (Hann et al. 1997; USDA 1999b). Based on various information sources, the amount of old growth on the Flathead National Forest historically would have been on the order of 15 to 60 percent (USDA 1999b). Generally, across the Flathead National Forest and the entire Columbia River Basin, there was a higher percentage of old forest across the landscape than there is currently. For more information on old growth habitat conditions across the Flathead National Forest, see the Final EIS for the Forest Plan, Amendment 21 (USDA 1998a).

EXISTING CONDITION

Over the last 100 years, old forests in the Interior Columbia Basin have declined by 27 to 60 percent and large residual trees and snags have decreased by 20 percent (Quigley et al. 1996). These changes have contributed to declining habitat conditions for numerous species of wildlife associated with old growth forests. This decrease in old growth forest has occurred within all sub-basins of the Flathead National Forest (Forest Plan Amendment 21). Based on a broad Regional review using FIA data, approximately 11.0 percent of the Flathead National Forest is old growth forest, with a 90 percent Confidence Interval lower bound of 9.0 percent and an upper bound of 13.1 percent (Bush et al. 2004). When comparing the historical range of variability for old growth, or the normal fluctuations that occurred in ecosystem conditions or processes through time, it appears that in the Swan Valley, old growth forest types, or late seral classes, are currently below the historical minimum value for all terrestrial community groups; lower montane, montane, and subalpine (USDA 1999b).

In the Swan Valley, the major differences between current conditions and historical conditions, are that the total amount of old growth forest habitat covers less land area, the patches of old growth forest are smaller in size, and remaining old growth forest habitat has changed both structurally and in distribution (Hart 1994). This translates into smaller blocks of older forest that are not as “secure” for old growth associated species as larger blocks of old growth forest with more interior area. The decline can be largely attributed to land clearing in the valleys, timber harvest, and road construction. The existing old growth forest stands are more numerous on the mid and upper-level slopes of the Swan Range. As would be expected, conversion of old growth forest has occurred at a higher rate in the valley bottoms. Lower elevation old growth forest is less prevalent than higher elevation old growth forest throughout most of the drainages in the Swan Valley.

Based on Regional FIA Data for the Glacier Loon Area (fifth code watershed 1701021101), the estimate for percent old growth in the watershed is 9.09 percent, with lower and upper bounds of 0.0 to 20.0 percent (Bush et al. 2004). This fifth code watershed includes Glacier Creek, Kraft Creek,

Herrick Run, Lindbergh Lake, and portions of the Swan River. These results, the process, and its appropriate application (Czaplewski 2004) are available on the USDA Forest Service Inventory and Analysis website at <http://fsweb.r1.fs.fed.us/forest/inv/index.htm>.

Old growth forest was identified within the Glacier Loon Project Area using “The Western Montana Zone Old Growth Type Characteristics” (Green et al. 1992)). Approximately 1,159 acres of old growth forest was identified on NFS lands in the vicinity of the proposed cutting units (See Map 3-6). There is probably additional old growth forest located on other NFS lands within the 37,320-acre Glacier Loon Project Area. Old growth on individual private lands has not been included in the old growth analysis because the availability of old growth habitat on these lands is uncertain.

Patch size of old growth forest is an important characteristic in its function as habitat. As mentioned previously, one of the changes from historical conditions is the fragmentation, or disruption of continuity, of old growth forest patches that are presently available across the Swan Valley. Old growth associated wildlife species use other habitats as well, but rely on old growth for at least a portion of their habitat needs. Many of these species are sensitive to fragmentation. For example, research suggests that 250 to 500 acres of old growth is required for the pine marten, and approximately 100 to 250 acres for the pileated woodpecker (McClelland et al. 1999). The average patch size (uninterrupted continuity) of old growth in the immediate Glacier Loon Project Area (near and adjacent to cutting units) is 77 acres, with patch sizes ranging from 20 acres to 272 acres. As would be expected, the smaller patch sizes are located at the lower elevations; patch sizes get larger in size as they are located further up the slope of the Mission Mountains. It would be likely that patch sizes of old growth in other portions of the Glacier Loon Area, outside of the heavily managed, roaded area, are similar or larger in size.

The northern goshawk, as mentioned previously, is associated with old growth habitats for a portion of its territory, specifically closed canopy old growth in larger patch sizes. The goshawk can be used as an indicator species for old growth conditions with these characteristics. Stand conditions used by the goshawk include forests with a relatively closed overstory canopy (50 to 90 percent), and a more open understory for foraging (Beier et al. 1997; Samson 2005; Squires and Kennedy 2006; Squires et al. 1997; USDI 1998). The average patch size of core nesting areas appears to be somewhat dependent on available habitat conditions; 30 acres recommended in the southwestern United States (Reynolds et al. 1992), 40 acres found by Clough (2000) in west central Montana, 148 acres found by McGrath et al. (2003) in Oregon and Washington, and approximately 80 acres found by Patla (1997) in Idaho. Live trees large enough to support a large platform nest are required. Hayward et al. (1989) found that nest sites in northwest Montana were often located in older stands that support widely-spaced large trees and which had water and large forest openings within 0.3 miles of the nest. Adjacent to the nest site, there is a post-fledging area that ranges from approximately 200 to 500 acres (USDA Forest Service 2007b), which is, along with the nesting area, usually defended by an adult pair. The size, shape, and habitat composition of these areas varies with local conditions, but is generally in pole-sized or larger forest with closed (50 percent to greater than 70 percent) canopies. A recent study in southeastern British Columbia (Harrower et al. 2010) found that northern goshawk post-fledging areas in their study area averaged approximately 90 acres; they recommended that forest managers wishing to conserve goshawk should maintain areas of 50-100 acres for post-fledglings. Northern goshawk foraging areas are heterogeneous, with goshawks preying on a variety of medium-sized forest birds and mammals, and hunting forest edges and openings, as well as forest cover.

The Glacier Loon Project Area could potentially support at least two goshawk territory blocks, assuming an average goshawk home range of about 5,000 acres with no overlapping home ranges. There is potential habitat for a northern goshawk territory block in the Glacier Creek Area (Sections 16, 17, 20, and 21 T19N R17W) and potential habitat for another block in the Bunyan Lake/Meadow Lake Area (Sections 33, 34, 35, T19N R17W and Sections 3 and 4, T18N, R17W). Both potential blocks would have sufficient old growth habitat for nesting, sufficient forest stands with closed canopies for post-fledging habitat, and sufficient foraging habitat.

The Flathead National Forest examined the amount and distribution of goshawk habitat found on NFS lands within the Flathead National Forest (USDA 2000). Goshawk habitat was summarized for

individual sub-basins. In the 469,280-acre Swan Valley Sub-basin, approximately 203,972 acres of suitable habitat were identified. Northern goshawks are known to occur in the Swan Valley. There are no known goshawk nest sites near any of the proposed treatment units.

ENVIRONMENTAL CONSEQUENCES

The Glacier Loon Project consists of a No Action Alternative and three action alternatives. A cumulative effect considers and describes proposed activities in addition to the past, current, and reasonably foreseeable activities. Cumulative effects are discussed throughout this section under the specific alternatives. For a detailed discussion of all known past, present, and foreseeable activities see the Cumulative Effects Worksheet for Old Growth Associated Species (Project File Exhibit H-21).

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

There would be no fuel reduction/forest health treatment, or associated activities, proposed with this alternative. There would be no direct effects to old growth habitats on NFS lands or to old growth associated wildlife species using these lands. This alternative would sustain habitat for old growth associated species, at least over the short term.

It is possible that an indirect effect of Alternative A would be an increased likelihood of a larger, more intense wildfire in the Glacier Loon Area. Indirectly, taking no action to reduce fuel buildups could increase the potential for a loss of old growth forest in the Glacier Loon Area. However, the level of effects would depend on the size and intensity of the wildfire, which would depend on the actual location, intensity, moisture and weather conditions associated with a presently unknown future fire event. The Crazy Horse Fire Area is located partially within the Glacier Loon Project Area; a fire start within the old burn area would not be as likely to spread and become an intense wildfire as a fire start elsewhere.

TNC activities have occurred on lands within the project area. These activities reduced available forest canopy, decreased mature trees, snags and down woody debris. TNC harvest is located on lands previously managed as industrial timberlands. All of the TNC harvest areas occurred in previously-logged stands. Outside of the riparian buffers, these stands do not typically contain the large-tree size, structurally-complex characteristics, snags or coarse woody debris the make up old growth habitat.

Natural vegetative processes would continue on NFS lands in the Glacier Loon Area. Older mature forest stands would become old growth stands. Existing old growth forest would experience increased tree mortality in the overstory, with younger trees growing into the natural openings. Replacement of the older trees would take many decades and the stands would take on an uneven-aged character. The amount of old growth habitat across the landscape would fluctuate as older trees are replaced by younger trees and as younger forests grow into future old growth.

There would be no proposed road decommissioning with the No Action Alternative.

ALTERNATIVE B - PROPOSED ACTION DIRECT AND INDIRECT EFFECTS

There is no proposed fuels reduction or forest health treatment in existing old growth forest stands under Alternative B, Alternative C, or Alternative D.

OLD GROWTH ASSOCIATED SPECIES DISTURBANCE/DISPLACEMENT

Proposed activities in Alternative B could temporarily displace old growth habitat associated wildlife species if treatments are occurring adjacent to old growth. In Alternative B, the potential for

displacement of old growth associated species would be highest in Units 26, 27, 29, 41-48, 58, 65, 86, 87, 89, 90, 92, 94, 209, 211, and 212. These proposed units are located adjacent to, and share a boundary with, existing old growth stands. Possible displacement could be up to 5 years.

As described above, the northern goshawk is associated with old growth habitats for a portion of its territory, specifically closed canopy old growth in larger patch sizes, and could be used as an indicator species for old growth conditions with these characteristics. There is potential habitat (e.g., sufficient nesting and post-fledging habitat) for at least 2 nesting goshawk pairs within the Glacier Loon Project Area. Under Alternative B, there would be nine proposed units that fall within potential goshawk post-fledging habitat: Units 84 thru 90, 92, and 94. Implementation of Alternative B would decrease the amount of potential post-fledging habitat by 145 acres. Sufficient potential post-fledging habitat would still remain to support at least 2 nesting goshawk pairs. There would, however, be the potential for disturbance and displacement of any goshawks using the area surrounding these units for nesting or post-fledging. The disturbance could be for 5 years or less.

INTERIOR INTEGRITY OF EXISTING OLD GROWTH

Timber harvest in stands immediately adjacent to old growth could cause negative direct/indirect effects. New “edge” is created when stands adjacent to old growth habitat are converted from a late- or mid-seral structural stage to an early seral (seedling/sapling) structural stage. The creation of edge adjacent to old growth forest has two negative effects on old growth: It directly affects the adjacent old growth stand or old growth block by reducing the interior integrity of the stand or block (Russell et al. 2001), and it narrows or eventually severs the connection between different old growth patches. 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 1,500 feet or more (Lidicker et al. 1996). In Alternative B, new high contrast edge would be created adjacent to nine existing old growth stands by the proposed regeneration treatment in Units 45, 46, 47, 48, 58, 86, 87, 89, 90, 92, and 94. This high contrast edge would be created for a total distance of approximately 10,400 feet (2.0 miles).

There are also 11 proposed Intermediate Harvest Units that are located adjacent to 4 existing old growth units. These units (26, 27, 29, 41-44, 65, 209, 211, and 212) are partial cuts. There would be some overstory remaining in the proposed treatment units, which would create less of a high contrast edge effect along the border of the existing old growth stands and the proposed units. There would be approximately 6,200 feet (1.2 miles) of this less contrast edge created adjacent to existing old growth stands under Alternative B.

OLD GROWTH RECRUITMENT

In units proposed for Clearcut with Reserves, nearly all of the existing trees would be removed from the site (240 acres). These treatment areas consist primarily of even-aged lodgepole pine with little species or structural diversity. They are either experiencing mountain pine beetle mortality or are at risk of being affected. Most of these units are not currently on a trajectory towards old growth; they would not provide potential old growth habitat for a very long time regardless of whether they are treated now or not.

In units that are proposed as Seed Tree with Reserves (463 acres) a portion of the existing overstory (e.g., 5 to 15 trees per acre) consisting of long-lived, fire-resistant, shade-intolerant species (western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be retained. This density is designed mainly to provide seed sources, along with some long-term structural diversity. Many of these areas are dominated by lodgepole pine infested with mountain pine beetle and are not presently on a trajectory towards old growth stand conditions. However, some of these stands are on a trajectory towards old growth and currently exhibit many old growth habitat characteristics (e.g., Units 45, 46, 86, 87). Proposed treatment of stands not dominated by at risk lodgepole pine would likely mean a longer time period before the stand would function as old growth habitat.

There are 70 acres of proposed Shelterwood with Reserve Units in Alternative B. Again, similar to Seed Tree with Reserves, a portion of the existing overstory (e.g., 10 to 30 trees per acre) would be retained. More trees would be retained in the Shelterwood Treatment than in the Seed Tree or

Clearcut Treatments. Generally, the treatment prescriptions would retain sufficient large trees to keep the stands on a trajectory towards old growth habitat conditions.

In the proposed units where Intermediate Treatments are proposed (e.g., Improvement Cut, Commercial Thin, Sanitation, Salvage), many dominant and co-dominant trees would be retained. Long-lived, fire-resistant, shade-intolerant species (typically; western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be favored for retention; smaller trees would be removed to improve stand health, enlarge the growing space of desirable trees, and reduce tree competition for limited site resources. In most cases, the proposed intermediate forest health treatments would keep the stands on a trajectory towards providing old growth habitat conditions for old growth associated wildlife species in the future.

EFFECTS OF TEMPORARY ROAD CONSTRUCTION

Alternative B proposes 11.5 miles of temporary road. The construction of temporary roads adjacent to old growth stands can create the same 'edge effect' as described above when stand conversion occurs due to logging (e.g., clearcut). The edge created by constructing a temporary road would, however, be smaller in size. There would be no *additional* high contrast edge created as a result of temporary road construction in Alternative B, other than edge already created by the unit treatment itself, because the temporary roads are inside the units at the point where they intersect the edge of an existing old growth stand.

Under Alternative B, there would be approximately 0.4 miles of temporary road construction to access Units 47 and 48, and 0.3 miles of temporary road construction to access Unit 90, that would increase access to old growth forest. Temporary roads would not be open to public use and would be reclaimed following use. If the temporary road is reclaimed correctly, there would not be an increased risk of important old growth snag habitat being removed as firewood.

ROAD DECOMMISSIONING

In Alternative B, 4.1 miles of road decommissioning is proposed. There are three roads proposed for decommissioning that are located partially in existing old growth stands: A portion of NFS Road #9579 (0.8 miles), NFS Road #10568 (0.3 miles), and NFS Road #10247 (0.3 miles). National Forest System Roads #9579 and #10568 would have passive reclamation; there would be no ground disturbance within the old growth stands. For NFS Road #10247, the decommissioning work would involve the removal of culverts and the installation of waterbars every 100 to 300 feet, as needed. Although there would be short-term displacement of old growth associated species during the decommissioning work, the proposed road decommissioning would increase long-term habitat security for old growth associated wildlife species.

SLASH TREATMENT

Proposed slash treatment consists of a variety of methods, including the scattering of slash where fuel loads are lighter, chipping of woody material, piling slash and burning the piles, and broadcast burning following logging activity. Where units that are adjacent to existing old growth stands have broadcast burning as the proposed slash treatment there is a potential for old growth trees along the border between the stands to be inadvertently lost through broadcast burning. There are 47 acres of broadcast burning proposed in Alternative B adjacent to existing old growth habitat (Units 47, 86, and 87).

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no change to existing MA designations under Alternative B.

ALTERNATIVE B - PROPOSED ACTION CUMULATIVE EFFECTS

Past land management activities in the area, including timber management, road construction, residential development, and agricultural conversion, have decreased the amount of available old

growth forest and have fragmented the patches of old growth that are left into smaller blocks. Timber harvest activities on PCTC lands and on NFS lands in the Upper Swan Valley peaked during the mid to late 1980s, although timber harvest has continued up to the present on all ownership lands. There are past timber harvest projects on NFS lands in the Upper Swan Valley, including the Meadow Smith, Summit Mountain Pine Beetle Salvage, and Hemlock Elk Projects. TNC activities have occurred on lands within the project area. These activities reduced available forest canopy, decreased mature trees, snags and down woody debris. **TNC harvest is located on lands previously managed as industrial timberlands. All of the TNC harvest areas occurred in previously-logged stands. Outside of the riparian buffers, these stands do not typically contain the large-tree size, structurally-complex characteristics, snags or coarse woody debris the make up old growth habitat. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. This project would not treat old growth. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project.**

The Glacier Loon Project is located south/southwest of the community of Condon, Montana. There are part-year and yearlong residences in the area, as well as a managed campground, managed trail systems, and other dispersed recreational opportunities. The level of human activity in the area increases the chance for disturbance or displacement of old growth associated wildlife species. There is also an increased risk for the removal of snags (firewood), an important component of old growth habitat. Other human activity in the area includes various road use permits, easements, and special use agreements.

Residential development and timber harvest on other ownership lands has, in the past, broken up the continuity of mature forest near and adjacent to old growth patches on NFS lands. The intermingled ownership pattern in the Swan Valley has presented difficulties in the past in managing old growth habitat connectivity with patch sizes that occurred historically. It is anticipated that, in the future, this condition would improve due to the Montana Legacy Project; a land conveyance from PCTC to the USDA Forest Service that has created larger blocks of public land which can be managed in larger patch sizes.

Significant adverse cumulative effects to old growth associated wildlife species would not be expected as a result of implementing Alternative B because;

1. There is no proposed treatment in old growth stands,
2. Untreated, existing old growth stands in the area would continue to provide potential habitat for old growth associated wildlife species, and
3. Intermediate harvest treatments (e.g. partial cutting as compared to clearcut) would retain vigorous, healthy, wind-firm, fire-resistant, and longer-lived tree species. One of the objectives of this type of treatment is to increase the amount of old growth forest over the long-term, as mature forested stands are put on a trajectory where they can become future old growth habitat.

ALTERNATIVE C

DIRECT AND INDIRECT EFFECTS

There is no proposed treatment in existing old growth forest stands under Alternative C. Effects to old growth associated species are similar in Alternatives B and C, with slightly less impact under Alternative C.

OLD GROWTH ASSOCIATED SPECIES DISTURBANCE/DISPLACEMENT

Proposed activities in Alternative C could temporarily displace old growth habitat associated wildlife species if treatments are occurring adjacent to old growth. In Alternative C, the potential for displacement of old growth associated species would be highest in Units 26, 27, 29, 41-48, 58, 65, 89, 90, 92, 94, 209, 211, and 212. These proposed units are located adjacent to, and share a boundary with, existing old growth stands. Possible displacement could be up to 5 years.

Alternative C would have less potential to disturb or displace old growth associated wildlife species than Alternative B, because there are less proposed units adjacent to existing old growth habitat; Units 86 and 87 (proposed in Alternative B) would not be treated under Alternative C. Unit 58 is significantly smaller in Alternative C (2 acres compared to 16 acres).

Under Alternative C, there would be less proposed units within potential goshawk post-fledging habitat than in Alternative B; there would be 5 proposed units instead of 9 (Units 88-90, 92, and 94). Implementation of Alternative C would decrease the amount of potential post-fledging habitat by 92 acres. Sufficient potential post-fledging habitat would still remain to support at least 2 nesting goshawk pairs. There would, however, be the potential for disturbance and displacement of any goshawks using the area surrounding these units for nesting or post-fledging. The disturbance could be for 5 years or less.

INTERIOR INTEGRITY OF EXISTING OLD GROWTH

Timber harvest in stands immediately adjacent to old growth could cause negative direct/indirect effects. In Alternative C, new high-contrast edge would be created adjacent to eight existing old growth stands by the proposed regeneration treatment in Units 45, 46, 47, 48, 58, 89, 90, 92 and 94. This high-contrast edge would be created for a total distance of approximately 8,800 feet (1.7 miles). This amount is less than the amount of high-contrast edge that would be created with implementation of Alternative B.

Similarly to Alternative B, there are 11 proposed intermediate harvest units that are located adjacent to four existing old growth units. There would be approximately 6,200 feet (1.2 miles) of this less contrast edge that would be created adjacent to existing old growth stands under Alternative C.

OLD GROWTH RECRUITMENT

In units proposed for Clearcut with Reserves, nearly all of the existing trees would be removed from the site (229 acres).

In units that are proposed as Seed Tree with Reserves (405 acres) a portion of the existing overstory (e.g., 5 to 15 trees per acre) consisting of long lived, fire resistant, shade intolerant species (western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be retained. As in Alternative B, many of these areas are dominated by lodgepole pine infested with mountain pine beetle and are not presently on a trajectory towards old growth stand conditions. However, some of these stands are on a trajectory towards old growth and currently exhibit many old growth habitat characteristics (e.g., Units 45, 46). Proposed treatment of stands not dominated by at risk lodgepole pine would likely mean a longer time period before the stand would function as old growth habitat.

There are 51 acres of proposed Shelterwood with Reserve Units in Alternative C; a portion of the existing overstory (e.g., 10 to 30 trees per acre) would be retained. Generally, the treatment prescriptions would retain sufficient large trees to keep the stands on a trajectory towards old growth habitat conditions.

In the proposed units where intermediate treatments are proposed (e.g., Improvement Cut, Modified Commercial Thin, Commercial Thin, Sanitation, Salvage), many dominant and co-dominant trees would be retained. In most cases, the proposed intermediate forest health treatments would keep the stands on a trajectory towards providing old growth habitat conditions for old growth associated wildlife species in the future.

EFFECTS OF TEMPORARY ROAD CONSTRUCTION

Alternative C proposes 7.4 miles of temporary road. There would be no additional high-contrast edge created as a result of temporary road construction, other than edge already created by the unit treatment itself, because the temporary roads are inside the units at the point where they intersect the edge of an existing old growth stand. Similarly to Alternative B, under Alternative C, there would be approximately 0.4 miles of temporary road construction to access Units 47 and 48, and 0.3 miles of temporary road construction to access Unit 90; these temporary roads would increase access to old growth forest habitat.

ROAD DECOMMISSIONING

In Alternative C, 8.4 miles of road decommissioning is proposed. There are three roads proposed for decommissioning that are located partially in existing old growth stands: A portion of NFS Road #9579 (0.8 miles), NFS Road #10568 (0.3 miles), and NFS Road #10247 (0.3 miles). National Forest System Roads #9579 and #10568 would have passive reclamation; there would be no ground disturbance within the old growth stands. For NFS Road #10247, the decommissioning work would involve the removal of culverts and the installation of waterbars every 100 to 300 feet, as needed. Although there would be short-term displacement of old growth associated species during the decommissioning work, the proposed road decommissioning would increase long-term habitat security for old growth associated wildlife species.

SLASH TREATMENT

Where units that are adjacent to existing old growth stands have broadcast burning as the proposed slash treatment method, there is a potential for old growth trees along the border between the stands to be inadvertently lost through broadcast burning. There are only 12 acres of broadcast burning proposed in Alternative C adjacent to existing old growth habitat (Unit 47); this would be less than Alternative B.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative C would include a permanent MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake.

Alternative C proposes that 213 acres of MA 15 and 8 acres of MA 15C be permanently changed to an MA 5 designation. On MA 15 and MA 15C lands, cost-effective timber production with roads is emphasized. Additionally, on MA 15C lands, special consideration is to be given to white-tailed deer summer range. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would likely translate to less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake. This would likely mean that the potential for these 221 acres to support more old growth forest habitat over a longer period of time would be greater; this would be beneficial for old growth associated wildlife species.

ALTERNATIVE C CUMULATIVE EFFECTS

Cumulative effects described under Alternative B would apply to Alternative C, as well. Significant adverse cumulative effects to old growth associated wildlife species are not expected as a result of implementing Alternative C because;

1. There is no proposed treatment in old growth stands,
2. Untreated existing old growth stands in the area would continue to provide potential habitat for old growth associated wildlife species, and
3. Intermediate harvest treatments would retain vigorous, healthy, wind-firm, fire-resistant, and longer-lived tree species which would encourage a trajectory towards old growth habitat conditions.

ALTERNATIVE D DIRECT AND INDIRECT EFFECTS

There is no proposed forest health or fuels reduction activity in existing old growth forest stands under

Alternative D. Alternative D would have the least impact on old growth associated wildlife species.

OLD GROWTH ASSOCIATED SPECIES DISTURBANCE/DISPLACEMENT

As in Alternatives B and C, proposed activities in Alternative D could temporarily displace old growth habitat associated wildlife species, if treatments are occurring adjacent to old growth. In Alternative D, the potential for displacement of old growth associated species would be highest in Units 26, 44, 48, 58, 65, 89, 90, 92, 94, 209, 211, and 212. These proposed units are located adjacent to, and share a boundary with, existing old growth stands. Possible displacement could be up to 5 years, but probably less than Alternatives B or C due to the decrease in proposed treatment acres.

Alternative D would have less potential to disturb or displace old growth associated wildlife species than either Alternative B or C, because there are less proposed units adjacent to existing old growth habitat.

Under Alternative D, there would be less proposed units within potential goshawk post-fledging habitat than in Alternative B. Similarly to Alternative C, there would be 5 proposed units (Units 88-90, 92, and 94) within potential goshawk post-fledging habitat. Implementation of Alternative D would decrease the amount of potential post-fledging habitat by 92 acres. Sufficient potential post-fledging habitat would still remain to support at least two nesting goshawk pairs. There would, however, be the potential for disturbance and displacement of any goshawks using the area surrounding these units for nesting or post-fledging. The disturbance could be for 5 years or less.

INTERIOR INTEGRITY OF EXISTING OLD GROWTH

Timber harvest in stands immediately adjacent to old growth could cause negative direct/indirect effects. New “edge” is created when stands adjacent to old growth habitat are converted from a late- or mid-seral structural stage to an early-seral (seedling/sapling) structural stage. As described above, the creation of edge adjacent to old growth forest has two negative effects on old growth: It directly affects the adjacent old growth stand or old growth block by reducing the interior integrity of the stand or block, and it narrows or eventually severs the connection between different old growth patches. In Alternative D, new high-contrast edge would be created adjacent to eight existing old growth stands by the proposed regeneration treatment in Units 48, 58, 89, 90, 92, and 94. This high-contrast edge would be created for a total distance of approximately 6,600 feet (1.3 miles). This amount is less than the amount of high contrast edge created with implementation of Alternatives B or C.

There are six proposed intermediate harvest units that would be located adjacent to four existing old growth stands. In these intermediate harvest units, there would be some overstory trees retained, which would create less of a high-contrast edge effect along the border of the existing old growth stands and the proposed units. There would be approximately 4,600 feet (0.9 miles) of this less-contrast edge created adjacent to existing old growth stands under Alternative D; less than under Alternatives B or C.

OLD GROWTH RECRUITMENT

Under Alternative D, there would be 217 acres of Clearcut with Reserves; nearly all of the existing trees would be removed from the site. These treatment areas would consist primarily of even-aged lodgepole pine with little species or structural diversity. Most of these units are not currently on a trajectory towards old growth; they would not provide potential old growth habitat for a very long time regardless of whether they are treated now or not.

In units that are proposed as Seedtree with Reserves (347 acres), a portion of the existing overstory (e.g., 5 to 15 trees per acre) consisting of long-lived, fire-resistant, shade-intolerant species (western larch, ponderosa pine, western white pine, and occasionally Douglas-fir) would be retained. This density is designed mainly to provide seed sources, along with some long-term structural diversity. Many of these areas are dominated by lodgepole pine infested with mountain pine beetle and are not presently on a trajectory towards old growth stand conditions. Under Alternative D, stands that are on a trajectory towards old growth and currently exhibit many old growth habitat characteristics (e.g., Units 45, 46, 86, and 87) would not be treated.

There are 31 acres of proposed Shelterwood with Reserve Units in Alternative D; a portion of the existing overstory (e.g., 10 to 30 trees per acre) would be retained. More trees would be retained in the Shelterwood Treatment than in the Seed Tree or Clearcut Treatments. Generally, the treatment prescriptions would retain sufficient large trees to keep the stands on a trajectory towards old growth habitat conditions.

As described for Alternatives B and C, in the proposed units where intermediate treatments are proposed (e.g., Improvement Cut, Commercial Thin, Sanitation, Salvage), many dominant and co-dominant trees would be retained. In most cases, the proposed intermediate forest health treatments would keep the stands on a trajectory towards providing old growth habitat conditions for old growth associated wildlife species in the future.

EFFECTS OF TEMPORARY ROAD CONSTRUCTION

Under Alternative D, there would be 5.8 miles of temporary road. The construction of temporary roads can create the same 'edge effect' as described above when stand conversion occurs due to logging (e.g., clearcut). The edge created by constructing a temporary road would, however, be smaller in size. As explained above for Alternatives B and C, there would be no additional high contrast edge created as a result of temporary road construction because the temporary roads are inside the units at the point where they intersect the edge of an existing old growth stand.

As in Alternatives B and C, under Alternative D, there would be approximately 0.4 miles of temporary road construction to access Unit 48, and 0.3 miles of temporary road construction to access Unit 90. These proposed temporary roads could potentially increase access to old growth forest. Temporary roads would not be open to public use and would be reclaimed following use. If the temporary road is reclaimed correctly, there would not be an increased risk of important old growth snag habitat being removed as firewood.

ROAD DECOMMISSIONING

In Alternative D, there is 8.4 miles of road decommissioning proposed. As described above for Alternatives B and C, there are three roads proposed for decommissioning that are located partially in existing old growth stands. For NFS Road #10247, the decommissioning work would involve the removal of culverts and the installation of waterbars as needed. Although there would be short-term displacement of old growth associated species during the decommissioning work, the proposed road decommissioning would increase long-term habitat security for old growth associated wildlife species.

SLASH TREATMENT

Where units are adjacent to existing old growth stands that have broadcast burning as the proposed slash treatment, there is a potential for old growth trees along the border between the stands to be inadvertently lost through broadcast burning. Under Alternative D, there is no broadcast burning proposed adjacent to existing old growth habitat.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative D would include a permanent MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake. The proposed MA change on 221 acres above Lindbergh Lake would likely mean less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake, which would be beneficial for old growth associated wildlife species.

ALTERNATIVE D CUMULATIVE EFFECTS

Past land management activities in the area, including timber management, road construction, residential development, and agricultural conversion, have decreased the amount of available old growth forest and have fragmented the patches of old growth that are left into smaller blocks. As described above, under Alternative B, there are part-year and yearlong residences in the area, as

well as a managed campground, managed trail systems, and other dispersed recreational opportunities. The level of human activity in the area increases the chance for disturbance or displacement of old growth associated wildlife species. There is also an increased risk for the removal of snags (firewood), an important component of old growth habitat. Other human activity in the area includes various road use permits, easements, and special use agreements.

Residential development and timber harvest on other ownership lands has, in the past, broken up the continuity of mature forest near and adjacent to old growth patches on NFS lands. The intermingled ownership pattern in the Swan Valley has presented difficulties in the past in managing old growth habitat connectivity with patch sizes that occurred historically. It is anticipated that, in the future, this condition would improve due to the Montana Legacy Project.

TNC activities have occurred on lands within the project area. These activities reduced available forest canopy, decreased mature trees, snags and down woody debris. TNC harvest is located on lands previously managed as industrial timberlands. All of the TNC harvest areas occurred in previously-logged stands. Outside of the riparian buffers, these stands do not typically contain the large-tree size, structurally-complex characteristics, snags or coarse woody debris the make up old growth habitat. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. This project would not treat old growth. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project.

Significant adverse cumulative effects to old growth associated wildlife species are not expected as a result of implementing Alternative D because;

1. There is no proposed treatment in old growth stands,
2. Untreated, existing old growth stands in the area would continue to provide potential habitat for old growth associated wildlife species, and
3. Intermediate harvest treatments (e.g., Partial cutting as compared to Clearcut or Seed Tree) would retain vigorous, healthy, wind-firm, fire-resistant, and longer-lived tree species:

One of the objectives of this type of treatment is to increase the amount of old growth forest over the long-term, as mature forested stands are put on a trajectory where they can become future old growth habitat.

REGULATORY FRAMEWORK AND CONSISTENCY

The NFMA requires that the Forest Service “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.” In addition, NFMA regulations 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.” According to NFMA; “This will satisfy the statutory requirement to provide for diversity of plant and animal communities based on suitability and capability of the specific land area in order to meet multiple use objectives.”

Amendment 21 to the Forest Plan was signed in January 1999. It has a goal to “maintain and recruit old growth forests to an amount and distribution that is within the 75 percent range around the median of the historical range of variability. Where current conditions are below this amount, actively manage to recruit additional old growth.” Amendment 21 further states that management actions within old growth stands should be limited to those actions that “maintain or restore old growth composition and structure consistent with native disturbance and succession regimes, or reduce risks to sustaining old growth composition and structure.”

Implementation of all alternatives would comply with the standards contained in the Forest Plan relative to old growth.

SNAG AND DOWN WOODY ASSOCIATED SPECIES

INTRODUCTION

Snags, broken-topped live trees, down logs, and other woody material are required by a wide variety of species for nesting, denning, roosting, perching, feeding, and cover (Bull et al. 1997). Snags and down, dead, material are also used for communication purposes:

- Singing, (songbirds),
- Drumming (grouse and woodpeckers),
- Calling (squirrels, jays, birds of prey), and
- Sight recognition posts.

Small mammals and birds use standing and down dead material for food storage and for hunting. Down logs and stumps are important for travel, both below the snow in the winter, and as travel cover throughout the year. It is estimated that about one third of the bird and one third of the mammal species that live 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 (USDA 1999b). The 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, and several other species), shrews, bryophytes, lichen, fungi, and protozoa. As down woody material further decays, it plays an important role in nutrient cycling, soil fertility, and erosion control.

Snags and their management have become a major conservation issue in managed forests across the western United States. Biologists have recognized for a long time that snags and down woody material provide important wildlife habitat, but only in the last decade or so have managers begun to understand that not only is tree decay an important ecological process that affects wildlife habitat (Bull et al. 1997), but snags and dead wood are an essential, important part of the larger ecosystem. The number, species, size, and distribution of available snags strongly affect snag-dependent wildlife. An insufficient number of suitable snags may limit or eliminate populations of cavity-using species (Saab et al. 1998; Thomas et al. 1979).

Although various sizes of snags and down woody are used, larger birds and mammals require larger dead trees. The larger-diameter down trees provide stable and lasting structure and offer better protection from weather extremes (Bull 2002). Longer down woody pieces provide better runways, shelter, and under-snow access.

Several wildlife species that use snag and down woody habitats on the Flathead National Forest are USFS Region One Sensitive Species, including the bald eagle, black-backed woodpecker, fisher, flammulated owl, Townsend's big-eared bat, and wolverine. One of the TES Species on the Flathead National Forest, the Canada lynx, has a strong habitat association with down woody material (denning).

Snags are essential habitat for at least 42 species of birds and 10 species of mammals in Montana. Table 3- 88 displays specific habitat relationships and Montana NHP rankings for wildlife species in Montana associated with snag, "defective" live tree, or down woody habitat.

TABLE 3- 89 SPECIES THAT USE SNAGS, "DEFECTIVE" LIVE TREES, AND/OR DOWNED LOGS.

SPECIES	GLOBAL & STATE RANKS (MTNHP 2009) *	SNAG DBH (INCHES)	SNAG HEIGHT (FEET)	DOWNED LOGS?	OCCURRENCE
American Kestrel (N)	G5, S5B	17	20		Known current
Bald Eagle (S)	G5, S3, SOC	25	40		Known current
Barred Owl (former MIS)	G5, S4	25	30		Known current
Barrow's Goldeneye	G5, S4, potential SOC	25	10		Known current
Big Brown Bat	G5, S4	17	20		Known current
Black-backed Woodpecker (S)	G5,S3 (SOC)	17	10		Known current
Black-capped Chickadee	G5, S5	9	10		Known current
Bobcat	G5, S5	-	-	yes	Known current
Boreal Chickadee	G5,S3 (SOC)	9	10		Known current
Boreal Owl (former S)	G5, S4	17	10		Known current
Brown Creeper	G5, S3, SOC	15	20		Known current
Bufflehead	G5, S5B	17	10		Known current
Canada lynx (T)	G5, S3, SOC	-	-	yes	Known current
Chestnut-backed Chickadee	G5, S4	9	10		Known current
Common Goldeneye	G5, S5	25	10		Known current
Common Merganser	G5, S5B	17	10		Known current
Dark-eyed junco	G5, S5B	-	-	yes	Known current
Downy Woodpecker	G5, S5	11	10		Known current
Fisher (S)	G5, S3, SOC	25	30	yes	Known current
Flammulated Owl (S, N)	G4, S3B, SOC	17	10		Known current
Great Horned Owl	G5, S5	25	30		Known current
Hairy Woodpecker	G5, S5	17	20		Known current
Harlequin Duck (S)	G4, S2B, SOC	-	-	yes	Known current
Hooded Merganser	G5, S4, potential SOC	17	10		Known current
House Finch	G5, S5	15	10		Known current
House Sparrow	G5, undesired species	15	20		Known current
House Wren (N)	G5, S5B	15	10		Known current
Lewis' Woodpecker	G4, S2B (SOC)	17	30		Known current
Little Brown Myotis	G5, S4	17	10		Known current
Long-eared Myotis	G5, S4	17	10		Known current
Long-legged Myotis	G5, S4	17	10		Known current
Long-tailed Weasel	G5, S5	-	-	yes	Known current
Marten (former MIS)	G5, S4	17	20	yes	Known current
Mountain Bluebird	G5, S5B	15	10		Known current
Mountain Chickadee	G5, S5	9	10	yes	Known current
Northern Alligator Lizard	G5,S3 (SOC)	-	-	yes	Known current
Northern Flicker	G5, S5	17	10		Known current
Northern Flying Squirrel	G5, S4	17	20		Known current
Northern Goshawk (former S)	G5,S3 (SOC)	-	-	yes	Known current
Northern Hawk Owl	G5, S4, potential SOC	25	10		Known current
Northern River Otter	G5, S4	-	-	yes	Known current
Northern Waterthrush (N)	G5, S5B	-	-	yes	Known current
Osprey	G5, S5B	17	40		Known current

TABLE 3- 89 SPECIES THAT USE SNAGS, "DEFECTIVE" LIVE TREES, AND/OR DOWNED LOGS.

SPECIES	GLOBAL & STATE RANKS (MTNHP 2009) *	SNAG DBH (INCHES)	SNAG HEIGHT (FEET)	DOWNED LOGS?	OCCURRENCE
Painted Turtle	G5, S4	-	-	yes	Known current
Pileated Woodpecker (former MIS)	G5,S3 (SOC)	25	60		Known current
Pygmy Nuthatch	G5, S4	17	30		Known current
Pygmy Owl	G5, S4	17	30		Known current
Raccoon	G5, S5	25	10		Known current
Red-breasted Nuthatch	G5, S5	17	20		Known current
Red-naped Sapsucker (N)	G5, S4B	17	20		Known current
Rubber Boa	G5, S4	-	-	yes	Known current
Ruffed Grouse	G5, S4	-	-	yes	Known current
Saw-whet Owl	G5, S4	17	20		Known current
Silver-haired Bat	G5, S4, potential SOC	17	20		Known current
Southern Red-backed Vole	G5, S4	-	-	yes	Known current
Spruce Grouse	G5, S4	-	-	yes	Known current
Striped Skunk	G5, S5	-	-	yes	Known current
Swainson's Thrush (N)	G5, S5B	-	-	yes	Known current
Tailed Frog	G5, S4	-	-	yes	Known current
Three-toed Woodpecker	G5, S4	17	20		Known current
Tree Swallow (N)	G5, S5B	15	20		Known current
Vaux's Swift (N)	G5, S4B	25	40		Known current
Violet-Green Swallow	G5, S5B	15	20		Known current
Western Bluebird	G5, S4B	15	10		Known current
Western Jumping Mouse	G5, S4	-	-	yes	Known current
Western Screech Owl	G5, S3, potential SOC	17	20		Known current
Western (Townsend's) Big-eared Bat (S)	G4, S2 (SOC)	?	?		Known current
White-breasted Nuthatch	G5, S4	17	20		Known current
Williamson's Sapsucker (N)	G5, S4B	17	20		Known current
Wilson's Warbler (N)	G5, S5B	-	-	yes	Known current
Wolverine (S)	G4, S3 (SOC)	-	-	yes	Known current
Wood Duck	G5, S5B	25	10		Known current
Yuma Myotis	G5, S3, potential SOC	17	10		Known current

T=Threatened; S=Sensitive Species; N=Neotropical migratory bird; Natural Heritage Program Rank: G=species range-wide (global); S=state wide; 2=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. 3=Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas. 4=Uncommon but not rare (although it may be rare in parts of its range), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern. 5=Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range. B=State rank modifier indicating breeding for a migratory species. SOC=Montana Species of Concern.

ANALYSIS AREA

SPATIAL BOUNDS

The Glacier Loon Project Area was considered for the evaluation of direct and indirect effects on snag and down woody associated species. This approximately 37,320-acre area is large enough to include the home ranges of several individuals or pairs of a species, and is representative of the effects of fire, natural tree mortality, timber harvest, and road management across the landscape. The actions proposed in the alternatives that could directly or indirectly affect snag or down woody associated wildlife species are contained within this area. The Upper Swan Valley was considered in the cumulative effects analysis. A multi-scale assessment was also conducted to address habitat diversity concerns for dead tree dependent species (USDA 2006).

TEMPORAL BOUNDS

The length of time for effects from the proposed fuels and forest health treatments is approximately 1 to 5 years. This is based on the probable contract length for the proposed project, and the timeframes for related activities.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included project area field visits, research literature, and GIS and dataset information for features, such as general forest attributes, habitat type, and forest type.

MEASUREMENT INDICATORS

The effects analysis will focus on:

1. Effects to snag and down woody habitat, and
2. Potential effects to snag/down woody associated wildlife species.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Forest ecosystems in the western United States have adapted in response to disturbances such as wildfire, insects, disease, and windstorms. Snags and down woody material have always occurred on the landscape, a direct result of these disturbance factors, either on a large scale, or on a very small scale, as individual trees grow old and die. Ritter and others have described snag populations as occurring in either “pulses” of snags following a large disturbance event, or as “continuous” populations of scattered individuals (Ritter et al. 2000).

Historically, in the Swan Valley, snag habitat and down woody material, though always present in varying amounts, experienced greater “pulses” across the landscape and in localized areas as a result of natural disturbances. Warmer and drier areas historically underwent more frequent, lower-intensity fires, and typically supported fewer snags and large down logs than cooler and moister environments, where the stands reached climax conditions before experiencing stand-replacing fire.

EXISTING CONDITION

The Northern Region of the Forest Service estimated snag densities for Western Montana Forests by

using FIA Data to explore the density and distribution of snags within and outside of wilderness/roadless areas. Snag densities were inventoried and estimated by habitat type groups, dominance groups, and seral stages. The analysis took into consideration recent findings on the effect of timber harvest and human access on snag density; how snag density relates to stand succession and disturbances; and the spatial pattern of snags. Table 3- 89 displays mean snag densities for the western Montana Forests including the Flathead National Forest. The total primary sampling units (PSUs) are the number of FIA plots within the domain of interest, such as wilderness/roadless. The number of forested PSUs is the number of FIA grid locations that have at least a portion of the PSU with a “forested” condition. Estimates of mean snag density from FIA Data are displayed with their respective 90 percent confidence intervals, which provide an indication of the reliability of the estimate. At a confidence level of 90 percent, unless a 1 in 10 chance has occurred, the true population mean is within this interval.

It should be noted that the three diameter classes for snags are not mutually exclusive; e.g., all snags 15.0 inches DBH and larger are included in the estimate of snags 10.0 inches DBH and larger and all snags 20.0 inches DBH and larger are included in the estimate of snags 15.0 inches DBH and larger.

TABLE 3- 90. MEAN SNAG DENSITIES PER ACRE WITH 90% CONFIDENCE INTERVAL, BY DIAMETER CLASSES, INSIDE AND OUTSIDE OF WILDERNESS/ROADLESS AREA FOR EACH WESTERN MONTANA FOREST.

AREA	WILDERNESS/ ROADLESS	SNAGS/ACRE 10"+			SNAGS/ACRE 15" +			SNAGS /ACRE 20"+			TOTAL PSUs	No FORESTED PSU
		Mean	90% CI – Lower Bound	90% CI – Upper Bound	Mean	90% - CI Lower Bound	90% CI – Upper Bound	Mean	90% CI – Lower Bound	90% CI – Upper Bound		
Western Montana	IN	11.4	10.1	12.9	3.5	3.0	3.9	1.0	0.8	1.2	625	625
Bitterroot		13.1	10.3	16.2	4.1	3.0	5.3	1.1	0.7	1.5	159	159
Flathead		10.0	7.8	12.4	2.8	2.2	3.5	0.9	0.6	1.1	214	214
Kootenai		10.9	8.6	13.4	3.4	2.5	4.4	1.0	0.6	1.4	144	144
Western Montana	Out	8.1	7.0	9.1	2.3	2.0	2.7	0.8	0.7	1.0	618	618
Bitterroot		2.7	1.3	4.2	0.8	0.3	1.4	0.6	0.2	1.1	67	67
Flathead		9.8	7.4	12.5	2.6	1.8	3.4	1.1	0.7	1.6	124	124
Kootenai		9.8	8.1	11.5	2.4	1.9	3.0	0.8	0.6	1.2	244	244
Lolo		6.6	4.9	8.4	2.6	1.9	3.4	0.8	0.5	1.1	183	183

This evaluation of snag densities on the western Montana Forests of Region One used a hierarchical approach. Snag densities within and outside of wilderness and roadless areas were looked at, with the goal of obtaining information on natural snag abundance and distribution compared to snag densities in areas where there has been a history of timber harvest and human access. As would be expected, access and forest management activities can have a substantial effect on snag density and longevity (Russell et al. 2001; Wisdom et al. 2008). It is acknowledged that there is some uncertainty about how climate, a period of cool and moderate precipitation, and fire suppression from 1930 to 1985 has affected snag density and distribution in wilderness and roadless areas. However, even with some degree of uncertainty, it is probably the best quantitative data available to represent natural forested systems.

As shown in Table 3- 89, there are fewer snags in each of the diameter classes outside of wilderness and roadless areas for the western Montana portion of the region in general, and for all of the Forests. As an example, there is a statistically significant difference in 15 inch+ diameter snag number within roadless/wilderness compared with outside these areas. Furthermore, the larger the snag, the less common it is.

ENVIRONMENTAL CONSEQUENCES

The Glacier Loon Project consists of a No Action Alternative and three action alternatives. A cumulative effect considers and describes proposed activities in addition to the past, current, and reasonably foreseeable activities. Cumulative effects are discussed throughout this section under the specific alternatives. For a detailed discussion of all known past, present, and foreseeable activities see the Cumulative Effects Worksheet for Snag and Down Woody Associated Species (Project File Exhibit H-21).

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Under this alternative, there would be no reduction of snags as a result of proposed fuels reduction or forest health activities and no reduction of down woody logs or debris. New snags created as a result of insects or disease would not be cut down as a result of harvest treatment and existing snags would eventually fall over and add to the down woody material in the area. Dead trees would be retained and continue to provide habitat for wildlife species associated with snag or down woody material. There would be less potential displacement of wildlife species from snag/down woody habitat under this alternative.

No direct effects to wildlife that depend on snag or down woody material for all or part of their habitat needs are anticipated as a result of implementing Alternative A. Indirectly, there may be an increased likelihood under the No Action Alternative of more intense, stand-replacing fires in some habitats within the project area due to the increased amount of potential fuels on the ground. Such fires would have the effect of increasing the amount of snag habitat and reducing the amount of down woody debris (at least short-term) compared to current conditions.

TNC activities have occurred on lands within the project area. These activities reduced available forest canopy, decreased mature trees, snags and down woody debris. TNC harvest is located on lands previously managed as industrial timberlands. All of the TNC harvest areas occurred in previously-logged stands which outside of riparian buffers do not typically have large diameter trees, snags or large amounts of down woody debris.

In the past, human-caused threats to snag and down woody associated species have included timber management, road building, agricultural conversion, residential development, firewood cutting, fire suppression, and disease control. Under the No Action Alternative, these activities would continue across the Upper Swan Valley.

There would be no proposed road decommissioning with the No Action Alternative.

ALTERNATIVES B AND C

DIRECT AND INDIRECT EFFECTS

These alternatives are discussed together due to the similarity of their effects on snag and down woody dependent wildlife species. Alternatives B and C have the most potential to impact snag and down woody dependent wildlife species because they have the most acreage treatment overall and the most temporary road construction.

COMMERCIAL TREATMENTS

Commercial treatment would include proposed Clearcut, Seed Tree, Shelterwood, Commercial Thin, Modified Commercial Thin, Improvement Cut, and Sanitation/Salvage Treatments. Commercial harvest activities proposed under Alternative B would reduce the amount of snags and down woody material on 1,749 acres. Under Alternative C, snag and down woody material would be reduced on 1,556 acres. Wisdom et al. (2008) found that snag densities were 19 times higher in unharvested stands compared to harvested stands. Although snags are not usually targeted for removal, they are sometimes removed inadvertently to increase logging efficiency, or if they are deemed a hazard to the woods workers, they are removed for safety reasons. If snags are recently dead, they could be removed for commercial reasons. In treatment units near private property, where the main purpose is fuel reduction, snags could be removed to meet the objective of reducing the potential fuels in an area. Down woody material suitable for wildlife use is usually reduced during logging activity as a result of heavy equipment use, purposeful removal to reduce fuels, or removal to facilitate reforestation. The effect to snag and down woody dependent species would be an immediate decrease in available habitat. Over time, which could be 50 to 100 years or more depending on existing snag/down woody habitat, the amount and condition of snags and down woody material would be expected to return to pre-harvest levels.

Proposed slash treatment consists of a variety of methods, including the scattering of slash where fuel loads are lighter, chipping of woody material, piling slash and burning the piles, and broadcast burning following logging activity. In units proposed for broadcast burning, there is a potential for down woody material or snags that are not removed during actual logging activity to be inadvertently lost through broadcast burning. There are 164 acres of broadcast burning proposed in Alternative B and 102 acres proposed in Alternative C.

As mitigation for snag and down woody associated wildlife species, snags and down woody material would be retained in all treatment units (Table 3- 89). The prescriptions for treatment would be designed to retain a minimum average of 6 snags per acre that are 12 to 20 inches DBH; all snags greater than 20 inches DBH would be left. If existing snag densities are below these densities, substitute live trees would be left. All standing dead cull western larch, ponderosa pine, and Douglas-fir trees 16 inches DBH or greater would be retained if possible. Generally, snags to be left would be further than 150 feet from open roads and private land boundaries. Snags that pose a safety hazard to the contractor's operation would be removed. In addition to these snag retention criteria, the minimum retention for down woody material would be approximately 10 tons per acre, where available. To achieve the tonnage required, down woody material, which includes the longest material available (e.g., 16 feet long or longer) with the largest diameters available (e.g., 15 inches DBH or greater), would be retained, in sufficient amounts to achieve the required tons per acre.

NON-COMMERCIAL TREATMENTS

Non-commercial treatment would consist of Post and Pole Treatments and Pre-Commercial Thinning. Under both Alternatives B and C, the amount of non-commercial treatment proposed would be 353 acres. Direct and indirect effects from the proposed non-commercial treatments would be minimal. The trees in these stands, and the available down woody material, are small and do not currently provide quality snag/down woody habitat. In the long-term, the effects of the proposed treatment could be beneficial to wildlife species dependent on snag and down woody habitats because the removal of excess trees would reduce growth stagnation and enable the retained trees to grow more vigorously.

OLD GROWTH AND RIPARIAN HABITAT

Old growth habitats and riparian habitats are very important to snag and down woody dependent wildlife species. These habitats frequently have abundance of larger snags and down woody material. Wisdom et al. (2008) found a strong relationship between snag density and seral stage; snag density was highest in late-seral stands. In Alternatives B and C, there would be no proposed treatment in old growth habitats. For more information on Old Growth Associated Wildlife Species, refer to that section of this environmental analysis.

There are management guidelines and BMPs in place (e.g., INFISH) that mitigate effects to riparian habitat. Riparian Habitat Conservation Areas restrict activities within a designated distance from streams, lakes, and wetlands (see Fisheries Report). The riparian guidelines in place for Alternatives B and C would help protect important riparian habitats for snag associated species. However, it should be mentioned that riparian habitats encompass more acreage than the wetland itself and probably extend beyond the guidelines established for aquatic riparian values. In other words, with implementation of Alternative B or C, there would still be direct and indirect effects to riparian habitats or wetland complexes that are important to snag and down woody associated species in the Glacier Loon Area. Direct and indirect effects would include the loss of both overstory cover and hiding cover adjacent to riparian habitats, and displacement from riparian habitats while activities are occurring in close proximity.

Important riparian habitat in the Glacier Loon Project Area includes portions of Sections 26 and 36 (T20N, R17W), portions of Section 6 (T19N, R16W), and portions of Sections 11 and 12 (T19N, R17W). Under Alternative B there would be a total of 612 acres of proposed commercial and non-commercial treatment in and adjacent to wetland habitats. With proposed implementation of Alternative C, there would be a total of 597 acres of proposed commercial and non-commercial treatment in and adjacent to wetland habitats.

TEMPORARY ROADS

There would be approximately 11.5 miles of temporary road constructed under Alternative B and approximately 7.4 miles of temporary road constructed under Alternative C. Snags that are located within the temporary road right-of-way would be cut down. If they are non-merchantable, they could be left on the ground as down woody.

SECURITY/MORTALITY RISK

Under Alternatives B and C, it is possible that project implementation would directly affect snag or down woody dependent wildlife species through disturbance or incidental mortality. During sale activities, both open and closed roads would be used. In addition, as mentioned above, temporary roads would be constructed. In their snag density research, Wisdom et al. (2008) found that stands without a road adjacent to them had 3 times the density of snags in contrast to stands along an open road. They also found that snag density was 40 percent lower along transects within 164 feet of an adjacent road compared to those transects greater than 164 feet. Fewer snags are present even beyond 164 feet as firewood cutters are using cable systems to cut and move snags at longer distance from roads (Wisdom and Bate 2008, Flathead National Forest employee observances). Activity conducted along an open road would not be a change from the existing condition; however, opening closed roads and constructing temporary roads has the potential to increase access for firewood cutters. Design Criteria under all action alternatives would require that temporary roads be reclaimed; public use of closed roads would not be permitted, reducing the risk of losing potential snag tree habitat to firewood cutters.

ROAD DECOMMISSIONING

In Alternative B, there is 4.1 miles of road decommissioning proposed. In Alternative C, there is 8.4 miles of road decommissioning proposed. This would increase long-term habitat security for snag and down woody associated species. The potential for removal of snags from firewood cutting would be decreased.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative C would include a permanent MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake. There would be no change to existing MA designations under Alternative B.

Under Alternative C, 213 acres of MA 15 and 8 acres of MA 15C would be permanently changed to an MA 5 designation. On MA 15 and MA 15C lands, cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would likely translate to less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake. This would likely mean that the potential for these 221 acres to support more snag and down woody habitat over a longer period of time would be greater.

ALTERNATIVE D DIRECT AND INDIRECT EFFECTS

COMMERCIAL TREATMENTS

Commercial harvest activities proposed under Alternative D would reduce the amount of snags and down woody material on 1,045 acres. The effect to snag and down woody dependent species would be a decrease in available habitat.

As mitigation for snag and down woody associated wildlife species, snags and down woody material would be retained in all treatment units. The prescriptions for treatment would be designed to retain a minimum average of 6 snags per acre that are 12 to 20 inches DBH; all snags greater than 20 inches DBH would be left. If existing snag densities are below these densities, substitute live trees would be left. All standing dead cull western larch, ponderosa pine, and Douglas-fir trees 16 inches DBH or greater would be retained if possible. Generally, snags to be left would be further than 150 feet from open roads and private land boundaries. Snags that pose a safety hazard to the Contractor's operation would be removed. In addition to these snag retention criteria, the minimum retention for down woody material would be approximately 10 tons per acre, where available. To achieve the tonnage required, down woody material, which includes the longest material available (e.g., 16 feet long or longer) with the largest diameters available (e.g., 15 inches DBH or greater), would be retained, in sufficient amounts to achieve the required tons per acre (Table 2- 16).

In units proposed for broadcast burning, there is a potential for down woody material or snags that are not removed during actual logging activity to be inadvertently lost through broadcast burning. There are 82 acres of broadcast burning proposed in Alternative D.

NON-COMMERCIAL TREATMENTS

There is 105 acres of proposed non-commercial treatment in Alternative D. Direct and indirect effects from the proposed non-commercial treatments would be minimal.

OLD GROWTH AND RIPARIAN HABITAT

In Alternative D, there would be no proposed treatment in important old growth habitats. Under Alternative D, there would be less proposed treatment in and adjacent to wetland habitats than under Alternatives B or C; Alternative D includes approximately 320 acres of proposed commercial and non-commercial treatment in and adjacent to wetland complexes.

TEMPORARY ROADS

There would be 5.8 miles of temporary road constructed under Alternative D. There would probably be a decrease in snag and down woody habitat where temporary roads are constructed.

SECURITY/MORTALITY RISK

Under Alternative D, it is likely that project implementation would directly affect snag or down woody dependent wildlife species through disturbance or possibly incidental mortality. During sale activities both open and closed roads would be used. In addition, as mentioned above, temporary roads would be constructed. Design Criteria (Table 2- 16) under all action alternatives would require that temporary roads be reclaimed; public use of closed roads would not be permitted, reducing the risk of losing potential snag tree habitat to firewood cutters.

ROAD DECOMMISSIONING

In Alternative D, 8.4 miles of road decommissioning is proposed. This would increase long-term habitat security for snag and down woody associated species. The potential for removal of snags from firewood cutting would be decreased.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative D would include the permanent MA change in the Forest Plan, which was described above for Alternative C. The proposed MA change on 221 acres above Lindbergh Lake would probably translate into less regeneration harvest and road building on those acres. The potential for these 221 acres to support more snag and down woody habitat over a longer period of time would be greater.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Human-caused threats to snag and down woody associated species include activities that reduce the availability or use of snag/down woody habitat. Activities that have reduced dead tree habitat in the Glacier Loon Area, and throughout the Swan Valley, are timber management, road building, agricultural conversion, residential development, firewood cutting, fire suppression, and insect and disease control.

On many of the roads in the project area, and throughout the Swan Valley, public access has been restricted through seasonal or yearlong road closures. This has helped to reduce the loss of important snag habitat to firewood cutters.

Recently, large fires in Montana have created a “pulse” of snag habitat across the landscape. Fires within the last 10 years within stands greater than 9 inches (trees large enough to provide a potentially suitable snag) have occurred at 125.5 percent of the average historic conditions (Hillis, Pengeroth, et al. 2003). In the Swan Valley, adjacent to the Glacier Loon Project Area, the Crazy Horse Fire (over 11,000 acres) burned in the late summer of 2003 creating a large amount of snags, many of which were not harvested. In 2006, the Holland Peak Fire burned over 1,800 acres east of the project area. Again, most standing snags were not cut down. Although these same fires reduced available down woody debris for the short-term, over time the snags would decay and fall down, creating new down woody habitat within the fire areas.

TNC activities have occurred on lands within the project area. These activities reduced available forest canopy, decreased mature trees, snags and down woody debris. TNC harvest is located on lands previously managed as industrial timberlands. All of the TNC harvest areas occurred in previously-logged stands which outside of riparian buffers do not typically have large diameter trees, snags or large amounts of down woody debris. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project.

Significant adverse cumulative effects to snag and down woody associated species are not expected as a result of implementing Alternatives B, C, or D because;

1. There is no treatment proposed in important old growth habitats,
2. The proposed treatments would retain snag and down woody habitat in each unit; and

3. Large fires in Montana have created a “pulse” of snag habitat across the landscape in the recent past.

REGULATORY FRAMEWORK AND CONSISTENCY

The Forest Service is required by the 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.” A wide variety of wildlife species are dependent on the existence of standing snags and down woody material. Forest Plan Amendment 21 (USDA 1999b) provides the current direction for snags and down woody material. Sufficient vegetation structure is to be retained, including large diameter trees, in timber harvest areas. 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 snag retention levels, minimum retention levels have been established as the standard.

All of the Glacier Loon Alternatives would comply with standards in the Forest Plan for snag and down woody habitat and associated wildlife species.

MANAGEMENT INDICATOR SPECIES COMMONLY HUNTED BIG GAME

INTRODUCTION

White-tailed deer, mule deer, and elk are Management Indicator Species (MIS) for commonly hunted big game species on the Flathead National Forest (USDA 1985). At the Forest level, meeting the habitat needs for white-tailed deer, mule deer, and elk would indicate that the habitat needs for other commonly hunted big game species, such as black bear, mountain lion, and moose, would also be met. Habitat needs that each of these species has in common include cover (hiding and thermal), forage, and security (Witmer et al. 1998).

Natural disturbances, such as fire or major insect infestations, and man-caused disturbances, including timber harvest, road construction, agricultural conversion, or residential development, alter the landscape, changing the amount and juxtaposition of cover and forage. These changes affect big game use patterns as they search out forage and cover, and can also affect habitat security.

ANALYSIS AREA

SPATIAL BOUNDS

The effects analysis area for direct, indirect, and cumulative effects to white-tailed deer, mule deer, and elk is the Glacier Loon Project Area. This area (approximately 37,320 acres) is large enough to be representative of the effects of fire, natural tree mortality, timber harvest, and road management across the landscape. The actions proposed that could affect white-tailed deer, mule deer, or elk, are contained within this area. In addition, the area is sufficiently large enough to evaluate the ability of the habitat to support other big game species considered under the MIS umbrella.

TEMPORAL BOUNDS

The length of time for effects analysis is approximately 1 to 5 years. This is based on the probable contract length for the proposed project, the timeframes for related activities, and the reasonably foreseeable actions identified.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included Open Road Densities (ORDs), stand exam surveys, aerial photography, VMAP Data, project area field visits, research literature, and GIS and dataset information for features, such as riparian habitats, wet areas, old growth stand layers, white-tailed deer winter range, deer summer range, elk winter range, and general forest attributes like habitat type, forest type, elevation, and slope.

MEASUREMENT INDICATORS

Important considerations for summer range habitat for deer and elk include moist sites or riparian habitat, hiding cover, forage, and general habitat security, especially during hunting season. These elements of deer and elk summer habitat, and the anticipated effects to these elements from project implementation, are the predominant measurement indicators used in this analysis. In addition, there is an area of designated white-tailed deer winter habitat in the project area; thermal cover, hiding cover, and forage are important considerations for deer and will be measurement indicators in the area where white-tailed deer winter habitat could be affected with implementation of the Glacier Loon Project.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

The Swan Valley has historically provided year-round habitat for deer and elk, as well as for other big game species covered under the MIS umbrella. White-tailed deer habitat consists of a mixture of various forested communities that provide cover, foraging habitat, and water within a reasonable distance. While elk and mule deer use similar habitats, white-tailed deer are more closely associated with riparian features than elk or mule deer. White-tailed deer exhibit a broad range of summer and fall habitat use, but are commonly associated with warm and moist mixed-species coniferous forest and lowlands interspersed with aquatic wetlands, meadows, and stream bottoms. The wetland complexes in the Upper Swan Valley, including river and stream riparian zones, fens or peat lands, marshes, vernal pools, ponds, and lakes, are quite extensive (Swan Ecosystem Center 2004). Habitats favored by elk during the summer months include moist parks, meadows, and riparian areas, offering succulent forage and bedding sites. Elk remain on higher elevation summer ranges until forced down to lower elevations by snow and severe weather. Both elk and mule deer are also commonly associated with shrub, seedling, and sapling habitats. Mule deer have similar seasonal habitat and elevational range preference as elk. Like elk, mule deer elevational range is dictated by food availability and weather conditions.

In the past, ungulate populations undoubtedly fluctuated between mild winter years and hard winter years. The use patterns of deer and elk have also undoubtedly shifted as a result of natural disturbances such as wildfire, windfall, and insect infestations, which typically remove or alter hiding cover, thermal cover, and forage. Thermal cover describes the ability of a forested stand to intercept snow and provide winter protection for deer or elk (e.g., shallow snow depths, warmth). Winter thermal cover is very important to white-tailed deer populations. Hiding cover for both deer and elk refers to vegetation of sufficient size and density to conceal an animal from view at approximately 200 feet. Forage areas, as the name implies, are habitats that provide food for deer and elk.

Historically, there were large patch sizes of thermal and hiding cover, interspersed with patches of forage. As mentioned previously, the pattern across the landscape of cover and forage naturally fluctuated in response to winter severity, wildfire, insect and disease, windstorms, etc. Early surveys indicate that the white-tailed deer population in the Swan Valley ranged from approximately 4,000 to 8,000 animals in the 1930s, when surveys were first initiated, up to the 1990s. It was believed that white-tailed deer reached a population high in 1900 to 1915. There are few reliable historical estimates for elk or mule deer. Large-scale logging was at its peak in 1917 (on private land holdings), and it was the opinion of the local people that this reduced cover to such an extent that the deer population suffered (Freedman 1983; Mundinger 1982). Mundinger (1981) described the Swan Valley white-tailed deer population as one that is characterized by low and stable annual turnover and recruitment. He concluded that the population was stable, with an annual recruitment rate of 29 percent, and an annual survival rate of approximately 70 percent.

The Glacier Loon Project Area has historically been used year-round by white-tailed deer, mule deer,

elk, and other big game species. White-tailed deer have probably always been the most numerous of the big game species occurring in the Glacier Loon Area and throughout the Swan Valley.

EXISTING CONDITION

The greatest change from historic to current conditions for deer and elk, throughout the Swan Valley, has been the change in human activity. The level of human activity in the Swan Valley has obviously increased over early settlement and pre-settlement conditions. The result of increased human activity has been an increase in the amount of timber harvest, road construction, recreational use (including hunting), residential development, grazing, and agriculture. Residential and agricultural developments have permanently altered potential deer and elk habitats. Timber harvest across the valley has altered the amount and juxtaposition of thermal cover, hiding cover, and forage. Timber harvest typically removes big game cover and creates foraging areas by reverting forest succession to its earliest stage. As these foraging areas go through succession and become reforested, they again begin to provide cover; first hiding and then thermal cover. Where cover exceeds forage by a wide margin, removal of cover could enhance deer and elk habitat by increasing edge, increasing diversity, and increasing forage. In contrast, when an adequate distribution of cover is not present, additional removal of cover could reduce habitat values for deer and elk. The blocks of cover were more connected in the absence of timber management and residential development (Swan Ecosystem Center 2004).

The increase in miles of road, largely a result of land management activities, has resulted in a decrease in security for deer and elk, especially during hunting season. Security was higher in the absence of extensive road building and recreational hunting. In recent years, road closures for grizzly bear in the Swan Valley have undoubtedly benefited both deer and elk. Currently, in the Glacier Loon Project Area (Glacier Loon Grizzly Bear Subunit), 23 percent of the area exceeds 1 mile/square mile open motorized access. Approximately 41 percent of the area is free from motorized access and is at least 2,500 acres in size.

Historically, prior to fire suppression management, many forested stands in the lower elevations, especially on the east side of the Swan River, experienced frequent underburns, and shrubs and grasses grew up under more open canopies. Under existing conditions, many of these historically open stands have become more grown in, and stand conditions are no longer open; shrubs and other forage vegetation have declined. Any wildfire at this point would probably be stand replacing instead of a lower intensity underburn.

In 1986, the Forest Plan allocated approximately 12,000 acres of NFS land in the Upper Swan Valley as white-tailed deer winter habitat (MA 9). The Forest Plan also allocated lands in the Swan Valley as elk and mule deer winter habitat (MA 13). None of the activities proposed in the Glacier Loon Project are located in designated elk or mule deer winter habitat. There are approximately 21 acres of proposed treatment in designated white-tailed deer winter habitat. There are also treatments proposed on lands designated as MA 15C, where cost-effective timber production with roads is emphasized, with special consideration for white-tailed deer summer range. Within the Glacier Loon Project Area, there are approximately 7,108 acres of MA 15C lands.

As stated previously, exact numbers of deer and elk using the Upper Swan Valley, or specifically the Glacier Loon Area, are not known. White-tailed deer 2009 spring survey results in the Swan Valley recorded a lot of adult deer, but similar to the rest of the region, relatively few fawns were noted. The fawn:adult ratio for spring 2009 was 20:100, the lowest recorded in the Swan Valley. The ratio is thought to be the product of a combination of factors, including two back-to-back hard winters, deer being in the “down” side of their cycle, and predators (MFWP 2009).

A 2010 report by MDFW&P describes the estimated population for white-tailed deer, mule deer, and elk in Region 1, which includes the Swan Valley. In Region 1, the estimated population for white-tailed deer in 2011 was 73,996, with a 10-year average (2001 to 2010) of 73,872. The estimated population for mule deer in 2011 was 13,095, with a 10-year average of 15,973 (MFWP 2010). Elk status and objectives are described in the 2010 report by Hunting District (HD). The Swan Valley, more specifically the Glacier Loon Area, is located in HD 130. The most recent year that elk were

counted in HD 130 was 2008. There were 203 elk counted; assuming that 80 percent of elk are observed, the estimated elk population in 2008 was 254 in HD 130. The Elk Plan Objective for HD 130 is 225 elk; the status for elk in HD 130 is “At Objective” (MFWP 2004, 2010).

In the November 29, 2011, edition of *The Daily Inter Lake*, Jim Williams, Wildlife Manager, Region 1, MDFW&P, described how early hunting season results for northwest Montana were showing deer and elk population numbers still down. Check station counts in 2011 were 15 percent lower for white-tailed deer bucks, 35 percent lower for mule deer, and 23 percent lower for elk.

ENVIRONMENTAL CONSEQUENCES

The Glacier Loon Project consists of a No Action Alternative and three action alternatives. A cumulative effect considers and describes proposed activities in addition to the past, current, and reasonably foreseeable activities. Cumulative effects are discussed throughout this section under the specific alternatives. For a detailed discussion of all known past, present, and foreseeable activities see the Cumulative Effects Worksheet for Commonly Hunted Big Game (Project File Exhibit H-22).

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

There would be no proposed fuels treatment or forest health activities under this alternative. The occurrence and abundance of forage and cover would fluctuate and change over time as the area progresses through various successional stages. There would be no direct effects to riparian zones, existing hiding cover, or thermal cover, and no direct effects to foraging habitat as a result of implementing Alternative A. Security for white-tailed deer and elk/mule deer would remain the same. There would be no changes in the level of general motorized access, or hunting access. There would be no proposed road decommissioning with the No Action Alternative.

TNC activities have occurred on lands within the project area. These activities reduced available forest cover in the project area. In some areas big game forest may be improved while the reduction of cover would decrease security. Visual screening remains along open roads and the TNC activities maintained existing closure of motorized routes in the project area maintaining the existing public motorized access.

Indirectly, the likelihood of stand-replacement fires could be increased under Alternative A as compared to the action alternatives, with increased risk of cumulative effects to hiding and thermal cover. However, the level of effects would depend on the size and intensity of the wildfire, which would depend on the actual location, intensity, moisture and weather conditions associated with a presently unknown future fire event.

Human occupancy of private lands in the Swan Valley is likely to increase, as is overall human activity in the Glacier Loon Area. This increase in human use would likely increase the potential for disturbance of deer and elk. However, there is nothing about the No Action Alternative that is likely to interact cumulatively, causing significant negative effects on white-tailed deer, mule deer, elk, or other big game species.

ALTERNATIVE B – PROPOSED ACTION DIRECT AND INDIRECT EFFECTS

In a comparison of the action alternatives, the direct and indirect effects to deer and elk would be greatest with Alternative B, slightly less with Alternative C, and least with Alternative D .

Under Alternative B, there are 773 acres of Regeneration Treatment proposed (Clearcut/Seed Tree/Shelterwood) and 976 acres of Intermediate Treatment (Commercial Thin, Sanitation/Salvage, and Improvement Cut); total proposed commercial treatment is 1,749 acres. There are also 353 acres

of non-commercial treatment proposed in Alternative B, including 343 acres of Pre-Commercial Thinning and 10 acres of Post and Pole Treatment.

Proposed slash treatment consists of a variety of methods, including the scattering of slash where fuel loads are lighter, chipping of woody material, piling slash and burning the piles, and broadcast burning following logging activity. There is a potential for any of the proposed slash treatment methods to decrease hiding cover in the project area.

Access to proposed units would include open roads, restricted roads, and temporary roads. Under Alternative B, there are approximately 11.5 miles of proposed temporary road construction.

None of the proposed activities in Alternative B are located in areas mapped as mule deer and elk winter habitat (MA 13) in the Forest Plan. There are approximately 21 acres of proposed treatment in designated white-tailed deer winter habitat (MA 9).

In Alternative B, there are 1,359 acres of proposed treatment (Commercial and Non-Commercial) on lands designated in the Forest Plan as having an emphasis on cost-effective timber production with roads, with special consideration for white-tailed deer summer range. Important habitat characteristics of white-tailed deer summer range would include riparian areas, hiding cover, forage, and motorized road access restrictions necessary to allow white-tailed deer optimum dispersal. The potential direct and indirect effects on these important habitat characteristics are addressed below.

RIPARIAN HABITATS/WETLAND COMPLEXES

Riparian habitats are an important component of both deer and elk habitat. Riparian habitat would include rivers, streams, lakes, small wetlands, and ponds or potholes. There are management guidelines and BMPs in place (e.g., INFISH) that mitigate effects to riparian habitat. Riparian Habitat Conservation Areas restrict activities within a designated distance from streams, lakes, and wetlands (see Fisheries Section). The riparian guidelines in place for Alternative B would help protect important riparian habitats for deer and elk. However, it should be mentioned that riparian habitats, when considering deer and elk use, encompass more acreage than the wetland itself and probably extend beyond the guidelines established for aquatic riparian values. In other words, there would still be direct and indirect effects to riparian habitats or wetland complexes that are important for deer and elk in the Glacier Loon Area. Direct and indirect effects would include the loss of both thermal (summer cooling) cover and hiding cover adjacent to riparian habitats, and displacement from riparian habitats while activities are occurring in close proximity.

Important riparian habitat for deer and elk in the Glacier Loon Project Area includes portions of Sections 26 and 36 (T20N R17W), portions of Section 6 (T19N R16W), and portions of Sections 11 and 12 (T19N R17W). Big game use, including deer, elk, moose, and black bear, is heavy in these riparian area complexes, as evidenced by field visits and wildlife surveys. Under Alternative B, there would be 101 acres treated in Section 26 (Units 15-17), 224 acres treated in Section 36 (Units 19-31, 205), 64 acres treated in Section 6 (Units 41, 42, 206-210), and 223 acres treated in Sections 11 and 12 (Units 50-54, 213-217); a total of 612 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats. In some of the units, notably the proposed regeneration harvests where lodgepole pine is the dominant species, a decrease in thermal cover would occur naturally, regardless of whether proposed fuels reduction or forest health treatments are implemented, due to ongoing mountain pine beetle mortality in the stand. Hiding cover would probably decrease naturally in these stands as well, although to a lesser extent because dead trees, snags, blowdown, etc. would provide a measure of hiding cover.

HIDING COVER

Currently, approximately 70 percent of the Glacier Loon Project Area provides hiding cover for wildlife species. This percentage includes all NFS lands (e.g., Legacy Lands and Wilderness), but does not include private lands within the project area boundary. Approximately 96 percent (2,030 acres) of the mature and immature forest stands where treatment is proposed in Alternative B currently provide hiding cover for big game species, including deer and elk. The proposed fuels reduction and forest health treatments would decrease the amount of hiding cover across the Glacier Loon Area.

There would be little to no hiding cover left in stands proposed for Regeneration Treatment (Clearcut, Seed Tree, or Shelterwood) or Post and Pole. In stands proposed for Intermediate Treatment (Commercial Thin, Improvement Cut, Sanitation/Salvage), some of the area would continue to provide hiding cover following treatment and some of the area would not. This is due to the wide variability in the proposed prescriptions. For example, Commercial Thinning Treatments would leave 50 to 150 TPA. At the lower end (50 to 80 TPA) of the scale, there probably would not be sufficient cover left to function as hiding cover for deer and elk. At the higher end (80+ TPA), there would probably be sufficient cover to function as hiding cover. Non-commercial treatments would be similar to the commercial intermediate treatments; depending on the residual density target (e.g., 50 to 300 TPA), hiding cover would be eliminated or retained. Taking these prescriptions into account, under Alternative B, there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 1,453 acres. This assumes that half of the intermediate treatments would still provide hiding cover. This reduction in hiding cover under Alternative B would lower the percentage of hiding cover in the Glacier Loon Project Area from 70 percent to approximately 66 percent.

Hiding cover would take approximately 10 to 20 years to recover, depending on stand conditions. As discussed previously, there would be some decrease in hiding cover naturally, notably in the proposed regeneration harvests with large amounts of lodgepole pine. This would be regardless of treatment implementation, due to on-going mountain pine beetle mortality. Dead trees, snags, blowdown, etc., would still provide a measure of hiding cover in these stands.

Design Criteria for Alternative B (Table 2-16) stipulate that vegetative screening be retained along open roads in the project area and that Clearcut and Seed Tree Units retain cover, such that no point in the unit is more than 600 feet from hiding cover. These Design Criteria were developed for grizzly bear, but would benefit deer and elk, and other big game species, and help to mitigate negative effects on hiding cover.

WHITE-TAILED DEER WINTER HABITAT

In Alternative B, there is one unit (Unit 33) that is partially located in an area designated as white-tailed deer winter habitat. Thermal cover is an important habitat component for white-tailed deer on winter range; it helps moderate snow depths, and to a lesser extent, temperature. The proposed treatment would not decrease thermal cover in this unit because Unit 33 does not presently provide thermal cover for white-tailed deer due to the size of the trees in the stands (an older tree plantation). The proposed treatment, a Commercial Thin, would be designed to enlarge growing space for individual trees and improve the tree growth. As described in the Forest Plan, the prescription for this stand, since it is designated to be managed as White-tailed deer Winter Habitat, would be designed to achieve at least 50 percent thermal cover and would include diverse tree species, but feature Douglas-fir.

FORAGE

Several studies in the Swan Valley and Salish Mountains have demonstrated that white-tailed deer forage consists mainly of conifer and shrub browse, with Oregon grape (*Berberis repens*) and Douglas-fir by far the most abundant items (MFWP 2006). Forbs, grasses and lichens are also important seasonal food sources (e.g., grasses in the spring). The mature and immature stands where vegetative treatments are proposed offer foraging opportunities for deer and elk (Hildebrand 1971; Munding 1982). Although proposed vegetative treatments would initially decrease the amount of available forage due to ground disturbance, forage opportunities would increase again within 1 to 5 years. The additional sunlight reaching the forest floor could increase forage levels in some stands above existing forage amounts. Forage habitat is not presently limiting in the Glacier Loon Area for deer and elk.

HABITAT SECURITY

There is a potential for short-term displacement (approximately 5 years or less) of deer and elk from the immediate area during the proposed activities. It is expected that deer and elk use patterns would change slightly as the animals avoid areas of high human activity. There are large blocks of unroaded land and wilderness adjacent to the proposed project that could provide secure habitat for deer and

elk. There is no proposed treatment in old growth stands in the Glacier Loon Area. This would provide additional habitat security for deer, elk, and other big game species; several studies have demonstrated a close relationship between deer and the serally mature, “sub-climax,” or old growth forest (Mundinger 1982; Wallmo et al. 1980). In addition, Design Criteria (Table 2-16) in place for grizzly bear protection would benefit deer and elk, and other big game species. For instance, in order to avoid the potential disturbance of grizzly bears in important spring habitat, management activities that are planned in spring habitat, which is generally defined as areas below 5,200 feet, would not occur within the Spring Period (April 1 through June 15). This timing restriction would be beneficial to deer and elk. Road closures in effect for grizzly bear in the Glacier Loon Area would provide security for deer and elk, as well.

Existing open roads and closed roads would be used to conduct the proposed fuels reduction and forest health activities. Use of open roads would not be a change from the existing condition. Vegetative screening would be maintained along open roads. This would help to provide habitat security for deer and elk, especially during hunting season. Use of gated or bermed roads for hauling logs would increase human activity levels in areas normally more secure for deer and elk. Roads that are currently closed, but that would be used for proposed activities, would be closed to the general public during the time that they are used for timber management activities.

There would be no permanent road construction under Alternative B; however, approximately 11.5 miles of temporary road would be needed to access treatment areas. Temporary roads would be constructed to the minimum standards necessary for log hauling. There are no temporary roads located in white-tailed deer winter habitat.

Temporary roads would be reclaimed following use. The reclamation work would include the removal of any culverts, installing erosion control features, re-vegetation with native shrubs or seed mix, re-contouring, and the placement of woody debris on the reclaimed road. Despite the reclaiming of temporary roads, there is obvious evidence of ground disturbance and clearing of vegetation that remains after a temporary road is reclaimed. It is possible for these reclaimed areas to be an attractant to forest users. The goal of reclaiming the temporary roads is to discourage motorized use. There is always a potential for these temporary roads to be vectors of human use, but the potential is low, if the reclamation work is successful.

ROAD DECOMMISSIONING

In Alternative B, there is 4.1 miles of road decommissioning proposed. This would increase long-term habitat security for white-tailed deer, mule deer, and elk.

EFFECTS OF MANAGEMENT AREA CHANGE

There would be no change to existing MA designations under Alternative B.

ALTERNATIVE C

DIRECT AND INDIRECT EFFECTS

Under Alternative C, there are 685 acres of Regeneration Treatment proposed and 871 acres of Commercial Intermediate Treatment; total proposed commercial treatment is 1,554 acres. There are also 353 acres of non-commercial treatment proposed in Alternative C, including 343 acres of Pre-Commercial Thinning and 10 acres of Post and Pole Treatment.

Access to proposed units would include open roads, restricted roads, and temporary roads. Under Alternative C, there are approximately 7.4 miles of proposed temporary road construction.

None of the proposed activities in Alternative C are located in areas mapped as mule deer and elk winter habitat (MA 13); there are approximately 21 acres of proposed treatment in designated white-tailed deer winter habitat (MA 9).

In Alternative C, there are 1,358 acres of proposed treatment (Commercial and Non-Commercial) on lands designated in the Forest Plan as having an emphasis on cost-effective timber production with

roads, with special consideration for white-tailed deer summer range. This is very similar to Alternative B.

RIPARIAN HABITATS/WETLAND COMPLEXES

The riparian guidelines in place for Alternative C would help protect important riparian habitats for deer and elk. However, there would still be direct and indirect effects to riparian habitats and wetland complexes that are important for deer and elk in the Glacier Loon Area. Direct and indirect effects would include the loss of both thermal (summer cooling) cover and hiding cover adjacent to riparian habitats, and displacement from riparian habitats while activities are occurring in close proximity.

As described in Alternative B, above, important riparian habitat for deer and elk in the Glacier Loon Project Area includes portions of Sections 26 and 36 (T20N R17W), portions of Section 6 (T19N R16W), and portions of Sections 11 and 12 (T19N R17W). Under Alternative C, there would be 101 acres treated in Section 26 (Units 15-17), 223 acres treated in Section 36 (Units 19-31, 205), 64 acres treated in Section 6 (Units 41, 42, 206-210), and 209 acres treated in Sections 11 and 12 (Units 50-54, 213-217); a total of 597 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats. In some of the units, notably the proposed regeneration harvests where lodgepole pine is the dominant species, a decrease in thermal cover would occur naturally, regardless of whether proposed fuels reduction or forest health treatments are implemented, due to on-going mountain pine beetle mortality in the stand. Hiding cover would decrease naturally in these stands as well, although to a lesser extent because dead trees, snags, blowdown, etc. would provide a measure of hiding cover.

HIDING COVER

Currently, approximately 70 percent of the Glacier Loon Project Area provides hiding cover for wildlife species. This percentage includes all NFS lands (e.g., Legacy Lands and Wilderness), but does not include private lands within the project area boundary. Taking into account the proposed treatments in Alternative C, as described above in Alternative B, there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 1,310 acres with implementation of Alternative C. This assumes that half of the Intermediate Treatments would still provide hiding cover. This reduction in hiding cover under Alternative C would lower the percentage of hiding cover in the Glacier Loon Project Area from 70 percent to approximately 67 percent.

Hiding cover would take approximately 10 to 20 years to recover, depending on stand conditions. As discussed previously, there would be some decrease in hiding cover naturally, notably in the proposed regeneration harvests with large amounts of lodgepole pine. This would be regardless of treatment implementation, due to ongoing mountain pine beetle mortality. Dead trees, snags, blowdown, etc., would still provide a measure of hiding cover in these stands. Design Criteria for Alternative C stipulate that vegetative screening be retained along open roads in the project area and that Clearcut and Seed Tree Units retain cover such that no point in the unit is more than 600 feet from hiding cover. These Design Criteria were developed for grizzly bear, but would benefit deer and elk, and other big game species, and help to mitigate negative effects on hiding cover.

WHITE-TAILED DEER WINTER HABITAT

In Alternative C, there is one unit (Unit 33) that is partially located in an area designated as white-tailed deer winter habitat. The proposed treatment would not decrease thermal cover in this unit because Unit 33 does not presently provide thermal cover for white-tailed deer. As described in the Forest Plan, the prescription for this stand, since it is designated to be managed as white-tailed deer winter habitat, would be designed to achieve at least 50 percent thermal cover and would include diverse tree species but feature Douglas-fir.

FORAGE

Although proposed vegetative treatments would initially decrease the amount of available forage due to ground disturbance, forage opportunities would probably increase again within 1 to 5 years as a greater amount of sunlight and moisture reach the forest floor.

HABITAT SECURITY

There is a potential for short-term displacement of deer and elk from the immediate area during the proposed activities. It is expected that deer and elk use patterns would change slightly as the animals avoid areas of high human activity. Design Criteria in place for grizzly bear protection would benefit deer and elk, and other big game species.

Existing open roads and closed roads would be used to conduct the proposed fuels reduction and forest health activities. Vegetative screening would be maintained along open roads. This would help to provide habitat security for deer and elk, especially during hunting season. Use of gated or bermed roads for hauling logs would increase human activity levels in areas normally more secure for deer and elk. Roads that are currently closed, but that would be used for proposed activities, would be closed to the general public during the time that they are used for timber management activities.

Approximately 7.4 miles of temporary road would be needed to access treatment areas. There are no temporary roads located in white-tailed deer winter habitat. Temporary roads would be reclaimed following use. There is always a potential for these temporary roads to be vectors of human use, but the potential is low, if the reclamation work is successful.

ROAD DECOMMISSIONING

In Alternative C, 8.4 miles of road decommissioning is proposed. This would increase long-term habitat security for white-tailed deer, mule deer, and elk.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative C would include a MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake.

Alternative C proposes that 213 acres of MA 15 and 8 acres of MA 15C be changed to an MA 5 designation. On MA 15 and MA 15C lands cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would likely translate into less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake. The proposed MA change would probably result in positive effects for deer, elk, and other big game wildlife species because hiding cover and thermal cover would be retained, at least over the short-term, and security for wildlife species would be greater without additional road building.

ALTERNATIVE D DIRECT AND INDIRECT EFFECTS

In a comparison of the action alternatives, the direct and indirect effects to deer and elk would be greatest with Alternative B, less with Alternative C, and least with Alternative D (Table 3- 90).

Under Alternative D, there are 595 acres of Regeneration Treatment proposed (Clearcut/Seed Tree/Shelterwood) and 450 acres of Intermediate Treatment (Commercial Thin, Modified Commercial Thin, Sanitation/Salvage, and Improvement Cut); total proposed Commercial Treatment is 1,045 acres. There are also 105 acres of non-commercial treatment proposed in Alternative D, including 95 acres of Pre-Commercial Thinning and 10 acres of Post and Pole Treatment.

Access to proposed units would include open roads, restricted roads, and temporary roads. Under Alternative D, there are approximately 5.8 miles of proposed temporary road construction.

None of the proposed activities in Alternative D are located in areas mapped in the Forest Plan as mule deer and elk winter habitat (MA 13). There are approximately 21 acres of proposed treatment in designated white-tailed deer winter habitat (MA 9). In Alternative D, there are 591 acres of proposed treatment (commercial and non-commercial) on lands designated in the Forest Plan as having an

emphasis on cost-effective timber production with roads, with special consideration for white-tailed deer summer range.

RIPARIAN HABITATS/WETLAND COMPLEXES

Riparian habitats and wetland complexes are an important component of both deer and elk habitat. Riparian Habitat Conservation Areas restrict activities within a designated distance from streams, lakes, and wetlands (see Fisheries Section). The riparian guidelines in place for Alternative D would help protect important riparian habitats for deer and elk. However, it should be mentioned that riparian habitats, when considering deer and elk use, encompass more acreage than the wetland itself and probably extend beyond the guidelines established for aquatic riparian values. In other words, there would still be direct and indirect effects to riparian habitats or wetland complexes that are important for deer and elk in the Glacier Loon Area. Direct and indirect effects would include the loss of both thermal (summer cooling) cover and hiding cover adjacent to riparian habitats, and displacement from riparian habitats while activities are occurring in close proximity.

Important riparian habitat for deer and elk in the Glacier Project Area includes portions of Sections 26 and 36 (T20N R17W), portions of Section 6 (T19N R16W), and portions of Sections 11 and 12 (T19N R17W). Big game use, including deer, elk, moose, and black bear is heavy in these riparian areas, as evidenced by field visits and wildlife surveys. Under Alternative D, there would be 21 acres treated in Section 26 (Units 15-17), 149 acres treated in Section 36 (Units 19-31, 205), 19 acres treated in Section 6 (Units 41, 42, 206-210), and 131 acres treated in Sections 11 and 12 (Units 50-54, 213-217); a total of 320 acres of proposed commercial and non-commercial treatment adjacent to wetland habitats. In some of the units, notably the proposed regeneration harvests where lodgepole pine is the dominant species, a decrease in thermal cover would occur naturally, regardless of whether proposed fuels reduction or forest health treatments are implemented, due to on-going mountain pine beetle mortality in the stand. Hiding cover would decrease naturally in these stands as well, although to a lesser extent.

HIDING COVER

Currently, approximately 70 percent of the Glacier Loon Project Area provides hiding cover for wildlife species. As described above, in the effects analysis for Alternatives B and C, the proposed fuels reduction and forest health treatments would decrease the amount of hiding cover across the Glacier Loon Area. There would be little to no hiding cover left in stands proposed for Regeneration Treatments (Clearcut, Seed Tree, or Shelterwood) or Post and Pole. In stands proposed for Intermediate Treatment (Commercial Thin, Modified Commercial Thin, Improvement Cut, Sanitation/Salvage), some of the area would continue to provide hiding cover following treatment and some of the area would not. This is due to the wide variability in the proposed prescriptions. Taking the different prescriptions described in Alternative B into account, under Alternative D there would be a decrease in hiding cover across the Glacier Loon Project Area of approximately 888 acres. This assumes that half of the intermediate treatments would still provide hiding cover. The reduction in hiding cover under Alternative D would lower the percentage of hiding cover in the Glacier Loon Project Area from 70 percent to approximately 68 percent.

Hiding cover would take approximately 10 to 20 years to recover, depending on stand conditions. There would be some decrease in hiding cover naturally, notably in the proposed Regeneration Cuts with large amounts of lodgepole pine. This would be regardless of treatment implementation, due to on-going mountain pine beetle mortality.

Design Criteria for Alternative D stipulate that vegetative screening be retained along open roads in the project area and that Clearcut and Seed Tree Units retain cover such that no point in the unit is more than 600 feet from hiding cover. These Design Criteria were developed for grizzly bear, but would benefit deer and elk, and other big game species, and help to mitigate negative effects on hiding cover.

WHITE-TAILED DEER WINTER HABITAT

In Alternative D, there is one unit (Unit 33) that is located partially in an area designated as white-

tailed deer winter habitat. The proposed treatment would not decrease thermal cover in this unit because Unit 33 does not presently provide thermal cover for white-tailed deer due to the size of the trees in the stands (an older tree plantation). The proposed treatment, a Commercial Thin, would be designed to enlarge growing space for individual trees and improve the tree growth. As described in the Forest Plan, the prescription for this stand, since it is designated to be managed as white-tailed deer winter habitat, would be designed to achieve at least 50 percent thermal cover and would include diverse tree species but feature Douglas-fir.

FORAGE

The mature and immature stands where vegetative treatments are proposed offer foraging opportunities for deer and elk, although vegetative forage may be limited where the thickest canopy cover occurs. Although proposed vegetative treatments would initially decrease the amount of available forage due to ground disturbance, forage opportunities would increase again within 1 to 5 years as a greater amount of sunlight and moisture reach the forest floor. Forage habitat is not presently limiting in the Glacier Loon Area.

HABITAT SECURITY

There would be a potential for short-term displacement of deer and elk from the immediate area during the proposed activities. It is expected that deer and elk use patterns would change slightly as the animals avoid areas of high human activity. There are large blocks of unroaded land and wilderness adjacent to the proposed project that could provide secure habitat for deer and elk. In addition, Design Criteria in place for grizzly bear protection would benefit deer and elk, and other big game species.

Existing open roads and closed roads would be used. Use of open roads would not be a change from the existing condition. Vegetative screening would be maintained along open roads. This would help to provide habitat security for deer and elk, especially during hunting season. Use of gated or bermed roads for hauling logs would increase human-activity levels in areas normally more secure for deer and elk. Roads that are currently closed, but that would be used for proposed activities, would be closed to the general public during the time that they are used for timber management activities.

There would be no permanent road construction under Alternative D; however, approximately 5.8 miles of temporary road would be needed to access treatment areas. Temporary roads would be constructed to the minimum standards necessary for log hauling. There are no temporary roads located in white-tailed deer winter habitat.

Temporary roads would be reclaimed following use. The reclamation work would include the removal of any culverts, installing erosion control features, re-vegetation with native shrubs or seed mix, re-contouring, and the placement of woody debris on the reclaimed road. Despite the reclaiming of temporary roads, there is obvious evidence of ground disturbance and clearing of vegetation that remains after a temporary road is reclaimed. It is possible for these reclaimed areas to be an attractant to forest users.

ROAD DECOMMISSIONING

In Alternative D, 8.4 miles of road decommissioning is proposed. This would increase long-term habitat security for white-tailed deer, mule deer, and elk.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative D would include a MA change in the Forest Plan. In Alternatives D, 213 acres of MA 15 and 8 acres of MA 15C would be changed to an MA 5 designation. On MA 15 and MA 15C lands, cost-effective timber production with roads is emphasized. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would likely translate to less regeneration harvest and road building on the forested slopes along the western side of Lindbergh

Lake. This would be positive effect, as described above in Alternative C.

TABLE 3- 91. COMPARISON OF EFFECTS BY ALTERNATIVE.						
ALTERNATIVE	DECREASE IN HIDING COVER (ACRES)	ACRES OF TREATMENT IN WHITE- TAILED DEER SUMMER HABITAT (MA 15C)	ACRES OF TREATMENT IN WHITE- TAILED DEER WINTER HABITAT (MA 9)	MILES OF TEMPORARY ROAD CONSTRUCTED	MILES OF ROAD DECOMMISSIONED	ACRES TREATED ADJACENT TO WETLAND COMPLEXES
A	0	0	0	0	0	0
B	1,453	1,359	21	11.5	4.1	612
C	1,310	1,358	21	7.4	8.4	597
D	888	591	21	5.8	8.4	320

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Past land management activities in the area, including timber management, road construction, residential development, and agricultural conversion, have decreased and/or fragmented hiding cover, thermal cover, and forage. With increased human activity, have come decreased security levels for most wildlife species, including white-tailed deer, mule deer, and elk.

The Glacier Loon Project is located near the community of Condon, Montana. There is part-year and yearlong residences in the area, as well as other established human activities, including residential development, recreational trails, campgrounds, and a major highway. The level of human activity in the area increases the chance for disturbance or displacement of wildlife species. Other human activity in the area includes firewood cutting, hunting, various road use permits and easements, and road maintenance.

Timber harvest activities on PCTC lands and on NFS lands in the Glacier Loon Area peaked during the mid to late 1980s, although lower levels of timber harvest continue up to the present on all ownership lands. **TNC activities have occurred on lands within the project area. These activities reduced available forest cover in the project area. In some areas big game forest may be improved while the reduction of cover would decrease security. Visual screening remains along open roads and the TNC activities maintained existing closure of motorized routes in the project area maintaining the existing public motorized access. The Beaver Creek project is located to the south, outside of the Glacier Loon project area. Based on this project's layout and design is not expected to contribute adverse cumulative effects to the Glacier Loon project.**

Big game habitat is quite diverse and widespread in the Swan Valley and across the Flathead National Forest. It is conserved by the Forest Service through various forest management standards, including access management, riparian guidelines, and forest management practices. Standards and guidelines in place for the grizzly bear would benefit deer, elk, and other big game species. For example, it is recommended in the Montana Elk Management Plan (MFWP 2004), as well as Hillis et al. (1991), that at least 30 percent of an analysis area contain secure areas that are >250 acres in size and more than 0.5 miles from an open motorized route. The Forest Plan Amendment 19 standard for grizzly bear security core is stricter (e.g., security core >2,500 acres in size). The Glacier Loon Project Area spans the Glacier Loon and Buck Holland Grizzly Bear Subunits; security core in place for grizzly bear is 41 percent of the area in the Glacier Loon Subunit and 40 percent of the area in the Buck Holland Subunit. Security core for grizzly bear in the Glacier Loon Project Area would be beneficial for deer and elk.

The cumulative effect of past activities, the proposed fuels reduction and forest health project, and future activities, would not preclude deer or elk use of habitats in the area. There appears to be little risk of population loss, and species viability would be maintained. For additional information on the status of deer and elk on the Flathead National Forest, and the status at broader scales, reference

the Flathead National Forest Evaluation and Compliance with NFMA Requirements to Provide for Diversity of Animal Communities (Project File Section AA). See also the Flathead National Forest 2010 Monitoring and Evaluation Report located on the Flathead Forest Web page.

REGULATORY FRAMEWORK AND CONSISTENCY

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.”

Within summer and fall months elk favor habitat that includes moist sites associated with particular forest habitat types as well as meadows and riparian areas. Moist sites are defined by Lyon et al. (Lyon et al. 1985). The Flathead Forest Plan includes direction that elk summer habitat will be managed “in accordance with moist site and security area recommendations from Coordinating Elk and Timber Management, Final Report of the Cooperative Elk-Logging Study, 1970-1985” (Lyon et al. 1985). The Flathead Forest Plan states that “areas with moist sites will be managed during the elk use period with open road densities that average 1 mile or less per square mile.”

Lyon et al. (1985) recommends high priority road closures for elk habitat through “wet meadows and moist areas.” Moist areas defined by Lyon et al. (Lyon et al. 1985) are associated with elk summer range and include subalpine fire climax series, and are found in headwaters of drainages bordering streams, marshy meadows or occupy moist swales or benches. The project considered these conditions for moist sites: elk summer range, subalpine fir cover types (PF Exhibit I-1 pg. 106), and headwaters of streams, topographic defined basins or benches, adjacent to streams or marshes. Moist areas in the project area are located in the headwaters of Glacier Creek, Crazy Horse Creek and Herrick Run. These areas have road density of 1 mi/mi² or less in the project area and are consistent with forest plan direction. A project file exhibit in section AA displays a map of these moist areas and the road density associated with these moist sites.

Forest Plan direction for MA 9 directs to manage to achieve at least 50 percent of the area in winter thermal cover. Considering the MA 9 area in the Glacier Loon project including all MA 9 portions less than ½ mile separation, thermal cover exceeds 50%. The Glacier Loon project would not decrease thermal cover. Winter harvest activities may occur based on both project design criteria and timing regarding inactive/active SVGBCA guidelines. Design and layout of the project units will be shaped to provide optimum forage and distance to cover (less than 600 feet). These unit prescriptions will feature Douglas-fir.

The Forest Plan has identified white-tailed deer, elk, and mule deer as Commonly Hunted Big Game Management Indicator Species that use general forest habitat. Conditions favorable to these species would generally also benefit other big game species found within the project area, such as moose, black bear, and mountain lion, which are considered under the umbrella of MIS evaluation. Goals, objectives, and standards in the Forest Plan, specific to managing white-tailed deer, elk, and mule deer have been followed in the preparation and analysis of the Glacier Loon Project.

MIGRATORY BIRDS

INTRODUCTION

Neotropical migratory birds (NTMBs) are defined as those birds that regularly winter south of the Tropic of Cancer and summer in North America. 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.” The report, “Birds of Conservation Concern 2002,” identified the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priority. In the report, the United States is broken down into Bird Conservation Regions (BCRs), with bird species of conservation concern identified for each region. The Swan Valley is located in BCR 10. The bird species of conservation concern for the Glacier Loon Project Area are listed below in Table 3- 91.

TABLE 3- 92 NORTHERN ROCKIES "BIRDS OF CONSERVATION CONCERN" (USFWS 2008).		
BIRD NAME	GENERAL HABITAT SUMMARY	RELATIVE ABUNDANCE ON FLATHEAD NATIONAL FOREST
Bald Eagle	Nest in large conifers and deciduous trees; feed near lakes and rivers	Common
Black Rosy-finch	Nests in cliffs and talus above timberline; feed near snowfields	Occasional
Black Swift	Crevices or ledges on rocky cliffs; near waterfalls.	Rare
Brewer's Sparrow	Open, shrub-dominated habitats.	Uncommon
Calliope Hummingbird	Forest openings to moderate elevations in the mountains	Occasional
Cassin's Finch	Open conifer forests/early post-fire/mature lodgepole pine	Occasional
Ferruginous Hawk	Semi-arid plains and arid intermountain regions; tall trees along creek bottoms.	Rare
Flammulated Owl	Open ponderosa pine; mixed forest.	Rare
Lewis's Woodpecker	Open or park-like ponderosa pine; areas w/ scattered trees.	Occasional
Loggerhead Shrike	Open country with scattered shrubs or small trees.	Occasional
Long-billed Curlew	Moist to dry grasslands and meadows.	Uncommon
McCown's Longspur	Dry, short grass prairie.	N/A
Olive-sided Flycatcher	Logged or burned forests	Occasional
Peregrine Falcon	Open country with rocky cliffs and ledges near water.	Rare
Sage Thrasher	Sagebrush obligate in Montana	Uncommon
Sage Sparrow	Barren sagebrush deserts	N/A
Swainson's Hawk	Plains, prairies; open pine-oak woodlands; cultivated lands.	Rare
Upland Sandpiper	Open grasslands.	Rare
White-headed Woodpecker	Open Ponderosa pine forests	Rare
Williamson's Sapsucker	Pine forests; higher elevations.	Uncommon
Willow Flycatcher	Spruce-fir, Douglas fir, lodgepole pine, ponderosa pine and mixed deciduous-coniferous forest with quaking aspen	Uncommon
Yellow-billed Cuckoo	Woods and brush.	N/A

Error! Reference source not found. displays the NTMB species that use the Flathead National

Forest for their breeding habitat. Table 3- 92 includes information on global and state rankings, as well as habitat distribution information.

TABLE 3- 93 NEOTROPICAL MIGRATORY BIRDS THAT UTILIZE BREEDING HABITAT ON THE FLATHEAD NATIONAL FOREST (USA 2006).					
COMMON NAME (AND STATUS)	GLOBAL, STATE RANKS (MTNHP 2011) *	OLD GROWTH	SNAG/DOWN WOOD	RIPARIAN	GRASSLAND
American Kestrel	G5, S5B		X		X
American Redstart	G5, S5B			X	
American Robin	G5, S5B				X
Bank Swallow	G5, S5B			X	X
Barn Swallow	G5, S5B			X	X
Belted Kingfisher	G5, S5B			X	
Black Swift (SOC)	G4, S1B			X	
Black-chinned Hummingbird	G5, S4B				X
Black-headed Grosbeak	G5, S5B				
Bobolink (SOC)	G5, S3B				X
Brewer's Blackbird	G5, S5B			X	
Brewer's Sparrow (SOC) accidental	G5, S3B				X
Brown-headed Cowbird	G5, S5B			X	X
Calliope Hummingbird	G5, S5B				
Cassin's Vireo	G5, S4B				
Cedar Waxwing	G5, S5B			X	
Chipping Sparrow	G5, S5B				
Clay-colored Sparrow.	G5, S4B			X	X
Cliff Swallow	G5, S5B			X	X
Common Nighthawk	G5, S5B			X	X
Common Yellowthroat	G5, S5B			X	X
Cordilleran Flycatcher	G5, S4B			X	
Dusky Flycatcher	G5, S5B			X	
Eastern Kingbird	G5, S5B				X
Flammulated Owl (SOC, Sens, MIS)	G4, S3B	X	X		X
Grasshopper Sparrow (SOC)	G5, S3B				X
Gray Catbird	G5, S5B				X
Hammond's Flycatcher	G5, S4B	X			
Hermit Thrush	G5, S5B	X		X	
House Wren	G5, S5B		X		
Lazuli Bunting	G5, S4B				
Least Flycatcher	G5, S5B			X	
Lincoln's Sparrow	G5, S5B			X	
MacGillivray's Warbler	G5, S5B			X	
Merlin	G5, S4			X	X
Nashville Warbler	G5, S5B			X	
Northern Oriole	G5, S5B				
Northern Rough-winged Swallow	G5, S5B			X	X
Northern Waterthrush	G5, S5B		X	X	
Olive-sided Flycatcher	G4, S4B			X	X

TABLE 3- 93 NEOTROPICAL MIGRATORY BIRDS THAT UTILIZE BREEDING HABITAT ON THE FLATHEAD NATIONAL FOREST (USA 2006).

COMMON NAME (AND STATUS)	GLOBAL, STATE RANKS (MTNHP 2011) *	OLD GROWTH	SNAG/DOWN WOOD	RIPARIAN	GRASSLAND
Orange-crowned Warbler	G5, S5B			X	
Osprey	G5, S5B		X	X	
Peregrine Falcon (SOC, Sens, MIS)	G5, S3			X	X
Purple Martin	G5, SNA		X	X	X
Red-eyed Vireo	G5, S4B				
Red-naped Sapsucker	G5, S4B		X	X	
Red-winged Blackbird	G5, S5B			X	X
Rose-breasted Grosbeak	G5, SNA				
Ruby-crowned Kinglet	G5, S5B				
Rufous Hummingbird (PSOC)	G5, S4B				X
Savannah Sparrow	G5, S5B				X
Say's Phoebe	G5, S5B				X
Swainson's Hawk (PSOC)	G5, S4B				X
Swainson's Thrush	G5, S5B	X	X		
Tennessee Warbler (PSOC)	G5, S3B			X	X
Townsend's Warbler	G5, S5B	X		X	
Tree Swallow	G5, S5B		X	X	X
Turkey Vulture	G5, S4B				X
Vaux's Swift	G5, S4B	X	X		X
Veery (SOC)	G5, S3B			X	
Vesper Sparrow	G5, S5B				X
Violet-green Swallow	G5, S5B		X	X	X
Warbling Vireo	G5, S5B			X	
Western Kingbird	G5, S5B			X	X
Western Tanager	G5, S5B				
Western Wood-Pewee	G5, S5B			X	
White-throated Swift	G5, S5B			X	X
Williamson's Sapsucker	G5, S4B		X		
Willow Flycatcher	G5, S4B			X	
Wilson's Warbler	G5, S5B		X	X	
Yellow Warbler	G5, S5B			X	
Yellow-breasted Chat	G5, S5B			X	
Yellow-headed Blackbird	G5, S5B			X	X

*Sens = R1 Sensitive Species; MIS = Flathead National Forest Management Indicator Species; X = associated habitat component; SOC = Montana Species of Concern; PSOC = Montana Potential Species of Concern.

Montana Natural Heritage Program Ranks: G = species range-wide (global); S = statewide; 1 = 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; 2 = 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; 3 = Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas; 4 = Uncommon but not rare (although it may be rare in parts of its range), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern; 5 = Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range; B = State rank modifier indicating breeding for a migratory species; SNA = A conservation status rank is not applicable because either the taxa is of hybrid origin, is exotic, introduced, or accidental, it is not confidently present in the state.

Two habitats found in the Glacier Loon Area that are especially important to bird species (McClelland and Schmidt 1995), 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.

In addition, snags, broken-topped live trees, downed logs, and other woody material, are an important habitat characteristic because they are required by a wide variety of bird species for nesting, roosting, perching, feeding, and cover.

Although grassland habitats are a key habitat component for some bird species, grassland habitat is not common in the Glacier Loon Area and would not be affected by the proposed project.

ANALYSIS AREA

SPATIAL BOUNDS

The Glacier Loon Project Area was considered for the evaluation of direct, indirect, and cumulative effects on migratory bird species. This approximately 37,320-acre area is large enough to include the home ranges of several individuals or pairs of a species, and is representative of the effects of fire, natural tree mortality, timber harvest, and road management across the landscape. The actions proposed in the alternatives that could directly or indirectly affect migratory bird species are contained within this area.

TEMPORAL BOUNDS

The length of time for effects from the proposed fuels and forest health treatments is approximately 1 to 5 years. This is based on the probable contract length for the proposed project, and the timeframes for related activities.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

Data used included aerial photography, VMAP Data, field surveys of snags, old growth surveys, project area field visits, research literature, and GIS and dataset information.

MEASUREMENT INDICATORS

The effects analysis will focus on:

1. Effects to bird habitat, concentrating on riparian, old growth, and snag and down woody habitats, and
2. Potential effects to bird populations.

AFFECTED ENVIRONMENT

HISTORIC CONDITION

Forest ecosystems in the western United States have adapted in response to disturbances, such as wildfire, insects, disease, and windstorms. A wide diversity of habitats existed across the landscape, providing habitat for a diverse suite of NTMBs.

Historically, some habitats could have occurred in greater abundance on the landscape than now (e.g., old growth habitat). Population trends for different bird species have generally followed the distribution and amounts of the different preferred habitats. For example, the olive-sided flycatcher and Cassin's finch are associated with post-fire habitats and would have been abundant in areas where there was a large, stand replacing fire event. Species associated with open forests, such as the western tanager, Vaux's swift, chipping sparrow, yellow-rumped warbler and western wood pewee, would have been found more in areas that experienced frequent, low-intensity fires that re-initiated the understory but did not consume all of the large trees. Birds associated with dense forests, such as the sharp-shinned hawk, Cooper's hawk, or ruby-crowned kinglet, would have preferred older, closed canopy forest habitats.

EXISTING CONDITION

Generally, bird populations that breed in the western United States appear to be suffering from forest fragmentation in breeding habitat (Hejl et al. 1995). Timber harvest and excessive tree mortality could contribute to short-term fragmentation (Hejl et al. 2002; Rotenberry et al. 1995). Problems associated with forest fragmentation include overall habitat loss, an increase in edge habitat and edge effects, isolation effects, and increased vulnerability to predators (Finch 1991).

The Flathead National Forest has participated in two projects that included monitoring populations of migratory birds;

1. The Northern Region Landbird Monitoring Program, which looks at habitat relationships of landbirds that breed in the Northern Rocky Mountains, and
2. The Monitoring Avian Productivity and Survivorship (MAPS) Program, which was a cooperative effort with the Institute for Bird Populations (Point Reyes Station, California) with the objective of providing broad scale data on productivity and survivorship (USDA 2006).

Both of these programs were important to landscape and regional distributional and trend information. Table 3- 93 displays some of the population information obtained from these and other local monitoring/inventory projects.

COMMON NAME (AND STATUS)	SOC, TES	GLOBAL & STATE RANKS ^A	R1 LANDBIRD PROGRAM ON FNF 1994 TO 2004 ^B		MAX. ¼ W/OBS. WITH DIRECT EVIDENCE OF BREEDING, PAST 5 YEARS ^C	MAPS ON FNF ^D	FNF LANDS VIA FWP TRACKER BUT NOT LANDBIRD NOR MAPS ^E
			ABUND.	YEARS			
Black Swift	SOC	G4, S1B	0	--	1-5	Hilary Meadow and 6-mile Creek	1996 (several in Glacier NP)
Black-chinned Hummingbird		G5, S4B	2	1	25+	--	--
Bobolink	SOC	G5, S3B	0	--	1-5	(Not expected)	1991 (several in Flathead Valley)
Brewer's Sparrow	SOC	G5, S3B	0	--	1-5	--	--
Cassin's Vireo (Solitary Vireo in 1991)		G5, S4B	367	7	30+	--	Abundant and widespread

TABLE 3- 94. OBSERVATIONS ON FLATHEAD NATIONAL FOREST OF NEOTROPICAL MIGRATORY BIRDS LISTED THAT HAVE CONSERVATION CONCERNS.							
COMMON NAME (AND STATUS)	SOC, TES	GLOBAL & STATE RANKS ^A	R1 LANDBIRD PROGRAM ON FNF 1994 to 2004 ^B		MAX. ¼ W/OBS. WITH DIRECT EVIDENCE OF BREEDING, PAST 5 YEARS ^C	MAPS ON FNF ^D	FNF LANDS VIA FWP TRACKER BUT NOT LANDBIRD NOR MAPS ^E
			ABUND.	YEARS			
Clay-colored Sparrow.		G5, S4B	0	--	6-10	--	1991 (some SE of Flathead Lake)
Cordilleran Flycatcher		G5, S4B	8	3	1-5	--	--
Flammulated Owl	Sens, SOC	G4, S3B	0	--	1-5	(Not expected)	--
Grasshopper Sparrow	SOC	G5, S3B	2	1	1-5	--	(many SE of Flathead Lake)
Gray Catbird		G5, S5B	2	1	1-5	--	1989, 2001, 2005, 2007, 2008
Hammond's Flycatcher		G5, S4B	165	7	10+	--	1994, 1998, 2008
Lazuli Bunting		G5, S4B	34	5	1-7	--	1998, 2005
Merlin		G5, S4	0	--	1-10	--	1991, 1998
Olive-sided Flycatcher		G4, S4B	511	7	35+	--	1991, 1993, 1994, 1996 thru 2009
Peregrine Falcon	Sens, SOC	G5, S3	0	--	14-18	(Not expected)	2 eyries on FNF
Red-eyed Vireo		G5, S4B	29	5	5-8	--	1990 thru 95, 1999, 2000
Red-naped Sapsucker		G5, S4B	261	7	22-30	--	1999 (commonly seen & not reported)
Rufous Hummingbird	PSOC	G5, S4B	107	7	9-12	--	1990, 1993, 1994, 1999, 2001, 2005, 2008
Swainson's Hawk	PSOC	G5, S4B	0	--	1-5	(Not expected)	1985, 1997
Tennessee Warbler	PSOC	G5, S3B	0	--	4+	--	1994, 2010
Turkey Vulture		G5, S4B	4	3	4-6	(Not expected)	(commonly seen & not reported)
Vaux's Swift		G5, S4B	40	7	9-16	--	1991, 1993, 1994, 1998, 2000, 2008
Veery	SOC	G5, S3B	2	1	10-16	Hilary Meadow, Swan Oxbow2, and Simpson Creek	1995
Williamson's Sapsucker		G5, S4B	43	6	1-4	--	1989, 1994
Willow Flycatcher		G5, S4B	8	4	9-16	--	1990 thru 95, 1995, 2001, 2005, 2008

a = See PF H-14 for explanations of rankings and status. b = Avian Science Center's Northern Region Landbird Monitoring Program, University of Montana (http://avianscience.dbs.umt.edu/data_portal/data_portal.php). c = MDFWP & Montana NHP online "Field guide" as of 9/2010, maximum density in a quarter latilong area (<http://fieldguide.mt.gov/default.aspx>). d = Monitoring Avian Productivity and Survivorship (MAPS) Program as of 9/2010,

TABLE 3- 94. OBSERVATIONS ON FLATHEAD NATIONAL FOREST OF NEOTROPICAL MIGRATORY BIRDS LISTED THAT HAVE CONSERVATION CONCERNS.

COMMON NAME (AND STATUS)	SOC, TES	GLOBAL & STATE RANKS ^A	R1 LANDBIRD PROGRAM ON FNF 1994 to 2004 ^B		MAX. ¼ w/OBS. WITH DIRECT EVIDENCE OF BREEDING, PAST 5 YEARS ^C	MAPS ON FNF ^D	FNF LANDS VIA FWP TRACKER BUT NOT LANDBIRD NOR MAPS ^E
			ABUND.	YEARS			
(http://www.birdpop.org/nbii/nbiihome.asp). e = MDFW&P and Montana NHP online observation “Tracker” as of 9/2010, (http://mntnhp.org/Tracker/NHTMap.aspx).							

In 2010, Rocky Mountain Bird Observatory, in conjunction with its partners, conducted landbird monitoring in several BCRs, including BCR 10 (Northern Rockies). This project used a spatially balanced sampling design and a survey protocol implemented as part of a program titled "Integrated Monitoring in Bird Conservation Regions" (IMBCR). The IMBCR design allows inferences to avian species occurrence and population sizes from local to BCR scales (White et al. 2011).

The Upper Swan Valley provides a considerable diversity of habitats for NTMBs, including riparian areas, old growth habitat, and snag habitat. For more information on the existing condition of old growth habitats and snag habitat in the project area, refer to those separate wildlife sections. For more information about wildlife habitat conditions across the Flathead National Forest relevant to many Neotropical migrants, see the Final EIS for Forest Plan Amendment 21 (USDA 1998b).

ENVIRONMENTAL CONSEQUENCES

The Glacier Loon Project consists of a No Action Alternative and three action alternatives. A cumulative effect considers and describes proposed activities in addition to the past, current, and reasonably foreseeable activities. Cumulative effects are discussed throughout this section under the specific alternatives. For a detailed discussion of all known past, present, and foreseeable activities see the Cumulative Effects Worksheet for Migratory Birds (Project File Exhibit H-23).

ALTERNATIVE A - NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Under this alternative, there would be no fuels reduction or forest health treatments. There would be no direct effects to migratory birds.

A possible indirect effect of Alternative A would be an increased likelihood of a more intense wildfire event in the Glacier Loon Area. Indirectly, taking no action to reduce fuel buildups could increase the potential for a loss of riparian or old growth forest in the vicinity of the project area. The level of effects would depend on the size and intensity of the wildfire. An increase in wildfire potential would benefit bird species that are associated with open conditions or snag habitat. On the other hand, an increase in the potential for large, stand-replacement fires would be negative for bird species that are associated with mature forest or closed canopy conditions.

TNC activities have occurred on lands within the project area. These activities reduced available forest cover and canopy in the project area. This would benefit some species of migratory birds and be detrimental to habitat conditions of other species that prefer closed canopy forest conditions.

Numerous forest insects and diseases occur within the project area, and Upper Swan Valley, at endemic levels. They have been contributing to forest vegetative structure for some time. Historically, endemic levels of insects have occasionally turned into epidemic outbreaks in the Swan Valley. Mountain pine beetle outbreaks are known to have occurred in the Swan Valley throughout the 1980s and although mountain pine beetle populations are high at this time in the project area, species population dynamics suggest that it is likely that a similar increase has historically occurred at some time in the past. Alternative A - No Action would leave habitats across the project area to continue with natural vegetative processes. Where lodgepole pine is the dominant tree species, the trees would die and fall over, leaving a more open forest stand. This would be beneficial for some migratory

birds and not beneficial for others, just as the presence of bug-killed trees would be beneficial for some birds, and not for others.

Riparian areas and older forest stands with mixed-tree species would continue to provide important habitat for migratory birds, and there would be no direct reduction in the amount of down woody habitat or snags as a result of management activities. A wide variety of habitats would be available across the Upper Swan Valley to support multiple species of NTMBs.

Fragmentation of forested habitats on private lands in the area would probably continue. Many of these lands have been acquired by the Forest Service or sold under conservation easements, which would help to decrease further fragmentation in the area.

There would be no proposed road decommissioning with the No Action Alternative.

No significant cumulative effects to NTMBs are anticipated as a result of implementing Alternative A.

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

CANOPY COVER

In Alternatives B, C, and D, there are 773 acres, 685 acres, and 595 acres, respectively, of proposed regeneration treatment proposed. Under regeneration treatments (Clearcut/Seed Tree/Shelterwood) nearly all of the existing overstory trees would be removed. The direct effect could be beneficial to bird species that prefer non-forested habitats; it would be a negative effect for bird species that are associated with forested conditions, especially for birds that prefer older forests with closed canopies. It should be noted that in many of the regeneration units, under each alternative, the characteristics of closed canopy versus open canopy are being affected by mountain pine beetle, regardless of the proposed project. The regeneration harvest units would not provide significant canopy cover for approximately 80 to 100 years.

In Alternatives B, C, and D, there would also be 976 acres, 871 acres, and 450 acres, respectively, of Commercial Thin, Modified Commercial Thin, Sanitation/Salvage, and Improvement Cut Treatments, where overstory trees would be retained (50 to 200 TPA). Thinning the overstory, understory, or both, in forested stands, would have a negative effect on some bird species and a positive effect on other bird species. As an example, there would be immediate negative effects to the ruby-crowned kinglet, which prefers closed canopy conditions. Opening up the overstory, however, would produce positive effects for the yellow-rumped warbler and the western tanager.

In addition to the proposed regeneration and thinning Treatments, there is proposed Pre-Commercial Thinning and Post and Pole Treatment. Each of the alternatives has one 10-acre Post and Pole Unit. The stand is composed of very densely grown, small diameter lodgepole pine and provides limited habitat characteristics for NTMB species.

Under Alternatives B and C, there are 343 acres of Pre-Commercial Thinning proposed; Alternative D has 95 acres of proposed Pre-Commercial Thinning. These units are mostly sapling stands, which do not provide true overstory canopy cover. There would be no direct effect to canopy cover across the project area as result of the proposed Pre-Commercial Thinning Treatments.

OLD GROWTH HABITAT

Old growth habitats are known to contain some of the highest density and greatest diversity of bird species. There is no treatment proposed in old growth habitat under any of the action alternatives. There would be no direct effects on existing old growth habitat with implementation of the Glacier Loon Project. For discussion of possible indirect effects, (e.g., creation of high contrast edge, etc.) refer to the Old Growth Associated Wildlife Species Section.

RIPARIAN HABITAT

Potential effects to important riparian habitats would be greatly minimized through forest management

standards and Design Criteria associated with INFISH and RHCAs. Refer to the Fisheries Section of this EA for a detailed description of Design Criteria for stream buffers, etc. There would be no significant effects to potential NTMB habitat in existing riparian areas as a result of the proposed treatment.

SNAG/DOWN WOODY HABITAT

Reducing the amount of snags or down woody material could remove habitat features that are essential or very important to many bird species (Bull et al. 2005). Research suggests that retaining the bulk of the largest material may decrease these effects (Bull et al. 1999; Porter et al. 2005). Although a proportion of snags and downed wood would be retained under each of the action alternatives, there would still be a decrease in the amount of snags and down woody material from the existing condition. The negative effects to snag/down woody habitat and migratory birds associated with this habitat would be greatest with implementation of Alternative B and the least with Alternative D, due to the difference in overall acres treated. For more information on potential effects to snag/downed wood associated species, refer to the Snag and Down Woody Associated Wildlife Species Section.

HABITAT DISPLACEMENT/MORTALITY

It is possible under Alternatives B, C, or D, that project implementation would directly affect NTMBs through disturbance and/or occasional mortality associated with project activities. There is the potential that fuels reduction or proposed forest health activities could disrupt nesting activity and foraging activity, or that proposed activities would directly contribute to nest failure. Displacement of bird species would be short-term, up to 3 years (seasons) or less in the various parts of the Glacier Loon Project Area where work is occurring.

Existing open roads and closed roads would be used to conduct the proposed vegetative treatments. Use of open roads would not be a change from the existing condition. Vegetative screening would be maintained along open roads. This would help to provide habitat security for a variety of wildlife species, including birds. Roads that are currently closed, but that would be used for proposed activities, would be closed to the general public during the time that they are utilized for timber management activities. Use of these roads that are normally closed would increase the potential for displacement of migratory birds while harvest activities are occurring along the roads.

The potential for displacement or mortality would increase with the size and duration of the proposed activity; negative effects would be greatest with implementation of Alternative B and least with Alternative D, due to the difference in overall acres treated.

TEMPORARY ROAD CONSTRUCTION

Temporary road construction could remove site-specific bird habitat (e.g., trees, brush), or displace birds from the area during the actual construction or use of the temporary road. There would be greater potential for negative effects from temporary road construction in Alternative B (11.5 miles proposed) than in Alternative C (7.4 miles) or Alternative D (5.8 miles).

ROAD DECOMMISSIONING

In Alternative B, 4.1 miles of road decommissioning is proposed. In Alternatives C and D, 8.4 miles of road decommissioning is proposed. Road decommissioning would increase habitat security for migratory birds.

SLASH TREATMENT

Proposed slash treatment consists of a variety of methods, including the scattering of slash where fuel loads are lighter, chipping of woody material, piling slash and burning the piles, and broadcast burning following logging activity. There is a potential for any of the proposed slash treatment methods to disrupt nesting activity and foraging activity, or to directly contribute to nest failure through disturbance or displacement. Potential negative effects would be greatest with implementation of Alternative B and least with Alternative D, due to the difference in overall acres requiring slash

treatment.

EFFECTS OF MANAGEMENT AREA CHANGE

Implementation of Alternative C and Alternative D would include a permanent MA change in the Forest Plan. The change proposed is for the forested slopes along the western shore of Lindbergh Lake. There would be no change to existing MA designations under Alternative B.

Alternatives C and D propose that 213 acres of MA 15 and 8 acres of MA 15C be permanently changed to an MA 5 designation. On MA 15 and MA 15C lands cost-effective timber production with roads is emphasized. Additionally, on MA 15C lands, special consideration is to be given to white-tailed deer summer range. Management Area 5 lands consist of roaded timberlands in areas of high scenic value. One of the primary management objectives on MA 5 lands is to maintain a pleasing, natural-appearing landscape in which management activities are not evident.

The proposed MA change on 221 acres above Lindbergh Lake would likely translate to less regeneration harvest and road building on the forested slopes along the western side of Lindbergh Lake. The effects to NTMBs as a result of this proposed action would be insignificant across the project area or across the Swan Valley due to the size and nature of the potential effects. As vegetative changes occur in this area, whether naturally or through forest management activities that retain the natural-appearing landscape, habitat for a diverse population of migratory birds would be maintained, whether they are associated with openings, closed canopy, snag habitat, etc.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

There are part-year and yearlong residences in the area, as well as other established human activities. There has also been permanent conversion of lower elevation and valley lands from forested habitat to agricultural lands or other open conditions in the Glacier Loon Area.

Timber harvest activities on PCTC lands and on NFS lands in the Upper Swan Valley peaked during the mid to late 1980s, although timber harvest has continued up to the present on all ownership lands. There are other ongoing and planned timber harvest projects on NFS lands in the Upper Swan Valley, including the Meadow Smith, Summit Mountain Pine Beetle Salvage, and Hemlock Elk Projects.

The intermingled ownership pattern in the Swan Valley has made it difficult in the past to manage habitat connectivity with patch sizes that occurred historically. It is anticipated that, in the future, this condition would improve due to the Montana Legacy Project. Most of the PCTC sections in the Swan Valley have been conveyed to the Forest Service. This land conveyance has created larger blocks of public land that can be managed in larger patch sizes.

TNC activities have occurred on lands within the project area. These activities reduced available forest cover and canopy in the project area. This would benefit some species of migratory birds and be detrimental to habitat conditions of other species that prefer closed canopy forest conditions. Based on the extent of the TNC activities and the previous condition of Legacy Lands in the project area, this work likely had a small impact to closed forest bird species in the project area. Across the project area, a diversity of forest, riparian and open habitat conditions occur allowing habitat for numerous migratory birds occur within the project area. The Beaver Creek project would occur to the south, outside the Glacier Loon project area. The Beaver Creek project is not expected to contribute adverse effects to migratory birds.

While factors outside of the Forest Service's control (e.g., deforestation of tropical wintering grounds, drought, exotic species, parasitic species) could have negative effects on neotropical migrants, the actions taken under any of the alternatives proposed with the Glacier Loon Project are not expected to contribute significantly to negative effects on migratory birds because sufficient habitat for a broad suite of NTMBs would be maintained. Habitats shift over time with dynamics in age class, composition, and structure changing naturally. Bird populations in the Swan Valley have adapted to

this change with numbers of different species increasing or decreasing, depending on the availability of open forest, dense cover, old growth, snags, riparian habitats, or brush.

There are no proposed activities in old growth habitat, potential negative effects would be minimized through existing forest management standards associated with riparian habitat, and Design Criteria for snags and down woody material would help mitigate negative effects to NTMBs associated with snag or down woody habitat. If a variety of habitat conditions are maintained across the landscape, including old growth forest, riparian habitats, sufficient snags and downed wood, understory trees, and live trees, then adequate habitat could be maintained (Gaines et al. 2007).

For more information about wildlife habitat conditions across the Flathead National Forest, relevant to migratory birds, reference the Final EIS for Forest Plan Amendment 21 (USDA 1998b), and the Flathead National Forest Evaluation and Compliance With NFMA Requirements/Diversity document (Project File Section AA).

REGULATORY FRAMEWORK AND CONSISTENCY

The 1988 amendment to the Fish and Wildlife Conservation Act mandates 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.”

The Migratory Bird Treaty Act implements various treaties and conventions between the US, Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds, including nests and eggs, is unlawful. A list of NTMBs protected by the Migratory Bird Treaty Act is provided in 50 CFR 10.13.

In January 2001, an EO was signed outlining responsibilities of Federal agencies to protect migratory birds under the Migratory Bird Treaty Act (EO 13186). The report, “Birds of Conservation Concern 2002,” amended most recently in 2008, is the USFWS’ most recent effort to carry out this mandate and to meet their responsibilities under the 1988 amendment. The overall goal of this report is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priority. In the report, the United States is broken down into BCRs, with bird species of conservation concern identified for each region. The Flathead National Forest is located in BCR 10. It is recommended that the Bird Conservation Regional lists, with bird species of conservation concern, be consulted in accordance with EO 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds.”

As a complimentary measure to EO 13186, the Forest Service and the USFWS entered into a MOU in 2008. The purpose of this MOU is to strengthen migratory bird conservation through enhanced collaboration between the agencies, in coordination with state, tribal, and local governments.

Some migratory birds are covered by state hunting regulations; others are protected by non-game status with the MDFW&P. There are currently no Forest Plan Standards specific to migratory birds. The flammulated owl and the peregrine falcon (NTMBs) are also Forest Sensitive Species, and are discussed in the Biological Evaluation for the Project, as well as in the Sensitive Wildlife Species Section of this EA.

No substantial loss of migratory bird habitat is expected by implementing this project. The intent of the MBTA, the 2001 EO, and the MOU to conserve and protect NTMB, would be met under the action alternatives.

RECREATION, WILDERNESS, LANDS, AND RANGE

CHANGES FROM THE 2012 EA

^The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA. This section has been updated to reflect that the harvest activities that have occurred on Legacy Lands have been completed.

INTRODUCTION

The Glacier Loon Project Area stretches from the high alpine glacier and lake country of the southern Mission Mountains to the timbered lowlands along Lindbergh Lake and the Swan River in the Swan Valley. The project area's upper elevation lands within the Mission Mountains Wilderness are some of the most heavily visited portions of the Wilderness. While this high country is known for rugged hiking opportunities, the lower elevation portions of the project area offer excellent road access camping at the Lindbergh Lake Campground and in numerous dispersed recreation sites.

ANALYSIS AREA

SPATIAL BOUNDS

The analysis area for determining direct, indirect, and cumulative effects for recreation, wilderness, lands, and range resources are the lands within the Glacier Loon Project Area boundary. It is on these lands that all proposed activities would take place, and where effects to these resources, if any, would most likely occur.

TEMPORAL BOUNDS

The effects are limited to the operational period of the proposed action, including any post activity treatments.

AFFECTED ENVIRONMENT

RECREATION

Existing recreational activities and opportunities in the project area can be categorized into three groups, developed recreation sites, dispersed recreation use, and travel routes. Developed recreation sites are those facilities where the Forest Service has constructed amenities and encourages public use. Dispersed uses are those that are occurring on the landscape, often in locations where the Forest Service does nothing to encourage or discourage use and has installed few if any amenities. Travel routes are those roads and trails that facilitate access and recreation in the project area.

DEVELOPED SITES

There are two developed recreation sites in the project area, the Lindbergh Lake Campground and the Glacier Lake Trailhead. Both facilities see significant levels of public recreational visits during the summer months. While there are other trailheads within the project area, the Glacier Lake Trailhead is the only fully developed trailhead as it includes restroom facilities.

DISPERSED USE

The project area is used for a variety of dispersed recreation activities at various times during the year such as camping, driving for pleasure, wildlife watching, hiking access, picnicking, huckleberry picking, firewood gathering, hunting, fishing, snowmobiling, cross country skiing, or just the opportunity to be outdoors. Two small trailheads and a number of dispersed camping sites along the Swan River are the more heavily used dispersed recreation areas within the project area.

TRAVEL ROUTES

Trails - The following table lists the NFS trails within the project area and their current travel management.

TABLE 3- 95. TRAILS WITHIN THE GLACIER LOON PROJECT AREA.		
ACTION	DESCRIPTION	UNIT OF MEASURE
NFST #351 Crystal Lake	0.1	Wilderness non-motorized/non-mechanized
NFST # 690 Glacier Creek	4.6	Wilderness non-motorized/non-mechanized
NFST # 742 Glacier Lake Feeder	0.4	Wilderness non-motorized/non-mechanized
NFST # 708 Turquoise Lake	2.5	Wilderness non-motorized/non-mechanized
NFST # 481 Glacier Slough	1.5	non-motorized

The trails to Crystal Lake (#351), Glacier, Heart, Crescent, and Turquoise Lakes (#690, #742, and #708) are some of the most heavily used in the Mission Mountains Wilderness. High use levels on the trails and at the alpine lakes have resulted in closures to overnight camping at some campsites and within ¼ mile of Glacier Lake. The Glacier Slough Trail is a relatively lightly used non-wilderness trail in the project area that passes through harvested timberlands and makes its way to the Glacier Slough, a large pond system. Historically, a trail led from the Lindbergh Guard Station to the site of the Elbow Lookout. While this trail is still evident on the landscape it is no longer managed as part of the National Forest Trail System.

Roads - In general, driving for pleasure is one of the most popular recreation activities. Wheeled motorized access on forest roads also provides users access for hiking, firewood gathering, hunting, fishing, camping, huckleberry picking, ATV/motorcycle riding, wildlife viewing, stock use, and just appreciating their National Forests from a vehicle.

Within the project area, there are approximately 25.4 miles of road open yearlong to wheeled motorized use.

Winter Motorized Use - The Flathead National Forest Winter Motorized Recreation Plan ROD was signed November 17, 2006. This plan designates winter-motorized routes, play areas, and seasons for snowmobile recreation throughout the Flathead National Forest. Routes and areas designated for winter motorized use are depicted on the 2011 Over the Snow Motor Vehicle Use Map (Project File Exhibit O-4). Within the project area, a total of 21,801 acres are open to winter motorized use, when conditions permit, December 1 to March 31 on NFS lands, as designated on the 2011 Over the Snow Motor Vehicle Use Map. Routes and areas where snowmobiling are not allowed include the Glacier Slough Area and areas near Lindbergh Lake, as well as the Mission Mountains Wilderness. A total of 3,204 acres outside of the Wilderness in the project area are closed to over-the-snow motorized use.

WILDERNESS

The Glacier Loon Project Area includes lands in the Mission Mountains Wilderness, though no treatments or actions are planned within the Wilderness.

RANGE

Portions of two range allotments are within the project area. A total of 87 acres of the Barber Creek Allotment and 1,145 acres of the Holland Creek Allotment are within the project area. Both allotments are actively stocked, however cattle have not grazed on the portions of the allotments within the project area in a number of years.

LANDS

Land ownership patterns in the Glacier Loon Project Area have changed significantly over the last 15 years. What was once a landscape characterized by a checkerboard ownership pattern with the majority landowners being the Forest Service and PCTC, is now largely in Forest Service ownership. Since 1998, the Forest Service has acquired 6,191 acres in the project area. Acreage of other privately held lands has generally remained constant over this period. Table 3- 95 below details the acquisition of lands by the Forest Service in the project area.

TABLE 3- 96. FEDERAL LAND ACQUISITION WITHIN THE GLACIER LOON PROJECT AREA.			
PARCEL	ACREAGE IN PROJECT AREA	YEAR ACQUIRED	ACQUISITION METHOD
Sec. 27, T19N, R17W	597	1998	Land & Water Conservation Fund
Sec. 35, T19N, R17W	78	1998	Land & Water Conservation Fund
Sec. 11, T19N, R17W	160	2000	Land & Water Conservation Fund
Sec. 22, T19N, R17W	624	2000	Land & Water Conservation Fund
Sec. 17, T19N, R16 W	45	2004	Land & Water Conservation Fund
Sec. 1, T19N, R17W	225	2006	Land & Water Conservation Fund
Sec. 11, T19N, R17W	481	2010	Montana Legacy Project
Sec. 15, T19N, R17W	500	2010	Montana Legacy Project
Sec. 27, T20N, R17W	398	2010	Montana Legacy Project
Sec. 33, T19N, R17W	639	2010	Montana Legacy Project
Sec. 35, T20N, R17W	639	2010	Montana Legacy Project
Sec. 3, T19N, R17W	639	2010	Montana Legacy Project
Sec. 23, T20N, R17W	641	2010	Montana Legacy Project
Sec. 33, T20N, R17W	9	2010	Montana Legacy Project
Sec. 1, T19N, R17W	418	2010	Montana Legacy Project
Sec. 5, T19N, R16W	97	2010	Montana Legacy Project
Sec. 13, T20N, R17W	640	2013	Land & Water Conservation Fund
Total	Approximately 6,830		

ENVIRONMENTAL CONSEQUENCES

The Glacier Loon Project consists of three action alternatives and a No Action Alternative. The alternatives are described in detail in Chapter 2 of this EA. The Cumulative Effects Worksheet, located in the Recreation, Wilderness, and Range Project File (Project File Exhibit O-2) consider and describe proposed activities in addition to the past, current, and reasonably foreseeable activities listed at the beginning of this chapter. Please refer to these worksheets for more detailed discussion on cumulative effects.

ALTERNATIVE A – NO ACTION DIRECT AND INDIRECT EFFECTS

Under this alternative, no new management actions would occur. The project area would continue to

be used for year round motorized and non-motorized recreation, such as driving for pleasure, huckleberry picking, camping, hiking, and just enjoying the natural environment. In general, recreation would continue as it is now under current management direction. The developed and dispersed recreation pursuits would be unaffected if Alternative A were implemented. There would be no changes to the existing access management to trailheads, wheeled motorized use, and snowmobile seasons. Fuels reduction, forest health treatments, and associated activities would not take place thereby resulting in no effect to recreationists in the short term.

Alternative A would not affect the wilderness values in the Mission Mountains Wilderness.

No Range Allotments would be affected by Alternative A, existing range resources would remain available.

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

None of the action alternatives would significantly affect recreation opportunities in the Glacier Loon Project Area. The general nature of effects to recreational opportunities can be characterized as short-term disturbance that is limited in scope. Logging or burning operations may displace recreationists, be they hunters, hikers, or recreational road users, during operational periods. This is particularly true at the Lindbergh Lake Campground during harvest of units adjacent to the facility.

The temporary roads proposed in the action alternatives would not be available for public motorized use and would be obliterated at the end of the project. The proposed road decommissioning would affect some road miles that are currently available for non-motorized use. While a variety of techniques can be used for road decommissioning, it is likely that portions of the road templates would still be available for foot traffic.

The existing roads providing access to private land and to the general forest area would not change. Firewood and other forest products gathering opportunities would remain the same in all action alternatives. The indirect effects of increased traffic from timber management operations, including road maintenance such as BMP work on roads due to the proposed activities would be short-term.

There would be no changes to the existing access management to trailheads, wheeled motorized use, and snowmobile seasons.

Although short in duration and intensity, recreationists in the nearby Mission Mountains and Bob Marshall Wilderness Areas could be directly affected by having their visibility and air quality impaired by smoke produced by burning of slash in treatment units.

Approximately 187 acres of treatments are proposed within the Holland and Barber Range Allotments in the action alternatives. All action alternatives propose approximately 23 acres of commercial thinning in the Barber Allotment. In the action alternatives, approximately 164 acres would be treated with commercial thinning, pre-commercial thinning or improvement cuts. Alternative D, however, drops Unit 43 and its approximately 15 acres of commercial thinning. These actions would have a long-term beneficial effect on range resources, allowing for improved forage conditions. Grazing operations may be directly impacted by disturbance during harvest operations. The disturbance would be short-lived and as these are small portions of the much larger allotments the effects are considered minimal.

The action alternatives propose no harvest treatments on lands acquired as part of the Montana Legacy Project, however treatments are proposed on lands acquired with the LWCF. Montana Legacy lands are deed restricted through December 31, 2018, by the prior owner, TNC. The deed restrictions retain ownership of all merchantable timber on the parcels. **However, TNC has informed the Forest Service in 2016 that the fiber agreement between them and Plum Creek Timber Company has been terminated and that TNC has no plans for future timber harvest on Legacy Lands (Project File Section AA).** The LWCF acquired lands are not deed restricted in this manner and approximately 450 acres are proposed for treatment by Alternative B, 386 acres by Alternative C, and 338 acres by Alternative D. None of the proposed treatments are contrary to the purposes for which the land was

acquired.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Cumulative effects could result from the local and visiting populations that are increasing in the project area. Their desire for recreation activities, such as camping, hunting, fishing, huckleberry picking, firewood gathering, hiking, and biking is also increasing. The collective effect of these activities can result in overlapping the recreationists onto the same area, trails, and roads. The cumulative results are increased maintenance and repairs on facilities, roads, and trails, providing for health and safety issues, and overall people management.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change to the MA for a portion of the Glacier Loon Project Area along Lindbergh Lake, including the highly visible portions of the project area from the lakeshore to the slope break totaling approximately 221 acres. The proposal would change 213 acres of this area from MA 15, which consists of timberlands where timber management with roads is economical and feasible as currently assigned, to MA 5, which consists of roaded timberlands in areas of high scenic value. The other 8 acres would be changed from MA 15C, timberlands with emphasis on white-tailed deer summer range, to MA 5).

This change would have no effect on recreation, lands, or range resources. These MAs are outside any Range Allotment, so the change would have no direct, indirect or cumulative effects on range resources. The recreation opportunities available in these MAs would be unaffected by this change, resulting in no direct, indirect or cumulative effects. The change could be seen to have a minimal indirect beneficial effect on wilderness by potentially reducing the volume of harvest near the wilderness boundary. Again, this effect would be very minimal.

REGULATORY FRAMEWORK AND CONSISTENCY

This analysis tiers to the Forest Plan, Forest Plan EIS, and ROD, as amended. Chapter 2 of the Forest Plan establishes forest-wide recreation, wilderness, and range goals and standards. This project is consistent with Forest Plan direction for management of recreation, wilderness, lands and range resources.

SCENERY RESOURCE

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA.

INTRODUCTION

The Glacier Loon Project will meet Forest Plan Visual Quality Objectives (VQOs) with Design Criteria implemented. A few of the proposed vegetation treatment units would create visual contrast in several highly visually sensitive areas but these treatments are consistent with the Flathead National Forest Plan (Forest Plan). With Design Criteria applied, visual impacts would be reduced. Alternative C would incur the least amount of visual impacts while Alternative B would incur the most relative to the intensity of the treatment and to the amount of acreage seen within sensitive viewsheds. Treatment units located within the Lindbergh Lake shoreline residences viewshed were dropped for visual impacts in developing Alternative C. Units 83, 84, 85, 86, 87, 88, and 89 of Alternative B would potential create the highest visual impacts.

ANALYSIS AREA

SPATIAL BOUNDS

The total project area encompasses approximately 37,320 acres. Views into the project area from sensitive areas and non-Forest lands (i.e., private lands) were documented. Sensitive travel ways and use areas for this analysis are described in Table 3- 96. The viewed units within the “seen” area as determined from the sensitive areas made up the spatial boundary for assessing direct and indirect effects. All of the viewed lands within the “seen” area made up the spatial boundaries for assessing cumulative effects.

TEMPORAL BOUNDS

The temporal boundary used to describe effects varied from “immediate upon project completion” up to 5 years (short term). Effects visible for more than 5 years after completion of management activities are defined as long term. The criteria below were used to determine whether the “duration of impact” was met for each VQO upon implementation of a management activity.

- Retention VQO - “Immediate reduction in form, line and color, texture contrast... ...during operations or immediately after... ” (USDA 1974).
- Partial Retention VQO - “As soon after project completion as possible or at a minimum within the first year” (USDA 1974).
- Modification VQO - “Reduction in the form, line, color, and texture should be accomplished in the first year or at a minimum should meet existing regional guideline” (USDA 1974).
- Maximum Modification VQO - “Reduction of contrast should be accomplished in five years.” (USDA 1974).

Cumulative effects were analyzed for a 25-year period, which is the approximate time vegetation regrowth would need to occur before impacts would appear negligible within the characteristic landscape.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

The Scenery Resources Inventory consisted of a detailed evaluation of the Glacier Loon Project Area. The project inventory and analysis is consistent with the principles of the Scenery Management System (SMS) (USDA 1995d) and the Visual Management System (VMS)(USDA 1974), National Forest Landscape Management, Volume 2, Chapter 1, and the Agriculture Handbooks. Terminology used in this analysis follows the current SMS. However, because the Forest Plan has not been updated to follow this system, the Visual Quality Objectives are described using the previous VMS System. The project inventory was conducted in the spring, summer, and fall of 2011. The Forest-wide SMS inventory data was updated in 2006 and this data was also used in this analysis. The purpose of the scenery resources inventory is to identify and document landscape scenery and views of the project area. Project effects on Scenery Resources were assessed by determining the potential for change to the landscape character relative to Forest Plan direction. Key components of the assessment included evaluating existing and desired landscape character, existing scenic integrity, scenic attractiveness, scenic class, visibility, visual absorption capacity, and visual quality objectives. Measurable visual elements like dominance, degree of deviation, and intactness define the level of scenic integrity. Concern levels and distance zones relative to viewsheds define visibility. Three-D modeling from viewpoints helped in identifying potential changes.

The primary criterion for determining the project's effect is in evaluation of scenic integrity levels or meeting the VQOs. To determine the project's effects, the potential change in landscape character was measured against the VQOs. Failure to achieve the VQO specified in the Forest Plan would result in an "adverse" effect.

Achievement of or meeting the specified VQO would result in "no effect" finding, and meeting a VQO higher than specified would be a "beneficial" effect. Additional terms used to describe intensity of impacts include:

- Negligible: A majority of all visitors would not notice any effects or changes to the landscape. Design Criteria would not be necessary.
- Minor: The desired character of the landscape would be changed, but is not evident. Long-term deviations repeat form, line, and color and the effects on the valued landscape remain the same or "appear" intact; or effects would be short-term. If Design Criteria were necessary to offset adverse effects on Scenery Resources, it would be relatively simple and effective.
- Moderate: Effects would slightly alter the landscape character. Long-term deviations would be subordinate to the landscape character. Short-term effects could have a greater deviation but would recover to express intactness and natural appearance. Design Criteria would reduce long-term impacts.
- Major: Effects would dominate the landscape character. There would be substantial consequences to Scenic Resources. Effects would be very obvious, widespread, and long-term. Intactness of the landscape would be greatly altered. Design Criteria may help reduce impact but impacts would remain evident or even dominant.

MEASUREMENT INDICATORS

Measurement indicators for the Scenery Resource will evaluate the effect of project implementation on scenic integrity (visual quality). Scenic Resource indicators to be evaluated are:

1. Change in landscape character.
2. Whether Visual Quality Objectives (VQOs) are met or not.

AFFECTED ENVIRONMENT

EXISTING LANDSCAPE CHARACTER

The existing landscape character or place setting describes the project area within the context of the larger landscape scene. It provides a framework for predicting the degree of scenery modification and creating Design Criteria to reduce or limit that modification.

The project area is located within the Mission Mountains and Swan Valley, which are an area of outstanding scenic beauty described as rugged, snowcapped peaks, several small glaciers, alpine lakes, meadows, and clear cold streams. The upland topography is generally rough and broken. Slopes in the basins are gentle, but are steep toward the ridge-top. Vertical cliffs, flat, slab-like boulders, and talus slopes are abundant. The rock is of metamorphic origin and the soils are thin and gravelly. Several crystal clear lake and lush wetland areas are scattered throughout the project area creating thick pockets of vegetation and picturesque landscape.

Mountain top trees in the Mission Mountains are slow-growing; many are stunted and deformed. Trees are much thicker on the valley and lower mountain slopes. Common trees and shrubs are western larch, western red cedar, Engelmann spruce, Douglas fir, western white pine, lodgepole pine, whitebark pine, alpine fir, grand fir, quaking aspen, Rocky Mountain maple, and alder. The outstanding multi-colored displays of wildflowers in the alpine meadows and high basins are evident in late summer.

Contrasting past harvest units on nearby and distant hillsides can be seen as evidence of timber harvest activity in the Swan Valley.

LANDSCAPE VISIBILITY

This section addresses the relative importance and sensitivity of what is seen and perceived in the landscape. Landscape visibility consists of three elements: 1) distance zones, 2) concern levels, and 3) travel ways and use areas. As part of this inventory, travel ways, and use areas in the proximity to proposed treatment areas were identified and their concern levels documented. Distance zones were also identified in relation to the project area. The process for identifying distance zones and concern levels is described below.

Distance zones are an important part of scenery analysis because as the distance increases the level of visible detail decreases. Also, as distance increases so does the opportunity to minimize the impacts. Visibility is also affected because of topography, steep terrain, ridges, and road cuts that can affect sightlines. Topography and vegetation are factors used during project level planning and design.

Distance zones are measured from the viewpoint and are divided into five (5) categories:

1. Immediate Foreground, 0 to 300 feet,
2. Foreground, 300 feet to ½ mile,
3. Middle ground, ½ to 4 miles,
4. Background, 4 miles to horizon,
5. Seldom seen, areas not normally visible from the ground due to topography and lack of access.

Concern (or Sensitivity) levels are a measure of the degree of importance the public places on a

landscape being viewed from a particular travel way or use area. Three (3) sensitivity levels are used. Level 1 is the most important and Level 3 the least important. Sensitivity level is a function of both the number of visitors as well as their intent.

Level 1 is associated with major highways, areas of concentration, such as recreation facilities; special designations, such as scenic byways or national recreation/historic trails and cultural sites. Users have a high level of concern for scenery.

Level 2 areas are areas of lesser importance such as state highways, county roads, secondary trails, scenic overlooks, summer home tracts etc.

Level 3 areas are low use areas and low volume roads, trails waterways or recreation facilities.

Visibility levels were identified through existing data compiled during the Forest-wide SMS Inventory 2006 and verified by field observation in 2011. The project area has several areas of high concern (Level 1) because of high visibility. These areas include foreground and middle ground views of residences along the north and east shoreline of Lindbergh Lake. Also, the immediate foreground of Highway 83 (Swan Highway) is of high concern as a major highway. Recreational users on the lake, at the campground, and other scattered residences located within the project area, would also have high concern. Other secondary roads and forest lands would have lower concern levels depending on their level of use. Screening by vegetation and topography conceals many parts of the project area, which reduces the concern level for those forest lands (Project File Exhibit Q-1).

Travel Ways and Use Areas: Use Areas are locations that receive concentrated public viewing use. They include vista points, trailheads, campgrounds, recreation residences, parks, ski resorts, and other recreation sites. Use areas can also include urban areas, towns, suburbs, or other public lands and gathering places. Travel ways represent linear concentrations of public viewing, including freeways, highways, roads, railroads, trails, commercial flight paths, rivers, canals, and other waterways.

Table 3- 96 identifies use areas and travel ways not completely screened from the proposed treatment areas by vegetation or topography. The Distance Zone and Concern Level were identified from the 2006 SMS Forest-wide Inventory as well as from field observation.

TABLE 3- 97. SUMMARY OF TRAVEL WAYS AND USE AREAS.			
NAME	DESCRIPTION	DISTANCE ZONE	CONCERN LEVEL
Swan Highway (Hwy 83)	Open views adjacent to the road	Immediate Foreground	High
Lindbergh Lake Campground	Open within the campground	Foreground & Middle ground	High
Lindbergh Lake	Open	Foreground & Middle ground	High
Lindbergh Lake Residences	Open to Partially Screened	Foreground & Middle ground	High
Other Residences	Partially Screened	Foreground	High
Elbow Overlook	Open to Partially Screened	Middle ground & Background	Moderate
Glacier Slough Trail (#481)	Partially Screened	Immediate Foreground	High
Lindbergh Lake Road - Forest Road #79	Open along road, screened otherwise	Immediate Foreground	High
Kraft Creek Road - Forest Road #561	Open along road, screened otherwise	Immediate Foreground	High
Barber Creek Road - County Road #905	Open along road, screened otherwise	Immediate Foreground	High
Elk Creek Road - Forest Road #9591	Open along road, screened otherwise	Immediate Foreground	Moderate
Forest Roads #9679, #9500, #9578, #9575, #10567, #9572, #9552	Open along road, screened otherwise	Immediate Foreground	Low

VIEWSHEDS AND VIEWPOINTS

Viewsheds are visible portions of the landscape seen from viewpoints. Three levels of screening were considered for viewsheds based on intervening terrain, vegetation, and or structures. Open views exhibit minimal to no screening; partially screened views include areas where viewing opportunities are intermittent; screened views include areas where terrain, vegetation, or buildings obscure views. The level of screening within the project area varies greatly.

Figure 3- 13 Viewpoint and Visibility Map (next page) identified areas screened by topography using a GIS 10 meter Digital Elevation Models. The map areas shown in light red are completely screened (i.e., a standing individual in these areas would not have a view of the proposed treatment area from this location). However, areas not screened by topography may be partially screened by vegetation, structures, or by topography not within the limits of the 10 meter elevation accuracy. The Visibility Map helps identify large portions of land area that can be eliminated as potential viewing areas and focuses the inventory on travel ways and use areas with potential views of the proposed treatments.

Views from the Swan Highway (MT Hwy 83) and connected secondary roads are mostly screened by trees adjacent to the road. However some of the proposed treatments are directly adjacent to the Swan Highway and views are generally open from Lindberg Lake and lakeside residences into some of the proposed treatments areas, which are in the middle ground and foreground. Other primary and secondary roads within the analysis areas are primarily screened by vegetation unless a treatment is proposed directly adjacent to the road. Views from high on the mountains slopes such as Elbow Overlook also offer open views but are primarily visible in the distant middle ground and background views. Views looking out the campground, with the exception of the treatments within the camping areas, are screened by vegetation. Views from the lake and shoreline are open along the steeper slopes that rise from the lake but are concealed beyond by topography and vegetation. Numerous viewpoints were identified including residences, recreational facilities, and travel ways. A selection of these typical viewpoints were documented and included as part of this inventory. The following viewpoints were selected because they best represent critical views from use areas and travel ways with views towards the proposed treatments (See Visibility and Viewpoint Location Map (Figure 3- 13 and Viewpoint Figure 3- 14 through Figure 3- 21).

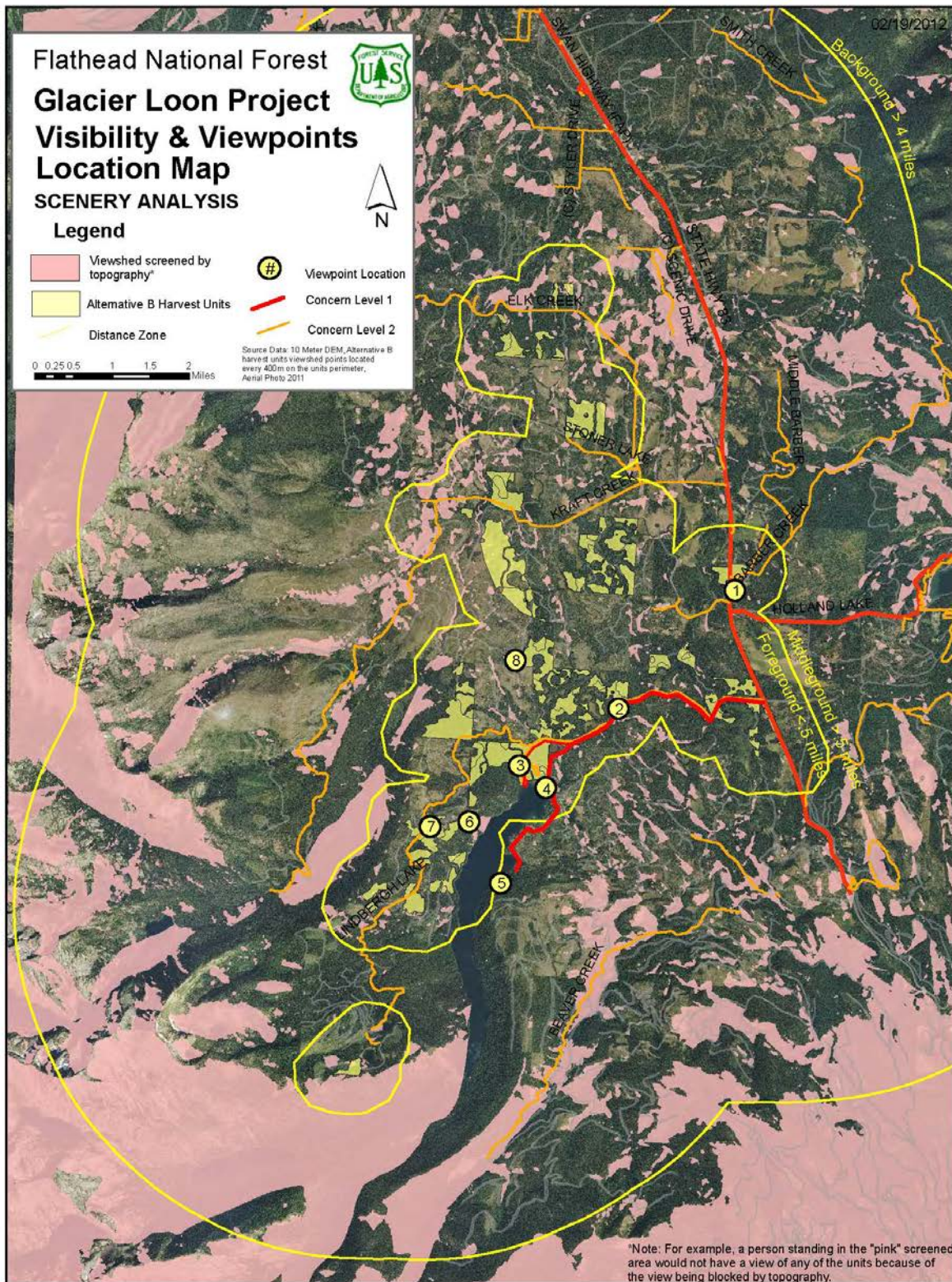


Figure 3- 13 Visibility and Viewshed Location Map



Figure 3- 14 - Viewpoint 1—U.S. Highway 83/Barber Creek Road. View east into analysis area from highway.



Figure 3- 15 - Viewpoint 2—Lindbergh Lake Road – NFS Road 79 North. View looking north in foreground.



Figure 3- 16 - Viewpoint 3—Lindbergh Campground. Immediate foreground view looking west from highway and residence



Figure 3- 17 - Viewpoint 4—Lindbergh Lake Residence North. View south from the middle ground of residence located on north shore.



Figure 3- 18 - Viewpoint 5—Lindbergh Lake Residence South. Foreground/middle ground view looking southwest from east shoreline residence dock.



Figure 3- 19 - Viewpoint 6 – Elbow Overlook. Middle ground/background view looking northeast.



Figure 3- 20 – Viewpoint 7 – Lindbergh Lake Road- 79 South. Immediate foreground view from roadside



Figure 3- 21 – Viewpoint 8 – Pulaski Road – NFS Road 5978. Immediate foreground view within the analysis area

EXISTING SCENIC INTEGRITY

Existing Scenic Integrity is determined on the basis of visual changes that detract from the scenic quality of the area. The existing scenic integrity was determined through ground surveys of the project area and adjacent lands. Viewed from the use areas and travel ways documented earlier, the project area has moderate to high scenic integrity relative to the respective settings. The project area is largely intact, appears natural, and has a high existing scenic integrity. Exceptions are areas where the edge of vegetation changes along the forest boundary. Additionally, visible cut and fill areas along the roads in the project area decrease the intactness and appear unnatural on the landscape. Areas of disturbance in localized areas because of past vegetation harvests, utilities, roads and housing have low intactness. However, on a landscape scale the project analysis area has moderate to high scenic integrity.

VISUAL QUALITY OBJECTIVES

Visual Quality Objectives (VQOs) establish the overall importance of Scenic Resources and sets an objective for the Flathead National Forest lands (Figure 3- 22). Within the Forest Plan, VQOs are identified geographically by MA and in narrative. The VQOs in the project area that have treatments proposed include the following:

Retention: Management activities are not visual evident. Activities may only repeat form, line, color, and texture which is frequently found in the characteristic landscape, Change in their qualities, pattern, etc., should not be evident.

Partial Retention: Management activities remain visually subordinate to the characteristic landscape when managed according to the partial retention visual quality objective. Activities may repeat form, line, color, or texture common to the characteristic landscape but not change in the qualities of size, amount, intensity, direction, pattern, etc. Activities remain subordinate to the visual strength of the characteristic landscape (USDA 1977).

Modification: Management activities may dominate the original characteristic landscape. However, activities of vegetation and landform alteration must borrow from the naturally established for, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding character type.

Additional parts of these activities such as structure, road, slash, root wads, etc., must remain visually subordinate to the proposed composition.

Maximum Modification: Vegetation and landform alterations may dominate the characteristics landscape. However, when viewed as background, the visual characteristics must be those of natural occurrence within the surrounding area or character type. When viewed as foreground or middle ground, they may not appear to completely borrow from the natural established for, line, color, or texture. Alterations may also be out of scale, or contain detail which is incongruent with the natural occurrences as seen in foreground and middle ground. Introduction of additional parts of these activities such as structures, roads, slash, root wads must remain visually subordinate to the proposed composition as viewed in background.

Within the project area, a portion of land on the west side of Lindbergh Lake is proposed to have the VQO changed from modification/maximum modification VQO to Retention VQO for Alternative C and D and is detailed further in the Environmental Consequences Section (Figure 3- 22). This track of land, located on the mountain slopes of Lindbergh Lake is identified as having Concern Level 1, and is within foreground and middle ground views with high concern.

VISUAL ABSORPTION CAPACITY

Visual Absorption Capacity (VAC) refers to the ability of forest lands to withstand various types of use without the loss of their natural character. Visual Absorption Capacity assessments provide the basis for predicting future scenic conditions that would result from project proposals. Slope, vegetation screening and vegetation diversity are primary factors incorporated into VAC determinations. The project area has a wide range of varying degrees of VAC. Generally areas of reduced VAC occur on steep slopes, areas with contrasting soil, and monoculture tree species dominance. Higher VAC occurs in flatter terrain and the ability for vegetation and topography screening from areas with high concern. The slopes of Lindbergh Lake and mountain slopes have low VAC and generally the majority of the project areas on flatter portions in the northern areas have high VAC because of vegetation screening.

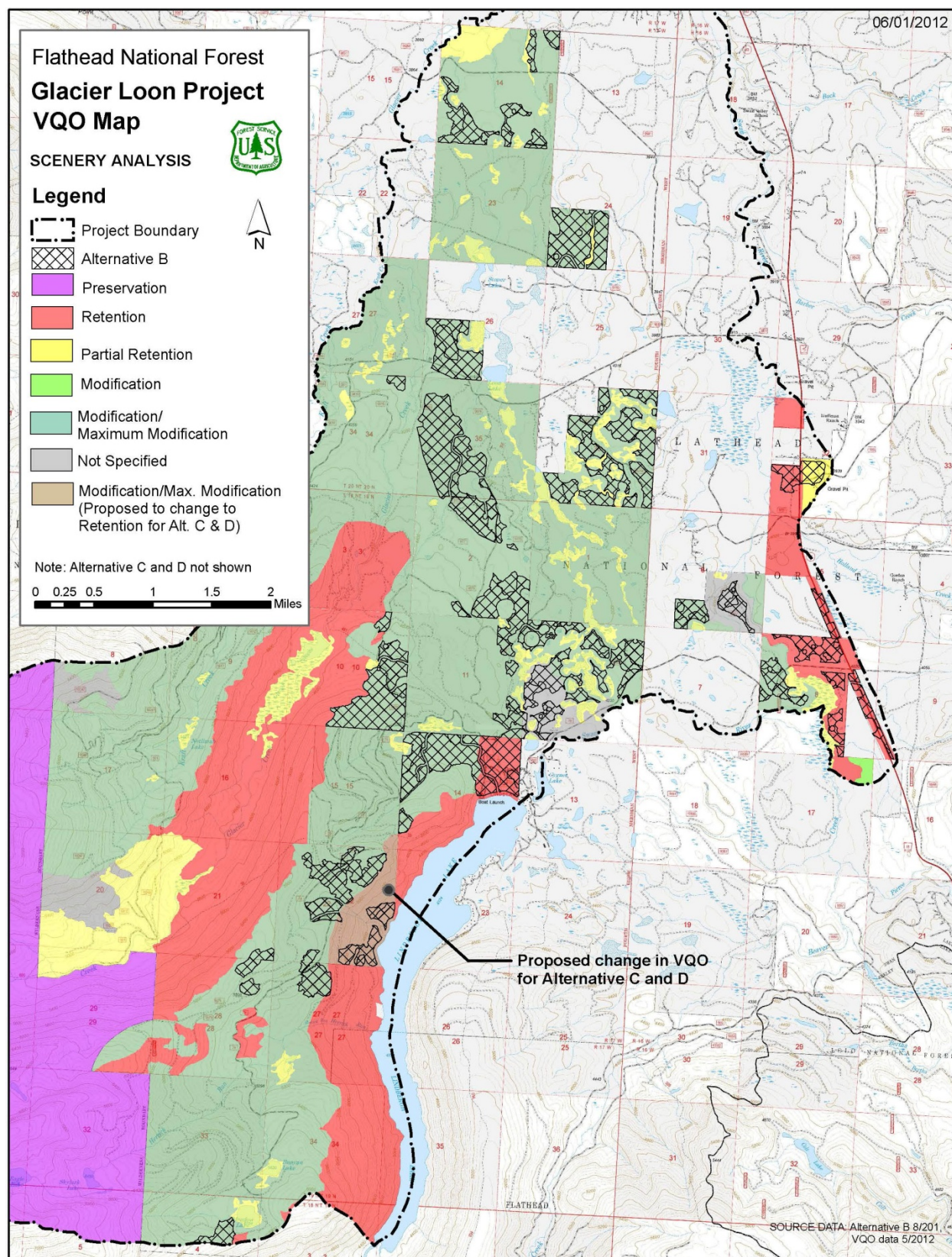


Figure 3- 22 Visual Quality Objective Map

ENVIRONMENTAL CONSEQUENCES

The Scenery Resource was analyzed for Alternative A - No Action, Alternative B - Proposed Action, and for Alternatives C and D. Analysis for assessing potential change resulting from the alternative impacts to Scenery Resources were measured through assessment of representational viewpoints at various unscreened locations towards proposed treatment areas. Table 3- 97 shows the VQOs and potential for change in scenic integrity from the selected viewpoints (described above) as they relate to the alternatives with applied Design Criteria. Additionally, the alternatives were analyzed for potential immediate effect (short-term) and effects after 5 years (long-term) (See Project File Exhibit Q-1).

Furthermore, three viewsheds were identified in the analysis area as having opportunities to implement Design Criteria to reduce impacts because of high concern levels. These include:

- State Highway 83 corridor viewsheds;
- Lindbergh Lake Road, National Forest System Road #79 (from the highway to the campground), and Lindbergh Lake Campground viewsheds;
- Lindbergh Lake and residences viewsheds.

Additional, Glacier Slough NFS Trail #481 (outside of these viewsheds) was identified as having high concern. With Design Criteria (Table 2- 16) implemented, these treatment units within these viewsheds would meet or exceed the VQO, identified in the Forest Plan.

TABLE 3- 98. VISUAL QUALITY IMPACTS SUMMARY FROM REPRESENTATIONAL VIEWPOINT LOCATIONS.							
#	VIEWPOINT NAME	VISIBILITY ¹	VQO(s)	CHANGE IN SCENIC INTERGRITY ²			
				ALT. A SHORT TERM/ LONG TERM	ALT. B SHORT TERM / LONG TERM	ALT. C SHORT TERM / LONG TERM	ALT. D SHORT TERM / LONG TERM
1	US Highway 83 Barber Creek Road	IFG/1	Retention	Not evident/ Not evident	Evident, but remains subordinate/Not evident	Evident, but remains subordinate / Not evident	Evident, but remains subordinate/ Not evident
2	Lindbergh Lake NFS Road #79, North	IFG/1	Modification & Maximum Modification	Not evident/ Not evident	Evident, but remains subordinate/Not evident	Evident, but remains subordinate/Not evident	Not evident/ Not evident
3	Lindbergh Campground	IFG / 1	Retention / Partial Retention	Not evident/ Not evident	Evident, but remains subordinate/Not evident	Evident, but remains subordinate/Not evident	Not evident/ Not evident
4	Lindbergh Lake Residence North	MG / 1	Modification & Maximum Modification Alternative C and D changed to Retention	Not evident/ Not evident	Dominant/ Dominate	Not evident Not evident	Not evident/ Not evident
5	Lindbergh Lake Residence South	FG / 1	Modification & Maximum Modification Alternative C and D changed to Retention	Not evident/ Not evident	Dominant/ Dominate	Not evident/Not evident	Not evident/Not evident
6	Elbow Overlook	MG & BG / 2	All visible	Not evident/ Not evident	Evident, but remains subordinate/Not evident	Evident, but remains subordinate/Not evident	Evident, but remains subordinate/Not evident
7	Lindbergh Lake Road NFS Road #79 South	MG & BG / 2	Modification & Maximum Modification	Not evident/ Not evident	Evident, but remains subordinate/Not evident	Evident, but remains subordinate/Not evident	Evident, but remains

TABLE 3- 98. VISUAL QUALITY IMPACTS SUMMARY FROM REPRESENTATIONAL VIEWPOINT LOCATIONS.							
#	VIEWPOINT NAME	VISIBILITY ¹	CHANGE IN SCENIC INTERGRITY ²				
			VQO(S)	ALT. A	ALT. B	ALT. C	ALT. D
				SHORT TERM / LONG TERM	SHORT TERM / LONG TERM	SHORT TERM / LONG TERM	SHORT TERM / LONG TERM
							subordinate/Not evident
8	Pulaski Road – NFS Road #5978	IFG / 3	Modification & Maximum Modification	Not evident/ Not evident	Dominate/ Evident but remains subordinate	Dominate/ Evident but remains subordinate	Dominate/ Evident but remains subordinate
¹ Viewing Distance/Concern Level (BG= background, MG=middle ground, FG = Foreground, IFG = immediate Foreground)							
² Change in scenic integrity of project area as seen from viewpoint locations. .							

ALTERNATIVE A – NO ACTION DIRECT AND INDIRECT EFFECTS

If no action is taken and the project does not take place, there would be no direct effect to landscape character associated with the project areas. There would be no change to the landscape character and, therefore, no direct change in future scenic integrity of the project area from current conditions. The No Action Alternative would meet Forest Plan VQOs.

Potential indirect effects on landscape character and scenic integrity would be probable loss of large groupings of pine trees because of mountain pine beetle infestation, with even greater mortality in uniform lodge pole pine stands. In addition, the potential fire hazard would increase for a short-term until the red-brown dead needles fell from the trees and then also in the longer term when trees begin to fall over. In the event of a fire, the fire scar would potentially damage scenic integrity for the long-term as seen from viewing areas with high concern. The impact would lower the intactness of the landscape and create a dominance of short-term contrasting color or long-term burn contrast if the beetle infestation and fire occurred on a larger than typical scale.

ALTERNATIVE A CUMULATIVE EFFECTS

The No Action Alternative cumulative effects analysis for Scenery Resources include analysis of the viewsheds of the land area encompassing the project area. Several past vegetation modifications including harvest and prescribed burns have occurred and are ongoing on both private and public lands within the existing viewsheds of MT Hwy 83 corridor and the Swan Valley. Reasonably foreseeable future actions if the No Action Alternative is selected are a continuation of these treatments within the area's viewsheds. Under the No Action Alternative, there would be the potential for increased risk of collapse of stands due to insect and disease attacks or catastrophic wildfire, spreading over a larger area within the respective viewshed identified. This would increase the cumulative effects by way of increase risk on the landscape character within the project area's viewsheds. Please refer to the Cumulative Effects Worksheet (Project File Exhibit Q-2) for more detailed information.

ALTERNATIVE B DIRECT AND INDIRECT EFFECTS

Visual effects from Alternative B will be described in 2 categories: Intermediate Harvest and Regeneration Harvest. The descriptive categories are separated because the level of potential visual impacts is easily distinguishable between the associated types of treatment. Road impacts will be described in association with specific units. This impacts analysis references the representational

viewpoints (Table 3- 97) and is described as a baseline for change in landscape character and for comparison of alternatives. All proposed harvest units were analyzed for potential impacts and assigned Design Criteria if needed (Table 2- 16).

INTERMEDIATE HARVEST UNITS

Approximately 1,321 acres of commercial thin (851 acres), improvement cut (117 acres), sanitation/salvage (8 acres), post and pole (10 acres), pre-commercial (343 acres) units are proposed as Intermediate Harvest. Unit 216 would receive hand treatments and all other units would be given tractor or mechanical treatments, which could include whole tree yarding, yarding of tops, lop and scatter, mastication, and/or piling. Some commercial thin units could receive prescribed fire in addition to pile burning. Post and pole and some pre-commercial thin units would also have pile burning.

Views into these intermediate harvest units are generally screened unless directly adjacent to a road or trail. A few open views into these units are offered from distant roads and use areas on the surrounding mountains. Negative visual effects resulting in lower scenic integrity as a result of implementation of these units would be negligible from these background and distant middle ground views. Greater visual impacts would occur from foreground and immediate foreground views primarily from adjacent roads. A higher percentage of overhead tree canopies would be retained in these intermediate harvest units however a limited number of units would have negative visual effects from viewing areas with high concern such as roadways, trails and from private property. After implementation, treatment units would generally showing contrast from unnatural appearing slash and stumps adjacent to roadsides. Paint marking, skid trails, roads, and landings would also create impacts because of contrast in color and form. Where burning occurs there is potential for black scarring of vegetation, stumps, and earth, which would largely appear natural unless abnormal appearing fire barriers or lines are created. Unnatural form in vegetation edges would be greatest in winter because of contrasting edges emphasized by the snow cover. In limited viewsheds throughout the project area, skid trails would also appear more dominate in the landscape, exposing contrasting soil disturbance that would delineate unnatural lines and forms. However, as new vegetation grows, the majority of these impacts would lessen and within the first year and within five years would not be evident as a visual deviation in the landscape from within sensitive viewsheds.

The travel ways and use areas (Figure 3- 22) analyzed adjacent to or within intermediate treatments that show the greatest sensitivity to viewers located in immediate foreground views include: MT Highway 83, Barber Creek (NFS Road #905), Kraft Creek Road (NFS Road #561), Lindbergh Lake Road (NFS Road #79), Lindbergh Lake Campground, residences adjacent to Unit 218 and 66 (north end of Lindbergh Lake). Intermediate harvest units with the greatest potential for impacting sensitive views, creating minor or moderate impacts, because of the level of sensitivity and distance to viewers particularly along roads with higher concern levels include the following units: 15, 32, 33, 34, 35, 36, 37, 43, 44, 64, 65, 66, and 212. Visual impacts along the edge of these units would have potential to contrast in form, line and texture with existing vegetation density from roadways. There is also potential for contrast in soil disturbance. Stumps potentially would appear unnatural. Piles or slash would potentially also contrast and appear unnatural.

REGENERATION HARVEST UNITS

Approximately 773 acres of harvest units including Clearcut with Reserve Trees (240 acres), Seed Tree with Reserve Trees (463 acres), and Shelterwood with Reserve Trees (70 acres) are proposed as regeneration harvest. These treatments would include tractor, skyline harvesting, mechanical, hand, and post-harvest treatments (i.e., burn piles and broadcast burns). Visual impacts associated with the above harvesting methods would be potentially greater because of the level of vegetation removed that would expose more ground disturbance impacts.

Foreground and immediate foreground views (less than 0.5 miles) would result in negative effects from contrasting skyline corridors, skid trails, landing areas, and temporary road construction, as well as unit shape and edge contrast. Additional exposure would occur from marking paint, slash and stumps visible from roads and trails (predominantly on the upslope). Post- harvest lopping and scattering of the slash/fuels or hand piling and mechanical treatments including whole tree yarding (or

possibly yarding of tops), excavator piling, or chipping/mastication broadcast burning, and pile burning would all have short-term negative impacts from viewing areas with high concern. The unnatural contrast in color and texture and form would dominate the landscape character in the short-term from foreground views. However, according to research found in Social Science to improve Fuels Management: A synthesis of Research on Aesthetics and Fuel Management (2005), this low-intensity burn can actually improve scenic integrity of an area as an indirect effect. The proposed treatments would improve forest health of the treatment areas and have a long-term indirect beneficial impact to scenery. After 5 years there may continue to be some dominating contrasting features but majority of impacts would generally diminish with vegetation regeneration. Unnatural vegetation forms like skyline corridors or straight boundary unit edges may take up to 15 to 25 years to become subordinate to the landscape character.

Middle ground and background views are generally limited within the project area because of topography and vegetation screening. A few exceptions include roads and use areas offering views from surrounding mountains which would have negligible effects because of the distant background and distant middle ground views within the context of the larger scale landscape. The travel ways and use areas (Figure 3- 13) analyzed show the greatest sensitivity for viewers located in foreground and middle ground views (less than 4-miles) associated with recreation user and residences on Lindbergh Lake. Additionally, Lindbergh Lake Road (NFS Road #79) and Elk Creek Road (NFS Road #9591) would also have higher immediate foreground regeneration harvest impacts relative to the travel way use levels and sensitivity.

Views from Lindbergh Lake and shoreline residences would experience foreground and middle ground views associated with regeneration harvest Units 83, 84, 85, 86, 87, 88, and 89. Negative effects from contrasting skyline corridors, skid trails, landing areas, and temporary road construction, as well as unit shape, texture, and form, as well as edge contrast would be dominate, and would show higher contrast in harvest unit edges and shapes during snow covered winter months. Overall these impacts would create moderate to major visual effects from the above mentioned viewing areas with high concern. The greatest potential for contrast would occur during the winter months because of the high contrast of texture associated with snow cover and would appear as a dominate feature. Within 5 years the unnatural appearing edge, silhouette, and shape effects caused by the proposed units and roads would begin to be reduced as new vegetation growth would begin to blend colors of the treatment areas, screen and change textures. In the long-term and with Design Criteria implemented, the effect of the proposed treatments would not be substantial enough to alter the character of the landscape. However the proposed harvest units collectively would have short-term and long-term moderate to major effects to foreground and middle ground views (See Table 3- 22 and Table 3- 23). The following table identifies those regeneration harvest units (with associated roads) that have the greatest potential for impacting sensitive viewsheds, creating moderate to major effects:

TABLE 3- 99. SUMMARY OF IMPACTS WITH VIEWS OF HIGH TO MODERATE CONCERN BY REGENERATION HARVEST UNIT.	
UNIT	DESCRIPTION OF VISUAL IMPACTS
83, 84, 85, 86, and 87	These units and roads would potentially have major effects because of contrasting line, texture, color, and form with the surrounding vegetation. These impacts would occur from foreground views from Lindbergh Lake and from shoreline residences with foreground and middle ground views.
88, 89	These units and associated roads would have potential contrast in line, texture, color, and form with surrounding vegetation within foreground views from Lindbergh Lake and would have major effects.
61, 57, and 58	There would be potential roadside impacts along Lindbergh Lake Road in the immediate foreground with regards to stumps, slash, edge, and texture contrast as a result of heavy alteration of vegetation having moderate effects.
2	There would be potential roadside impacts having moderate effects along Elk Creek Road in the immediate foreground with regard to stumps, slash, edge, and texture contrast as a result of heavy alteration of vegetation.

TABLE 3- 99. SUMMARY OF IMPACTS WITH VIEWS OF HIGH TO MODERATE CONCERN BY REGENERATION HARVEST UNIT.	
UNIT	DESCRIPTION OF VISUAL IMPACTS
73 and 74	Glacier Slough Trail #481 would potentially have immediate foreground moderate to major impacts with regard to stump, slash, edge, and texture contrast as a result of heavy alteration of the vegetation.

Temporary road construction would include 11.5 miles accessing 20 different units; 4.1 miles of roads are proposed for decommissioning. Several temporary roads were identified that would potentially have moderate to major effects as seen from sensitive travel ways and use areas with Concern Levels 1 and 2 include: Temporary Road #14D, Temporary Road #26A located along Elk Creek Road, Temporary Road #02D and Temporary Road #11C located along Lindbergh Lake Road, Temporary Road #14B located in the Lindbergh Lake Campground and Temporary Roads #22A and #22B within potential viewsheds of Lindbergh Lake. Potential impacts from the access point would be contrast in color and texture and form creating edge effects from soil and vegetation disturbance and would cause moderate to major impacts on these arterial roadways from views across the lake (Project File Exhibit Q-1). Decommissioned roads would potentially have a long-term beneficial effect to Scenery Resources because there would be a permanent reduction in impacts associated with cut and fill and the linear form of the roads within the natural appearing landscape.



Figure 3- 23 - Visual Simulation Viewpoint 1 - Existing Condition and Proposed Action

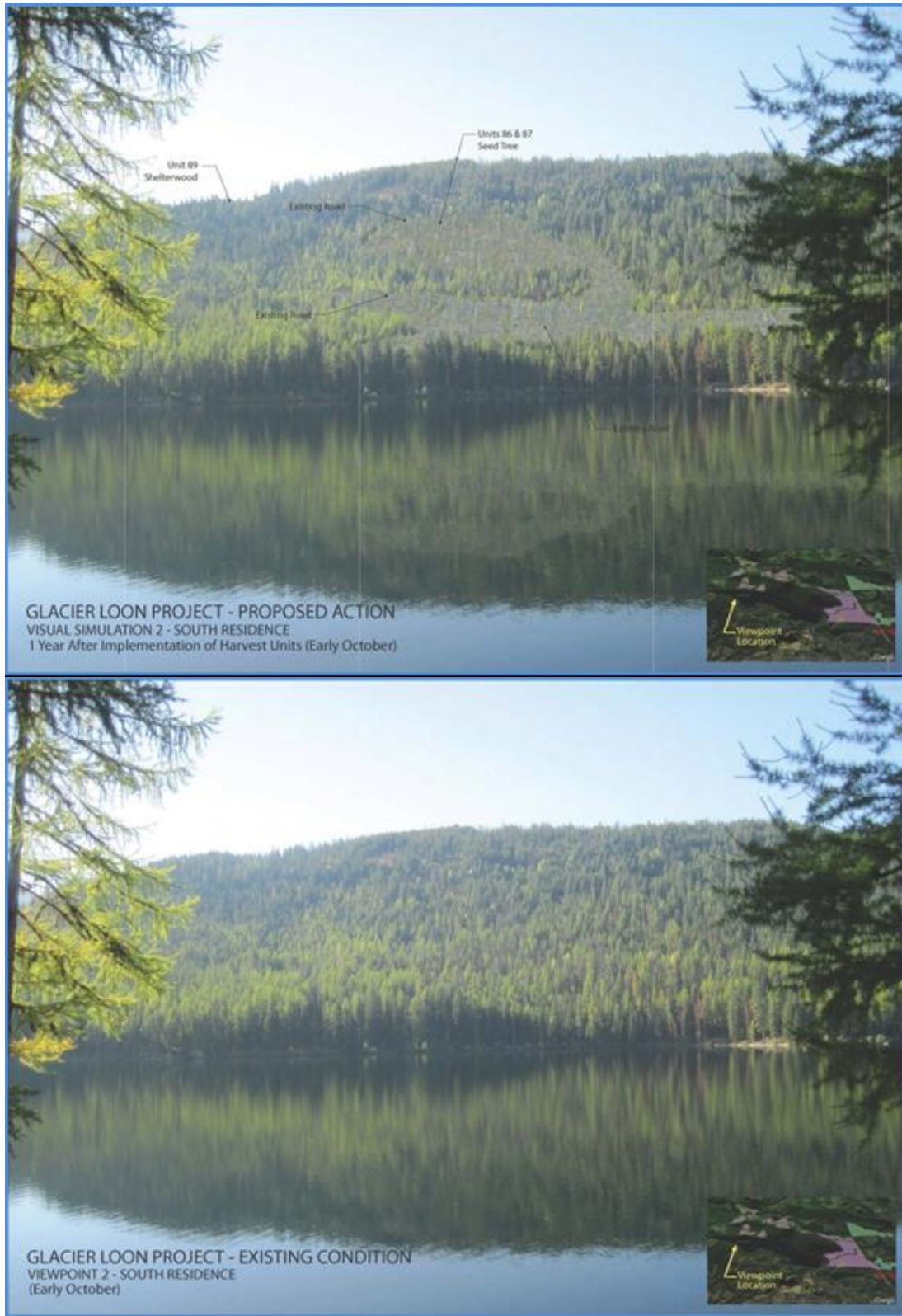


Figure 3- 24 – Visual Simulation Viewpoint 2 – Existing Condition and Proposed Action

ALTERNATIVE B CUMULATIVE EFFECTS

The Alternative B cumulative effects analysis for the scenery resources of the projects include analysis of the analysis areas and the land area encompassing the viewsheds of the project area. Several past vegetation modification projects including harvest and prescription burns have occurred and are ongoing on both private and public lands within the existing viewsheds. Additionally several private land and utility developments that could contribute to the cumulative effects within the project areas are historical, present and ongoing.

Primarily viewable from middle ground views from high concern travel ways (i.e., MT Hwy 83 Corridor), vegetation harvest units including both private and public land management activities have created contrast in color, texture, form and line having long-term negative impacts. These impacts vary however because regeneration harvest impacts have been reduced on some of the older projects. Other management activities including utilities (i.e., power lines, and roads) have lowered the scenic integrity of the landscape. Reasonably foreseeable future actions are a continuation of these treatments within the mountain range and valley viewsheds. Additionally, with the increase of adjacent private development and recreation use there is potential for scenery impacts to users to increase. These impacts would still however meet the Forest Plan direction.

If Alternative B is selected, impacts associated with this project in areas of high concern would contribute negatively to lowering the landscape scenic integrity in the short-term but would meet Forest Plan direction for the Forest's Management Areas. There would not be a change in long-term scenic integrity for the majority of the project area. The proposed management activities, with Design Criteria implemented, would create some short-term dominate-unnatural appearing visual contrast, primarily from roadside intermediate foreground views. However, overall, these major impacts would lessen over time and within 5 year would appear less evident. Foreground and middle ground views from the Lindbergh Lake and shoreline residences would show major impacts lasting longer than 5 years. Units 83, 84, 85, 86, and 87 would create the highest amounts of visual impacts. However, all of the proposed treatments would meet current Forest Plan Visual Quality Objectives.

ALTERNATIVES C AND D DIRECT AND INDIRECT EFFECTS

Visual effects from Alternatives C and D will be described in comparison to Alternative B using the representational viewpoint (See Table 3- 96 and Project File Exhibit Q-3).

INTERMEDIATE HARVEST UNITS

Alternative C (1,224 acres) and Alternative D (555 acres) consisting of Improvement Cut, Commercial Thin, Pre-Commercial Thin, and Sanitation/Salvage harvest units would all result in similar impacts for those units that are described in Alternative B. Alternatives C and D would also include Modified Commercial Thin treatments. Visual impacts from these units from high concern viewing locations are the equivalent or reduced compared to Alternative B. Impacts from these Intermediate Harvest units with the greatest potential for impacting sensitive views, creating a moderate effect, because of foreground impacts or because of edge, or road contrasts include the following:

- Alternative C - Units 15, 32, 33, 34, 35, 36, 37, 43, 44, 64, 65, 66, 212, and 218.
- Alternative D - Units 32, 33, 34, 35, 36, 37, 44, 65, 66, 212 and 218.

REGENERATION HARVEST UNITS

Alternative C (685 acres) and Alternative D (595 acres) consisting of Clearcut with Reserve Trees, Seed Tree with Reserve Trees, and Shelterwood with Reserve Tree harvest units would all result in similar impacts for those units that are described in Alternative B. Visual impacts from these units on sensitive viewing locations are the equivalent or reduced compared to Alternative B. Units 84, 85,

86, and 87 located within the viewshed of Lindbergh Lake were dropped in both Alternatives C and D, which reduces major visual impacts. Additionally, Unit 83 was dropped and Units 82 and 81 were modified in Alternative C to reduce visual impacts. For those other regeneration harvest units that are the same as those proposed in Alternative B, with the greatest potential for impacting views, the impacts would be the same and would have a moderate to major effect (Table 3- 99).

TABLE 3- 100. UNITS IMPACTING HIGH CONCERN VIEWSHEDS BY ALTERNATIVE.			
TREATMENT CATEGORY	ALTERNATIVE		
	B	C	D
Intermediate Harvest Units	13	13	11
Regeneration Harvest Units	10	4	5

Note: Regeneration harvest would typically have greater visual impacts than intermediate harvest units.

Alternative C proposes 7.4 miles of temporary road construction and 8.4 miles for decommissioning. Alternative D proposes 5.8 miles of temporary road construction and 8.4 miles for decommissioning. Impacts from roads are identified in Alternative B above. Potential impacts from the access point would have contrast in color and texture and form creating edge effects and would cause moderate to major impacts on these arterial roadways. Alternative C would have the least amount of impacts compared to Alternative B, which has the most impacts relative to the number of temporary road access points and views of temporary roads from the lake.

Additionally, several acres located on the western slopes of Lindbergh Lake are currently are MA 15 under the Forest Plan. Due to public scoping comments received for the Lindbergh Lake Viewshed, Alternatives C and D would propose to change the identified MA 15 acres to MA 5. This would change the VQO from modification/maximum modification to retention which would raise the level of current and future scenic integrity management for that land area. There would be no negative impacts associated with this change and would potentially have a long-term beneficial impact for Scenery Resources.

ALTERNATIVES C AND D CUMULATIVE EFFECTS

Several past vegetation modification projects including harvest and prescribed burn have occurred and are ongoing on both private and public lands within the existing viewsheds. Additionally several private land and utility developments that could contribute to the cumulative effects within the project area are historical, current and ongoing.

Reasonably foreseeable future actions are a continuation of these treatments within the mountain range, valley and highway viewsheds and also the potential for an increase in sensitive viewers. Alternatives C and D would also contribute to lowering the scenic integrity of the landscape but these impacts would be less than Alternative B relative to the amount of harvest units seen from areas of high concern. Additionally, Alternatives C and D would not conflict with current land management VQOs for Forest lands. The past, present, and reasonably foreseeable short-term impacts would be the least for Alternative C, which would have the fewest visible harvest units (See Table 3- 99).

With the implementation of Alternatives C and D there would not be a change in long-term scenic integrity. The proposed management activities, with Design Criteria implemented (Table 2- 16) would still create some dominate-unnatural appearing visual impacts in the short-term. Overall these major effects would lessen over time and within 5 years would appear less evident. Foreground and middle ground views from the Lindbergh Lake shoreline residences would have negligible visual impacts. Alternates C and D would have less visual impacts than Alternative B with Alternative C having overall the least amount of visual impact. All of the proposed treatments would meet Forest Plan Visual Quality Objectives.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change to the MA for a portion of the Glacier Loon Project Area along Lindbergh Lake, including the highly visible portions of the project area from the lakeshore to the slope break totaling approximately 221 acres. The proposal would change 213 acres from MA 15, which consists of timberlands where timber management with roads is economical and feasible as currently assigned, to MA 5, which consists of roaded timberlands in areas of high scenic value. The other 8 acres would be changed to from MA 15C, timberlands with emphasis on white-tailed deer summer range, to MA 5.

This would change the VQO from modification/ maximum modification to retention which would raise the level of current and future scenic integrity management for that land area. This would potentially result in a long-term benefit to Scenery Resources.

REGULATORY FRAMEWORK AND CONSISTENCY

LANDSCAPE CHARACTER GOALS, OBJECTIVES, AND STANDARDS

The Flathead Forest Plan contains direction for managing the scenic resources of the forest. Direction is contained in both Forest-wide and MA specific sections of the Plan. Direction relevant, with respect to scenery, to the proposed treatment units are summarized below.

FOREST-WIDE SCENERY STANDARDS:

- In each MA, meet or exceed the recommended VQO. Where management area goals and objectives can be fully achieved and a higher VQO met without increased costs or reduced future options, the higher VQO should be achieved.
- Through the use of proper design and scheduling of activities, potential impacts on the visual resource will be dispersed and not concentrated within an area or travel corridor within a short time frame. Achieving the long-term visual quality goal on the Forest will work in direct proportion to how well the cumulative effects of time and space are addressed. The time and space principles especially need to be applied to the key areas mentioned above. These areas are not viewed as a whole at one time; however, they are viewed sequentially from primary use areas, travel routes, or recreation sites (II-17).

MANAGEMENT AREA SCENERY STANDARDS AND GOALS

- MA 2 Retention
- MA 5 Retention, Maintain pleasing, natural appearing landscape in which management activities, including timber management with roads, are not evident.
- MA 9 Partial Retention
- MA 15 Modification or Maximum Modification.
- MA 15C Modification or Maximum Modification
- MA 17 None Specified

The Forest is transitioning to the Forest Service Scenery Management System (SMS) Scenic Integrity Objectives as part of the ongoing Forest Plan Revision (not final). The 2006 SMS Forest-wide Scenery Inventory was documented as part of this analysis but the existing 1985 VQOs were used as it relates to the current Forest Plan management direction.

HANDBOOK DIRECTION PERTAINING TO THE SCENIC RESOURCES:

In addition to Forest Plan direction, the following handbooks apply to National Forest Service lands under the Visual Management System. Definitions, guidance and procedure for managing the Scenic Resources are contained in the following Forest Service Handbooks:

- US Department of Agriculture. Agriculture Handbook 462. National Forest Landscape Management, v. 2, chapter 1: The Visual Management System. 1974.
- US Department of Agriculture. Agriculture Handbook 483. National Forest Landscape Management, v. 2, chapter 4: Roads. 1977.
- US Department of Agriculture. Agriculture Handbook 559. National Forest Landscape Management, v. 2, chapter 5: Timber. 1980.
- US Department of Agriculture. Agriculture Handbook 608. National Forest Landscape Management, v. 2, chapter 6: Fire. 1985.

(The above references can be found at http://fsweb.r1.fs.fed.us/rmlhw/scenery_mgmt/scenery.htm.)

TRANSPORTATION

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA.

INTRODUCTION

The Flathead National Forest Plan identifies the following Forest-wide goals that apply to roads:

1. Construct the minimum number of roads necessary to permit the efficient removal of timber and mineral resources; construct and reconstruct roads only to the minimum standards necessary to prevent soil loss, maintain water quality, minimize safety hazards for a reasonable and prudent Forest user, and provide access for fire protection where needed to meet MA goals; and
2. Maintain a balance of open and closed roads to continue present levels of motorized access, insure big-game habitat security, insure grizzly bear security to meet recovery goals, and reduce road maintenance costs (USDA 2001b).

Forest roads are an essential part of the transportation system designed to support multiple use of our National Forest lands. They help meet recreational demands and facilitate access to forest commodities. Forest roads provide access needed to manage the many resources of each forest ecosystem.

It is important to develop a long-term transportation plan that provides for a forest road system that best serves management objectives and public uses while protecting the health of our watersheds.

A Travel Analysis was completed for the Glacier Loon Analysis Area to comply with the administration of the Forest Transportation System Final Rule (36 CFR Part 212) and with the Forest Service Transportation Administrative Policy (FSM Chapter 7700). The revisions and amendments for the final rule were signed into effect on January 12, 2001. The final rule is intended to help ensure that additions to the National Forest System Road network are those deemed essential for resource management and use; that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and that unneeded roads are decommissioned and restoration of ecological processes are initiated.

The new policy removes emphasis on transportation development and adds a requirement for science-based transportation analysis. This science-based analysis process is spelled out in the USDA Forest Service Miscellaneous Report FS-643, Roads Analysis: Informing Decisions about Managing the National Forest Transportation System (Furniss 2000). The Glacier Loon Travel Analysis followed the recommended six-step process of this publication (Project File Exhibit R-4).

ANALYSIS AREA

SPATIAL BOUNDS

The analysis area for determining the direction, indirect, and cumulative effects for Transportation

are the lands within the Glacier Loon Project Area. It is on these lands that all road management activities would occur and where effects to the resource, if any, would most likely occur.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

A risk/benefit analysis was completed for each road in the Glacier Loon Project Area. The ID Team developed criteria to rate each road by assessing the benefit/risk for the road by each resource. Each road was rated based on need for access and resource environmental concerns. Roads were identified that were no longer needed for the long-term transportation system. This became the starting point for analyzing the road system for the Glacier Loon Project Area and identifying the issues that would drive our Travel Analysis. As we assessed the benefits and environmental effects of the road system, we identified opportunities for decommissioning, watershed restoration and road maintenance.

Field reconnaissance revealed that many of the roads do not meet current Best Management Practices (BMPs). Opportunities exist to improve the quality of the watersheds by bringing existing roads up to current BMP standards. This work usually involves structure installation, such as additional culverts, drainage dips, or surface cross drains. Meeting BMPs on all the roads in the project area would be expensive. This work has been prioritized in the Glacier Loon Travel Analysis to ensure the BMPs for roads with the highest environmental risks are accomplished first.

MEASUREMENT INDICATORS

Road miles are the measurement indicator used to assess the effects of the transportation system proposed in the alternatives.

AFFECTED ENVIRONMENT

There are approximately 140.3 miles of road with various standards and ownerships within the transportation system of the Glacier Loon Project Area. The Forest Service has jurisdiction over approximately 101.4 miles of road. The State Highway Department has jurisdiction over approximately 3.0 miles, The Nature Conservancy has approximately 4.6 miles, Missoula County has approximately 13.0 miles, private landowners have jurisdiction on approximately 17.1 miles of road and there are approximately 1.2 miles of road administered by the Forest Service under Special Use Permits.

Currently, approximately 25.9 miles of the NFS roads are managed as open yearlong and approximately 75.5 miles are restricted to closed year long. The following table displays information about the existing road system within the analysis area.

TABLE 3- 101. GLACIER LOON TRANSPORTATION SYSTEM EXISTING CONDITION.			
FEATURE	ITEM	MILES	REMARKS
ALL ROADS WITHIN THE GLACIER LOON ANALYSIS AREA		140.3	
Jurisdiction	Forest Service	101.4	
	State Hwy Dept.	3.0	
	Nature Conservancy	4.6	
	Missoula County	13.0	
	Private	17.1	
	FS Special Use Permit	1.2	
NATIONAL FOREST SYSTEM ROADS		101.4	
Functional Class	Arterial	0.0	NFS Road #'s 79 and 561 are collector roads, all other NFS Roads are local roads.
	Collector	21.3	
	Local	80.1	
Traffic Service Level (FS roads)	A	0.0	
	B	0.0	
	C	27.8	
	D	73.6	
Objective Maintenance Levels	4	0.0	The Objective and Operational Maintenance Levels do differ for some roads.
	3	22.3	
	2	3.3	
	1	75.5	
	D	0.3	
Miles of Road Subject to the Highway Safety Act	Maintenance Levels 3, 4, and 5	22.3	
Road Management	Open	25.9	
	Season Restrictions	0.0	
	Yearlong Restrictions	75.5	
Critical Traffic	4WD	0.4	
	Pickup	0.6	
	Passenger Car	0.1	
	Log Truck	89.3	
	Low Boy	9.9	
	Trailer	1.1	
Road Surfacing	Native	73.9	
	Aggregate	27.5	
	Bituminous	0.0	
Road Width	10 feet	0.5	
	12 feet	67.4	
	14 feet	33.0	
	20 feet	0.5	

ENVIRONMENTAL CONSEQUENCES

Several activities have been proposed in order to maintain and manage a cost-effective long-term road system that meets present and future resource management needs, increases security for wildlife, and insures safe access. The activities proposed in the project area include road maintenance, road decommissioning, and temporary road construction. Below is a brief definition and description of each of these activities. Please refer to the Project File Section R for a complete road-by-road list of these proposed activities. Please refer to Maps 2-1 through 2-6 in Chapter 2 for a display of the access management proposed for the action alternatives.

ROAD MAINTENANCE

This is the ongoing upkeep of a road necessary to meet the approved road management objectives (RMOs). The present focus of the RMOs is to meet current Best Management

Practices (BMPs) for each road.

BMPs help reduce the concentration of sub-surface and surface water runoff, minimize road surface erosion, filter ditch water before entering streams, and decrease the risk of culvert failures during peak runoff events. Road maintenance work could include culvert installation, replacement of existing culverts with larger culverts, installation of drainage dips and surface water deflectors, placement of rip-rap to armor drainage structures, aggregate surface replacement, aggregate placement to reinforce wet surface areas, ditch construction and cleaning where needed, and surface grading to restore the drainage efficiency of the road surface. These actions would bring the roads up to current BMP standards and provide benefits to the streams in the analysis area (refer to the Water Resources Section of this document). A list of the haul routes with proposed maintenance activity is located in the Transportation Section of the project file.

ROAD DECOMMISSIONING

This is defined as activities that result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR 212.1), (FSM 7703).

Decommissioning removes roads from the landscape that are no longer needed for current or future resource management or which pose a threat to water quality or wildlife security. This action would restore the natural drainage patterns interrupted when the roads were constructed. These methods for decommissioning include active and passive restoration. **Active treatment** could include:

- Total re-contouring that would restore the road template to the natural hill slope,
- Partial re-contouring to fill ditches or remove unstable road shoulders, removing culverts and other drainage structures,
- Ripping the roadbed to reduce compaction,
- Installing water bars,
- Out-sloping the road prism,
- Seeding and fertilizing disturbed soil, or
- Blocking the road entrance and abandoning the road to allow re-vegetation.

[The design features in Chapter 2 include further and more detailed descriptions of what this work will entail.](#)

Passive treatment would not involve any ground disturbing work.

ROAD CONSTRUCTION

The Glacier Loon Transportation Plan identified several areas that would need to be accessed by temporary roads. The proposed road construction would allow temporary access to proposed treatment activities in the area.

- **Historic Road Template:** An historic template can be defined as a constructed road surface that was once used for a transportation need but is not currently a part of the National Forest Road System. It has an overall template that has not been re-contoured, and is in a state that is impassible to full sized motor vehicles due to waterbars and culvert removals and/or closure by vegetation, earth berm, or other natural features.
- **Temporary Roads:** Temporary roads would be constructed to the minimum standards necessary for log hauling on National Forest System (NFS) roads. Temporary road surface width would be limited to truck bunk width plus 4 feet. Temporary roads would be reclaimed following their use using drain dips, outsloping, scarifying, seeding, and re-contouring.

ALTERNATIVE A – NO ACTION DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

The desired future condition of the Glacier Loon Transportation System is a condition where the National Forest Road System meets or exceeds the following criteria:

- Provides for safe access for forest users,
- Is responsive to public needs,
- Allows for economical and efficient management,
- Meets current and future resource management objectives,
- Is environmentally sound and begins to reverse adverse ecological impacts.

If no management occurs as a result of the No Action Alternative, the Forest Service Engineering Maintenance Crew would still maintain the roads for safe user access. However, with limited maintenance funds, work that would make the transportation system more economical, efficient, and environmentally sound would not occur as timely as with other action alternatives. The current trend of road maintenance is to bring the roads up to current BMP standards; past funding has limited that work to high-risk priorities or after-the-fact repairs where the eco-damage has already occurred. However, the Collaborative Forest Landscape Restoration Program (CFLRP) has helped reduce this trend. The work needed to economically and efficiently meet road and resource management objectives and reduce ecological impacts may take 10 to 20 years to achieve under the No Action Alternative. Under the action alternatives, this work would take place much sooner.

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

Direct and indirect effects on the transportation system are described below for proposed activities identified in Chapter 2. Cumulative effects were considered for all past, proposed, current, and reasonably foreseeable activities listed in Chapter 3 and are described at the end of this section.

A more detailed analysis of the impacts of roads on the Water and Fisheries Resources is contained in that section of this document. The impact of roads on the Wildlife Resource is addressed in the Wildlife Section of this document.

EFFECTS OF ROAD MAINTENANCE (BMPs)

Alternatives B, C and D each propose road maintenance on portions of roads within the Glacier Loon Project Area. The maintenance would reduce the direct and indirect effects roads have on water quality and produce immediate and long-term benefits to streams in the analysis area.

The BMP work would be designed with an emphasis on restoring the natural drainage patterns that were altered during the construction of the roads. The proposed work would not only reduce the effects of non-point source sediment problems to streams, but would also help reduce the risk of effects due to peak flow runoff events. Please refer to the Water Resources Section for more discussion of BMP work.

Based on the premise that timely completion of BMPs would maximize benefits to water quality, the alternatives with the most miles of haul routes would provide the greatest benefits. Table 3-101 below displays the estimated miles of haul routes for each alternative that would receive BMPs prior to timber sale haul.

TABLE 3- 102. ROAD MAINTENANCE BEST MANAGEMENT PRACTICES.

FUNDING SOURCE	ALTERNATIVE A	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D
Estimated Miles of NFS Roads to Receive Best Management Practices	0.0	37.7	34.7	29.1

EFFECTS OF ROAD DECOMMISSIONING

Alternative A proposes to decommission 0.0 miles of road, Alternative B proposes to decommission 4.1 miles of road and Alternatives C and D propose to decommission 8.4 miles of roads. National Forest Service Road #561F is currently open yearlong and the remaining roads are closed yearlong. The activities associated with decommissioning roads have the potential risk of exposing mineral soil and increasing short-term erosion. Sections of road proposed for decommissioning that parallel or cross streams within riparian areas total approximately 1.7 miles. There is no work anticipated for these roads that are located in riparian areas, however, all roads would be surveyed by Civil Engineers prior to implementation. All areas of soil disturbance would be seeded and fertilized in a timely manner. The risk of any potential effects to water quality during ground-disturbing implementation of this work would be reduced with soil erosion control protection measures. Table 3- 102 displays all the roads proposed for decommissioning and the type of decommissioning anticipated by alternative.

TABLE 3- 103. GLACIER LOON PROJECT AREA ROAD DECOMMISSIONING ACTIVITIES¹.

NFS ROAD #	BMP (MI)	EMP (MI)	EXISTING CONDITION	PASSIVE OR ACTIVE RESTORATION/TYPE OF WORK ANTICIPATED ²	ALT A (MI)	ALT B (MI)	ALT C (MI)	ALT D (MI)
9573	0.000	0.400	Road not revegetated.	Active: Construct water bars every 100-300 feet as needed. Remove culverts if scour is evident 100 feet above or below crossings.			0.400	0.400
9575	1.098	2.000	Road has ruts and rilling.	Active: Re-contour.			0.902	0.902
9579	0.715	1.500	Completely revegetated with vegetation past jct. with Road 9579C. Road crosses several wet areas.	Passive: No ground disturbing work anticipated.		0.785	0.785	0.785
10247	0.000	0.270	Road not revegetated.	Active: Construct water bars every 100-300 feet as needed. Remove culverts if scour is evident 100 feet above or below crossings.		0.270	0.270	0.270
10566	0.230	0.310	Road revegetated.	Passive: No ground disturbing work anticipated.		0.080	0.080	0.080
10568	0.000	0.300	Majority of road revegetated.	Passive: No ground disturbing work anticipated.		0.300	0.300	0.300
10730	0.000	0.450	Road has major erosion concerns.	Active: Construct water bars every 100-300 feet as needed. Remove culverts if scour is evident 100 feet above or below crossings. First 350 feet of road needs eroded section reshaped.		0.450	0.450	0.450
10731	0.000	0.400	Road revegetated.	Passive: No ground disturbing work anticipated.		0.400	0.400	0.400

TABLE 3- 103. GLACIER LOON PROJECT AREA ROAD DECOMMISSIONING ACTIVITIES¹.

NFS ROAD #	BMP (MI)	EMP (MI)	EXISTING CONDITION	PASSIVE OR ACTIVE RESTORATION/TYPE OF WORK ANTICIPATED ²	ALT A (MI)	ALT B (MI)	ALT C (MI)	ALT D (MI)
10732	0.300	2.300	Road was waterproofed in 2009 and has water bars in place with stream culverts removed. Slump located at M.P. 0.65.	Active: Re-contour.			2.000	2.000
10733	0.000	0.850	Road was waterproofed in 2009.	Active: Re-contour.			0.850	0.850
10734	0.000	0.150	Road was waterproofed in 2009.	Active: Re-contour.			0.150	0.150
11648A	0.000	0.180	Road is completely revegetated.	Passive: No ground disturbing work anticipated.		0.180	0.180	0.180
561F	0.000	0.370	First half of road has ruts and rilling. Several culverts undersized. Last 300 feet is located in floodplain, which washed out in 2009. Severe erosion source.	Active: Construct water bars every 100-300 feet as needed. Remove culverts if scour is evident 100 feet above or below crossings. Last 300 feet of road needs eroded section reshaped.		0.370	0.370	0.370
561G	0.000	0.200	Road not revegetated.	Active: Construct water bars every 100-300 feet as needed. Remove culverts if scour is evident 100 feet above or below crossings.		0.200	0.200	0.200
79B	0.000	0.200	Majority of road is revegetated.	Passive: No ground disturbing work anticipated.		0.200	0.200	0.200
79Y	0.000	0.750	Road has compacted drainage and has converted stream to a wetland.	Active/Passive: Construct water bars every 100-300 feet as needed. The first 800 feet shall have the road surface scarified and have seed and mulched placed on the roadbed. Brush shall be placed on the roadway at the entrance to prevent future unauthorized use. No ground disturbing work is anticipated after the first 800 feet.		0.750	0.750	0.750
79Z	0.000	0.150	Majority of road revegetated.	Passive: No ground disturbing work anticipated.		0.150	0.150	0.150
TOTAL					0.000	4.135	8.437	8.437

¹ Decommissioning activities will meet the "reclaim" definition in Amendment 19 (see Flathead National Forest Amendment 19 Amended EA, Appendix D-2).

² There could be further work necessary than identified here to meet the reclaim definition – e.g. removal of stream-aligned culverts, and recontouring, placement of natural debris, or revegetation with shrubs or trees. See design features in chapter 2 for further description.

EFFECTS OF TEMPORARY ROAD CONSTRUCTION

Temporary Road Construction

Table 3- 103 below displays the proposed miles of temporary road construction for each alternative. 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
- Where re-contouring is unnecessary, scarify with excavator teeth to a depth equal sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 and 12 inches)
- Removing any installed culverts or temporary bridges.
- Installing erosion control features where needed.
- Revegetation with native shrubs or native seed mix (specified by the Forest Botanist) after soil is replaced as soon as feasible after disturbance to provide for site protection until native species are established.
- Placing woody material on the template.

All temporary roads re-constructed for this project that utilize historic road templates would be reclaimed by any site-appropriate combination of the following:

- Removing any installed culverts or temporary bridges.
- Installing erosion control features where needed.
- Scarification with excavator teeth to a depth equal sufficient to ameliorate the presence of detrimental soil compaction (usually between 2 to 14 inches).
- Revegetation with native shrubs or native seed mix (specified by the Forest Botanist) after soil is replaced as soon as feasible after disturbance to provide for site protection until native species are established.
- Placing woody material on the template.

Roads should be reclaimed as soon as access is no longer required, before the close of the project.

TABLE 3- 104. MILES OF TEMPORARY ROAD CONSTRUCTION ASSOCIATED WITH THE GLACIER LOON PROJECT.				
	ALTERNATIVE			
	A	B	C	D
Temporary Roads On Historic Templates	0.0	2.3	2.0	1.4
Temporary Roads Requiring New Construction	0.0	9.2	5.4	4.4
Total	0.0	11.5	7.4	5.8

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

Activities that cumulatively affect the Transportation Resource are discussed below.

ROAD ACTIVITY

Routine road maintenance would occur as needed on roads in the project area, separate from any road maintenance identified in this EA. This would minimize road surface erosion, lessen the risk of culvert failures during peak runoff events, and retain the traffic safety standards for the road. Activities would include ditch and culvert cleaning, brushing, gate repair/replacement, road grading, and debris removal. Additional culverts are likely to be installed as needed. These activities would generally have a beneficial cumulative effect to Water and Fisheries Resources.

One culvert removal is proposed as Watershed and Fisheries restoration work. This culvert is located on Temporary Road #191712A, which would be utilizing an historic template. The culvert was poorly installed in early 1980s, and the stream almost breached the road in the prolonged

2011 runoff. In all action alternatives, the culvert would be used, and then removed afterwards. As stated above, temporary roads would be reclaimed. Design Criteria (Table 2- 16) has identified only removing the culvert during the dry period to minimize channel disturbance.

A new culvert on NFS Road #9552 at Meadow Lake outflow would be designed for aquatic fish passage and would be sized for 100-year flood event. This proposed work is also a restoration project and not a road concern (Resource Enhancement #2). The culvert is undersized and has developed about one foot high waterfall on the outlet. The existing road is poorly designed where it crosses the unnamed stream that flows between Meadow Lake and Bunyan Lake. The culvert is a seasonal fish migration barrier and the road surface erodes into the creek. Both Bunyan and Meadow Lake have wild (self-sustaining) cutthroat trout and the barrier is not desirable. This project would replace the culvert with either a larger culvert that provides fish passage or a bridge. The road would be reconstructed so that it does not erode into the stream. Minor work would also take place at the trailhead to reduce erosion. Please see the Water and Fisheries Sections of this document for more information.

All planned and proposed road-related work in the project area would contribute to the restoration efforts of the watersheds within Glacier Loon. Design Criteria (Table 2- 16) to reduce the effects of erosion would be implemented with all projects. The long-term effects of roads to the hydrology of the watersheds would be greatly reduced from that of our current existing condition. Our analysis concludes that beneficial gains to watershed restoration would result from the implementation of any action alternative listed in this document, and reductions in the direct, indirect, and cumulative effects of the road system on the environment would be realized.

Combined with this road activity, the work proposed in the action alternatives would cumulatively reduce the long-term effects of the road system on water quality, wildlife security, riparian areas, and road maintenance costs. Alternatives C and D would do more so than Alternative B.

LEGACY LANDS

No Temporary Road construction was associated with the TNC Fredswood Project. **The same is true for the Krafty 13 TNC Project which occurred prior to Forest Service acquisition of Section 13 (T.20N, R.17W.) where the project is located.**

All roads within harvest boundary would receive post-harvest road blading to smooth ruts, clear slash from road, and ensure drainage features are functioning properly. There are no other road management reasonably foreseeable actions in this analysis area. The road network on Legacy Land is encumbered by a deed restriction (timber rights reservation) until 2018. The Forest Service would not modify the transportation system with this encumbrance. No further work would be proposed on any Forest Service Road.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change to the MA for a portion of the Glacier Loon Project Area along Lindberg Lake, including the highly visible portions of the project area from the lakeshore to the slope break totaling approximately 221 acres. The proposal would change 213 acres of this area from MA 15, which consists of timberlands where timber management with roads is economical and feasible as currently assigned, to MA 5, which consists of roaded timberlands in areas of high scenic value. The other 8 acres would be changed to from MA 15C, timberlands with emphasis on white-tailed deer summer range, to MA 5.

Timber harvest would occur only when designed to improve or retain the scenic qualities of that area. Timber harvest designed as such would typically be less frequent and at a lower intensity. The effects of this change are included in the direct and indirect effects section, as well, due to changes in the action alternatives associated with this change such as reduction or deferral of road construction and access management opportunities within this area.

REGULATORY FRAMEWORK AND CONSISTENCY

All proposed road-related work in the action alternatives would meet the goals (USDA Forest Service, 2001, II-1), objectives (USDA Forest Service, 2001, II-7), and standards (USDA Forest Service 2001, II-21) of the Forest Plan. All proposed road activities would comply with Federal and State BMP standards. Road construction and reconstruction will adhere to the Forest Service Specifications for Construction of Roads and Bridges (EM-7720-100LL 1985). The Glacier Loon Travel Analysis (USDA Forest Service 2012) was completed in compliance with the Forest Transportation System Final Rule (36 CFR Part 212) and with the Forest Service Transportation Administrative Policy (FSM Chapter 7700).

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HERITAGE RESOURCES

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA.

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 Glacier Loon Fuels Reduction Project 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 prescribed burning, would typically receive less consideration from heritage resource personnel.

ANALYSIS AREA

The analysis area used to discuss the effects on Heritage Resources will be the project area. The effects on Heritage Resources would not extend beyond the project boundary.

DATA SOURCES, METHODS, AND ASSUMPTIONS USED

The Flathead National Forest is taking a multi-phase approach to Heritage Resource compliance [36 CFR 800.3(c)] for the Glacier Loon Fuels Reduction Project Analysis. This is possible because of the site-specific nature of Heritage Resources and Heritage Resource compliance. The first phase (1) is a reconnaissance level inventory of known Heritage Resources and a sampling of areas with a high probability for the occurrence of additional Heritage Resources. A pre-survey files 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 project area. The second phase (2) 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.

AFFECTED ENVIRONMENT

HISTORICAL CONDITION

Human occupation of the greater Swan Valley in general, and within boundaries of the proposed Glacier Loon Project specifically, has probably spanned the past 10,000 years. Evidence of those prehistoric hunters and gatherers however, forest wide, is rare. Typical Heritage Resource sites

or artifacts that one might encounter during pedestrian inventories would include tepee rings, scarred trees, pictographs or petroglyphs, lithic (stone) scatters of flint/chert debitage from the production of stone tools, isolated arrowheads or lance points, travois trails, hearths or roasting pits, bone tools, stone scrapers, awls, bifaces, knives, and cores.

Historic era Euro-American settlement of the Flathead Valley in general and the Swan Valley in particular came more than 50 years after fur trader/trapper David Thompson's early ventures into northwest Montana circa 1800. Evidence of early white settlers that might be discovered during heritage resource surveys include trappers lean-tos, metal traps, log cabins, rifles or other firearms, and various metal tools from plows to saws.

CURRENT CONDITION AND AFFECTED AREA

PRE-SURVEY FILES SEARCH

Prior to the two-phase inventory, the Forest's Heritage Resources Staff conducted an in-house files search for information on known, previously recorded Heritage Sites in the proposed project area. General Land Office Plat Maps, HES plats, BLM Land Status Records, historic forest maps, local history texts, the Flathead National Forest's Historic Overview, studies on Native American use of western Montana, and the Flathead National Forest's cumulative site atlas and survey atlas were all referenced.

The results of a pre-survey files search for information on known Heritage Resources in the proposed Glacier Loon Project identified three recorded heritage properties in the analysis area and eight previous inventories going back to 1982. Previous heritage surveys covered approximately 20 percent of the acreage in the Glacier Loon Project Area. None of the recorded heritage properties are in or near proposed treatment units and all will be unaffected by the proposed activities.

PEDESTRIAN SURVEY

The second phase of the two-part strategy requires the staff conduct a pedestrian based, stratified sample survey (inventory) of the proposed Glacier Loon Project. The survey strategy was taken from the Forest's Site Identification Strategy (SIS) which is part of the Region One Programmatic Agreement (R1PA) with the Montana State Historic Preservation Office (MTSHPO) and the Advisory Council on Historic Preservation regarding compliance to Sec 106 of the National Historic Preservation Act. The survey methodology is tied to topography and basic professional judgments about historic land use and cultural adaptation throughout history.

Simply stated, the methodology requires an 80 percent reconnaissance in topographic areas of less than 20 percent slope (such a level stream terraces) or in areas considered to exhibit a "high probability" for evidence of past cultural manifestations (i.e., ridge tops, rock outcrops, stream confluences). Survey transects would be spaced every 20 meters apart. Topographic areas in excess of 20 percent slope, but less than 50 percent, and which feature a "moderate" level of probability for containing cultural sites, were surveyed at 40 percent coverage, or with survey transects spaced every 40 meters. "Low"-level probability areas (slopes in excess of 50 percent) received 10 percent coverage with survey transects spaced every 70 meters apart.

The results of the stratified sample survey methodology identified two potential Heritage Sites, one historic located near a proposed unit and one prehistoric not in a unit but located near a proposed access route.

Discussions with the Confederated Salish and Kootenai Tribes (CSKT) did not identify any concerns in the project area. Consultation with the CSKT will continue.

ENVIRONMENTAL CONSEQUENCES

ALTERNATIVE A – NO ACTION DIRECT AND INDIRECT EFFECTS

Implementation of the No Action Alternative would neither directly nor indirectly affect Heritage Resources because there would be no change to the integrity of Heritage Resources as a result of no activities being implemented. An exception to this is the threat of wildland fire. Failure to reduce fuels as proposed in the action alternatives would increase the potential for severe wildland fire, increasing the potential for adverse effects by fire to Heritage Resources through and beyond the project area. Wildland fire also increases the risk of site looting and vandalism due to the exposure through lack of vegetative cover.

ALTERNATIVES B, C, AND D DIRECT AND INDIRECT EFFECTS

The Flathead National Forest participates in the Region One Programmatic Agreement (R1PA) with MTSHPD and the Advisory Council that provides for a more efficient process for conducting cultural resource inventories and meeting Section 106 compliance. Under the R1PA, if there are no eligible properties affected by the undertaking either through project redesign or because there are no properties located within the undertaking, then the undertaking is included in an annual report to MTSHPD and compliance is completed without project consultation. On the other hand, if an eligible property is affected by the proposed undertaking, then compliance is completed in the standard way with consultation with MTSHPD.

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# Protecting of Cultural 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.

Work proposed in this project is an undertaking with no effects to cultural sites through project redesign in accordance with the Region One Programmatic Agreement with the MTSHPD and the Flathead National Forest's Site Identification Strategy.

ALTERNATIVES B, C, AND D CUMULATIVE EFFECTS

There would be no cumulative effects to identified Heritage Resources in the Glacier Loon Project Area from any past, present, and reasonably foreseeable activities as presented at the beginning of this chapter. However, any such effects would be identified as part of the consultation process with MTSHPD and the CSKT and appropriate avoidance or moderating measures would be developed.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change to the MA for a portion of the Glacier Loon Project Area along Lindbergh Lake, including the highly visible portions of the project area from the lakeshore to the slope break totaling approximately 221 acres. The proposal would change 213 acres of this area from MA 15, which consists of timberlands where timber management with roads is economical and feasible as currently assigned, to MA 5, which consists of roaded timberlands in areas of high scenic value. The other 8 acres would be changed to from MA 15C, timberlands with emphasis on white-tailed deer summer range, to MA 5.

Timber harvest would occur only when designed to improve or retain the scenic qualities of that area. Timber harvest designed as such would typically be less frequent and at a lower intensity.

The effects of this change are included in the direct and indirect effects section. Any activities proposed within MA 5 would be evaluated under the Flathead National Forest multi-phase approach to Heritage Resource compliance [36 CFR 800.3(c)]. Future activities implemented through a timber sale contract would include the "B6.24# Protecting of Cultural 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.

REGULATORY FRAMEWORK AND CONSISTENCY

The Forest Service 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]. The tribes also have rights under the Hellgate Treaty of 1855, including hunting, gathering, and grazing rights.

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 Glacier Loon 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 file. 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.

Besides AIRFA, the USDA Forest Service is also 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 the Montana State Historic Preservation Office (SHPO). Sites that are determined as 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 American Indian Religious Freedom Act (1978) and the National Historic Preservation Act (1966) requirements are carried forward in the Flathead National Forest Plan standards for Heritage Resources (Forest Plan, pages II-18 to II-21).

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 under 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 Glacier Loon Project Alternatives are consistent with the laws and regulations listed above and incorporated into the requirements of the Flathead Forest Plan. Section 106 compliance and consultation with MTSHPD for this project has been completed.

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SOCIAL AND ECONOMIC

CHANGES FROM THE 2012 EA

The Glacier Loon Supplemental EA does not propose any additional activities when compared to the August 2012 Glacier Loon EA.

INTRODUCTION

The management of the Flathead National Forest has the potential to affect local economies. People are an important part of the ecosystem. Use of resources and recreational visitation to the Flathead National Forest generates employment and income in the surrounding communities and counties and generates revenues that are returned to the Federal Treasury or used to fund additional activities to accomplish resource management objectives.

This section presents concepts used to delineate an affected area and describes the methods and results of analyzing the economic effects of the project, including project feasibility, financial efficiency, and economic impacts. Project feasibility and financial efficiency relate to the costs and revenues of doing the action. Economic impacts relate to how the action affects the local economy in the surrounding area.

The NEPA requires that consequences to the human environment be analyzed and disclosed, based on issues. It does not require a monetary benefit-cost analysis. If an agency prepares an economic analysis, then one must be prepared and displayed for all alternatives [40 CFR 1502.23]. The preparation of NEPA documents is also guided by CEQ regulations for implementing NEPA [40 CFR 1500-1508].

Office of Management and Budget (OMB) Circular A-94 promotes efficient resource use through well-informed decision-making by the Federal Government. It suggests agencies prepare an efficiency analysis as part of project decision-making. It prescribes present net value as the criterion for an efficiency analysis.

The development of timber sale programs and individual timber sales is guided by agency direction found in FSM 2430. Forest Service Handbook 2409.18 guides the financial and, if applicable, economic efficiency analysis for timber sales.

ANALYSIS METHOD

Three measures are appropriate for this economic analysis:

1. Project feasibility,
2. Financial efficiency, and
3. Economic impacts.

These measures, including methodologies, are described below.

PROJECT FEASIBILITY

Project Feasibility is used to determine if the timber sale portions of a project are feasible, that is,

will it sell, given current market conditions. The determination of feasibility relies on a residual value (stumpage = revenues - costs) feasibility analysis that uses local delivered log prices, and stump to mill costs to determine if a project is feasible. The appraised stumpage rate from this analysis is compared to the base rate (revenues considered essential to cover regeneration plus minimum return to the Federal Treasury). The project is considered to be feasible if the appraised stumpage rate exceeds the base rates. If the feasibility analysis indicates that the project is not feasible, the project may need to be modified or supplemented with other funds if actual bids do not exceed base rates at the time of project award. Infeasibility indicates an increased risk that the project may not attract bids and may not be fully implemented. Greater stumpage amounts generated mean that additional project activities not generating revenue or affecting feasibility of timber sale portions of the project can be accomplished using that value as allowed given stewardship authorities.

FINANCIAL EFFICIENCY

Financial Efficiency considers anticipated costs and revenues that are part of Forest Service monetary transactions. Present net value (PNV) is used as an indicator of financial efficiency and is one tool to be used in conjunction with many other factors in the decision-making process. Present Net Value combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity in a single year. A positive PNV indicates that the alternative is financially efficient. Present Net Value was calculated using a 4 percent real discount rate. Costs for non-timber harvest activities, such as pre-commercial thinning, are based on recent experienced costs and professional estimates. Non-harvest related costs are included in the PNV analysis, but they are not included in the appraised timber value.

Financial efficiency analysis is not intended to be a comprehensive analysis that incorporates monetary expressions of all known market and non-market benefits and costs. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited financial efficiency framework. These non-market benefits and costs associated with the project are discussed throughout the various resource sections of this document.

ECONOMIC IMPACTS

Economic Impacts are used to evaluate potential direct, indirect, and cumulative effects on the economy. Economic impacts are estimated using input-output analysis. Input-output analysis is a means of examining relationships within an economy, both between businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given time period. The resulting mathematical representation allows examination of the effect of a change in one or several economic activities on an entire economy, all else are constant. This examination is called Impact Analysis. The IMPLAN Modeling System (IMpact analysis for PLANning, MIG 2003) allows the user to build regional economic models of one or more counties for a particular year. The model for this analysis used the 2009 IMPLAN Data. IMPLAN translates changes in final demand for goods and services into resulting changes in economic effects, such as labor income and employment of the affected area's economy.

The economic impact effects are measured by estimating the direct jobs and labor income generated by:

1. Processing of the timber volume from the project, and
2. Forest Service expenditures for contracted restoration activities included as part of the proposed treatments.

The direct employment and labor income benefit employees and their families and, therefore, directly affect the local economy. Additional indirect and induced multiplier effects (ripple effects) are generated by the direct activities. Indirect effects are felt by the producers of materials used by the directly affected industries. Induced effects occur when employees of the directly and

indirectly affected industries spend their wages. Together the direct and multiplier effects comprise the total economic impacts to the local economy.

Data used to estimate the direct effects from the timber harvest and processing were provided by the University of Montana's Bureau of Business and Economic Research (BBER) (Morgan et al. 2007). This national data is broken into multi-state regions and is considered more accurate than that which is available from IMPLAN. The Northern Rockies BBER Region (Montana and Idaho) is used for this analysis. The BBER Data represents the results of mill censuses that correlate production, employment, and labor income.

Potential limitations of these estimates are the time lag in IMPLAN Data and the data intensive nature of the input-output model. Significant changes in economic sectors since the latest data for IMPLAN have been adjusted using information from the University of Montana's BBER.

ANALYSIS AREA

SPATIAL AND TEMPORAL BOUNDS

The efficiency analysis includes all proposed activities and locations described for the Glacier Loon Project Area. All costs and revenues associated with the project were included. The time frame for this analysis is from the beginning of implementation of activities to the completion of the project. This project is expected to be completed over a five-year period, with the harvest activity occurring primarily within the first two years.

To estimate the potential impact on jobs and income, a zone of influence (or economic impact area) was delineated. The impact area was chosen using suggested USDA Forest Service protocols for delineating economic impact areas (Meti Corp 2010), which bases the selection of the impact area on commuting data and where the timber is likely to be processed (log flows). This analysis suggested that Missoula, Lake, and Flathead Counties were the appropriate counties to include in the economic impact analysis area.

AFFECTED ENVIRONMENT

THE ECONOMIC COMMUNITY

The Flathead National Forest includes parts of six Montana counties: Flathead, Lincoln, Lake, Missoula, Powell, and Lewis and Clark. About three-fourths of the area of the Flathead National Forest and most of the economic effects of its programs and projects occur in Flathead County. The Flathead National Forest has lesser effects in Lake County and only minimal effects in the other four counties. Within Missoula County, activity on the Flathead National Forest has some effects; however, within the Swan Valley portion of Missoula County, the effects of Flathead National Forest activities are somewhat magnified although empirical data is lacking. This is due to the high proportion of lands in the National Forest System, and few services with little or no manufacturing located in the Swan Valley as compared to the rest of Missoula County.

The Glacier Loon Project Area is located on the Swan Lake Ranger District of the Flathead National Forest, and entirely within Missoula County. Based upon the location of the sale, the most affected counties, in terms of economic effects, would be Missoula and Flathead, with lesser effects to Lake County.

The Flathead National Forest is an important part of the NCDE, 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 with respect to the Glacier Loon Project. The emphasis is on the economic effects that the Proposed Action and alternatives would have on the timber industry and the local communities that would be primarily affected by implementing those activities.

TIMBER INDUSTRY TRENDS

HISTORICAL PRODUCTION AND CAPACITY

Historically, annual timber harvest from NFS land in Montana peaked at greater than 800 million board feet at the end of the 1960s. In the period of 2000 to 2004, the timber harvest dropped to around 100 million board feet per year, slightly greater than 10 percent of the past peak level (USDA Forest Service 2004). In 2009 the annual timber harvest from NFS lands in Montana was about 86 million board feet or about 25 percent of the total harvest in the state (McIver et al. 2013).

In 1998, of the 227 million board feet of timber delivered to processing facilities in Missoula, Lake, and Granite Counties, approximately 41 million board feet, or about 18 percent, came from NFS land. In 1998, of the 293 million board feet of timber delivered to processing facilities in Flathead County, approximately 38 million board feet, or less than 13 percent, came from National Forest System land (Keegan et al. 2001).

Since 1980, Flathead County has had the largest wood products manufacturing industry of any county in Montana. Since 1976, the county's capacity to process saw timber has varied from a low of 265 million board feet (Scribner rule) as of 2001 to a high of 395 million board feet in 1983. However, according to The University of Montana's Bureau of Business and Economic Research, current capacity, as of 2011, in Flathead, Lake, and Missoula Counties is down to 303 million board feet for sawtimber, veneer, and house logs. Actual sawtimber processed since 1976 has varied from a low of 185 million board feet in 1982 to a high of 332 million board feet in 1988. Processing facilities utilization capacity has varied from a low of 51 percent in 1982 to a high of 97 percent in 1999. In 2000, the last year for which there are data, utilization capacity was at 94 percent. The plywood industry in Montana is presently (2001) at 93 percent of plant capacity. County level information on the plywood industry is generally not available because of data disclosure constraints (Keegan et al. 2001).

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

A global economic downturn in 2008 caused significant impacts to the timber industry in northwest Montana. The impacts have been extensive and include the loss of timber processing infrastructure, which reduces the ability to conduct fuels reduction and vegetation restoration work on NFS lands. In response to ongoing declines in housing, lumber prices dropped nearly 50 percent from 2005 to 2009. In 2010, however, lumber prices rose approximately 27 percent from 2009 levels due to rising exports and small gains in housing (Morgan and Keegan 2011).

Total sales value of wood and paper products in Montana in 2010 decreased approximately \$850 million since 2005 and \$225 million since 2009 (Morgan and Keegan 2011). At the end of 2010, estimated total employment in the wood products industry was about 6,840 workers, down about 3 percent from the revised estimate for 2009 of 7,060. Lumber production in Montana in 2009 fell to 415 MMBF, down by almost 60 percent from 2005, and was at the lowest level in more than five decades. However, in 2010 lumber production increased to approximately 480 MMBF (Morgan and Keegan 2011).

At the beginning of 2011, national forecasts were calling for a modest uptick in the US economy, housing starts and consumption of wood and paper products, though recent downturns in the global economy may temper this optimism. Some optimism was also reflected in the outlook of

Montana's wood products industry executives in early 2011, with 46 percent expecting 2011 to be better than 2010 (Morgan and Keegan 2011). In addition, the Western Wood Products Association (WWPA) predicted that lumber demand would increase by almost 10 percent in 2011 (Western Wood Products Association 2010).

The federal stimulus program was perceived by most Montana wood processing executives as not having much benefit for their firms. Most firms that reported a benefit said they received a low interest loan from the government, while only a few indicated having more work as a result of stimulus activities (Morgan and Keegan 2011).

ENVIRONMENTAL CONSEQUENCES

The following effects indicators were used to focus the economic analysis and disclose relevant environmental or social effects:

- Project Feasibility
- Effects on Financial Efficiency
- Effects on Employment

PROJECT FEASIBILITY

The estimation of project feasibility was based on a residual value appraisal model for the timber harvest portion of the Glacier Loon Project and associated activities only, which is based on logging system, timber volume removed per acre, delivered log prices, costs for slash treatment, reforestation costs, cost of specified road construction and reconstruction, temporary road construction, and road maintenance. The appraised stumpage rates (a conservative estimate of the timber value), predicted high bid (which incorporates competition factors and average experienced overbid), and base rates for each alternative are displayed in Table 3- 104 below. The appraised stumpage rate is positive for all alternatives based upon the residual value model and above the adjusted base rates, indicating that the timber harvest portions of the project would not require additional modification or funding to be feasible given current markets. These estimates are based upon a relatively low weighted average delivered log price (\$275 per thousand board feet) indicating good feasibility given current estimates. Additionally, the predicted high bid (the best estimate of the high bid resulting from the timber sale auction) for all alternatives is greater than the adjusted base rate, indicating that these alternatives would most likely sell and generate revenue.

Several factors affect the feasibility of these alternatives: reforestation costs, treatment of non-sawtimber, and brush disposal are significant costs affecting the bottom line feasibility of the action alternatives. The revenue estimates (based upon the predicted high bid) from the feasibility analysis are brought forward for use in the Financial Efficiency Analysis. Revenue estimates are based upon the Montana Sawlog and Veneer Log Price Report for January/March 2012.

It should be mentioned that the Glacier Loon Project has the potential to provide resources that could be converted into a variety of wood products. This could include but would not be limited to biomass, posts and poles, rails, bio-char, house logs, bio-fuels, hog fuel, utility poles, and specialty beam products. Due to a variety of current limitations in those markets ranging from extreme restrictions in production to non-existent re-sale markets in the Glacier Loon Project Area, these products and possible revenues are not included in this analysis. However, the actualization of these products could occur as a result of prospective purchaser marketing and ingenuity, thus positively affecting the feasibility of the project.

ALTERNATIVE B – PROPOSED ACTION DIRECT AND INDIRECT EFFECTS

Alternative B includes a variety of treatments, including two higher cost skyline logging system units. This alternative generates the most volume of sawtimber and non-sawtimber, the highest revenues, and treats the most acreage. However, by including more costly treatments, such as skyline harvests, the Stumpage Rate is lower than the other action alternatives. With an appraised Stumpage Rate of \$12.59/CCF, the timber sale portions of this alternative are feasible. Receipts generated in excess would be available to accomplish stewardship activities and other activities in the alternative.

ALTERNATIVE C DIRECT AND INDIRECT EFFECTS

The most significant changes to Alternative C from Alternative B include reducing temporary road costs by shortening temporary roads to reduce stream crossings and dropping the skyline harvest units. This increases the appraised Stumpage Rate to \$14.06/CCF by reducing costs, but keeps revenues high by only slightly reducing the acreage. The timber sale portions of this alternative are feasible, and would presently generate excess receipts available to accomplish stewardship and other activities included in this alternative.

ALTERNATIVE D DIRECT AND INDIRECT EFFECTS

Major reductions in acreage and volume harvested are included in Alternative D; however, the array of units in this alternative provides a highly feasible alternative. The appraised Stumpage Rate of \$14.58/CCF is the highest of the action alternatives. This is accomplished largely by recovering the highest volume per acre by focusing on regeneration harvest and dropping some costly items, such as skyline harvest, reducing temporary roads, and partial harvests. However, while the Stumpage Rate is the highest, the total revenues generated would be the least due to harvesting less volume. The result would be less revenue available to accomplish stewardship and other activities included in this alternative, although, one of the major non-timber sale activities proposed (pre-commercial thinning) is also significantly reduced in this alternative.

FINANCIAL EFFICIENCY

The financial efficiency analysis is specific to the commercial harvest and other activities associated with the alternatives (as directed in FSM 2400, found in the FSH 2409.18). All costs, timing, and amounts were developed with input from the Specialists on the Interdisciplinary Team. The expected revenue for each alternative is the corresponding predicted high bid (\$/CCF) from the sale feasibility analysis times the amount of timber harvested. The predicted high bid is used for the expected revenue (rather than the appraised Stumpage Rate), since the predicted high bid is the best estimate of the high bid resulting from the timber sale auction. The actual timber value would depend on the market when the timber is sold and could be higher or lower than the predicted high bid. Present Net Value was calculated using a 4 percent real discount rate over the 5-year expected project lifespan (2012-2017). For more information on the values or costs, refer to the Project File Exhibit S-3.

This analysis is not intended to be a comprehensive benefit-cost or PNV analysis incorporating a monetary expression of all known market and non-market benefits and costs generally used when economic efficiency is the sole or primary criteria upon which a decision is made. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. These values are discussed throughout this document, for each resource area.

Changes to resources like fisheries and wildlife habitat have been measured using changes to habitat conditions and will not be described in financial or economic terms for the Glacier Loon Project. Planning costs were not included in any of the alternatives, since they are sunk costs at the point of alternatives selection.

Table 3- 104 summarizes the project feasibility and financial efficiency, including the predicted high bid (and appraised stumpage value), total revenue, and PNV for each alternative. Because not all costs of the project are related to the commercial component of the project, two PNVs were calculated. One PNV indicates the financial efficiency of the commercial harvest and related activities including revenues and costs for harvest actions, sale preparation, sale administration, brush disposal, regeneration, planting, and monitoring. A second PNV includes all costs for each alternative, including other activities that are non-commercial harvest related, such as prescribed burning and varying amounts of pre-commercial thinning. The Forest may use dollars received from timber sale receipts to help fund all or a portion of these other project activities using stewardship contracting authorities. Project costs in excess, or not covered by those authorities, would have to be paid with appropriated dollars.

With regards to timber harvest and associated activities as described above, the action alternatives are essentially equally efficient. By reducing costs in Alternatives C and D relative to revenues, the PNV remains similar. Alternative D, for example, generates the least revenue, but costs associated with sale preparation are less due to the amount of work necessary to prepare those units for harvest being on average less intensive.

As displayed in Table 3- 104, Alternatives B and D are financially efficient with Alternative D being the most efficient, as indicated by positive PNV values for all activities. Alternative C proves to be the most financially inefficient for all activities including timber harvest and non-timber harvest as described above. Appropriated funding would be required to cover costs. Alternative A – No Action would not harvest or implement any additional management and would, therefore, incur no costs.

The PNV of any alternative as compared to the most efficient solution is a component of the economic trade-off, or opportunity cost, of achieving that alternative. As indicated earlier, many of the values associated with natural resource management are non-market benefits and costs. These trade-offs should be considered in conjunction with the financial efficiency information presented here.

TABLE 3- 105 PROJECT FEASIBILITY AND FINANCIAL EFFICIENCY SUMMARY (2012 DOLLARS).					
CATEGORY	MEASURE	NO ACTION	ALTERNATIVE B	ALTERNATIVE C	ALTERNATIVE D
Timber Harvest Information*	Acres Harvested	0	1,745	1,554	1,037
	Sawtimber Volume Harvested (CCF)	0	19,456	16,889	12,644
	Non-sawtimber Volume Harvested (CCF)	0	4,864	4,222	3,161
	Base Rates (\$/CCF)	\$0	\$3.00	\$3.65	\$3.96
	Appraised Stumpage Rate (\$/CCF)	\$0	\$12.59	\$14.06	\$14.58
	Predicted High Bid (\$/CCF)	\$0	\$31.80	\$33.27	\$33.79
	Non-sawtimber Rate (\$/CCF)	\$0	\$1.00	\$1.00	\$1.00
	Total Revenue (Thousands of \$)	0	\$619	\$562	\$427
Timber Harvest & Required Design Criteria	PNV (Thousands of \$)	0	\$188	\$183	\$168
Timber Harvest & All Other Planned Non-timber Activities	PNV (Thousands of \$)	0	\$34	-\$7	\$56

*Acreage listed may vary due to rounding, and represents those acres on which commercial products are expected to be generated by the various treatments in the alternatives. See Project File Exhibit S-3 for detailed acreage and cost summary spreadsheets.

The effects of timing play an important role in implementing projects of this size. The numbers listed in Table 3- 104 were generated using logging price indexes showing only slight recovery from a modern historical low period. The targeted completion date for this project is approximately 2019; market variability can and would have a large difference on values in that time.

When evaluating trade-offs, the use of financial efficiency measures is one tool used by the decision maker in making the decision. Many things cannot be quantified, such as effects on wildlife, impacts on local communities, and restoration of watersheds and vegetation. The decision maker considers many factors when making the decision.

ECONOMIC IMPACTS

The analysis calculated the jobs and labor income associated with the processing of the timber products harvested and additional activities that are anticipated to be contracted out. Timber products harvested from the proposed project and the non-timber activities would have direct, indirect, and induced effects on local jobs and labor income.

In order to estimate jobs and labor income associated with timber harvest, the timber harvest levels were proportionally broken out by product type, estimating 68 percent to be processed as sawtimber and 17 percent to be processed as pulp with 5 percent each to veneer, log homes, and post and pole products. The direct employment and labor income response coefficients (jobs and labor income per million cubic feet) for timber harvest activities were derived by the University of Montana's BBER. In order to estimate jobs and labor income associated with other activities, expenditures for these activities were developed by the Resource Specialists on the ID Team. The indirect and induced multiplier effects were estimated using the IMPLAN Model for the economic impact area. Only the expenditures associated with the contracted activities are included in the impact analysis, rather than work to be completed by Forest Service personnel.

Table 3- 105 displays the direct, indirect and induced, and total estimates for employment (part and full-time) and labor income that could be attributed to each alternative. Since the expenditures occur over time, the estimated impacts of jobs and labor income would be spread out over the expected 5-year life of the project (2012-2017). It is important to note that these may not be new jobs or income, but rather jobs and income that are supported by this project. These impacts are shown both in total (over the life of the project) and on an annual basis. It is anticipated that the timber harvest would occur over a 2-year period, with other activities spread out over the full 5 years. However, total implementation could take longer or be accomplished earlier.

TABLE 3- 106 ECONOMIC IMPACTS (EMPLOYMENT AND LABOR INCOME, TOTAL AND ANNUAL - \$2012).							
GLACIER LOON PROJECT	ALTERNATIVES						
	ALT. B		ALT. C		ALT. D		NO ACTION
	TOTAL	ANNUAL	TOTAL	ANNUAL	TOTAL	ANNUAL	TOTAL
PART AND FULL TIME JOBS CONTRIBUTED FOR NON TIMBER HARVEST ACTIVITIES							
Direct	6	1	7	1	4	1	\$0
Indirect and Induced	3	1	3	1	2	0	\$0
Total	9	2	9	2	6	1	\$0
LABOR INCOME CONTRIBUTED (\$M2012) FOR NON TIMBER HARVEST ACTIVITIES							
Direct	\$238	\$48	\$253	\$51	\$158	\$32	\$0
Indirect and Induced	\$87	\$17	\$95	\$19	\$66	\$13	\$0
Total	\$325	\$65	\$348	\$70	\$224	\$45	\$0
PART AND FULL TIME JOBS CONTRIBUTED FOR TIMBER HARVEST ACTIVITIES							
Direct	63	16	54	14	41	10	\$0

TABLE 3- 106 ECONOMIC IMPACTS (EMPLOYMENT AND LABOR INCOME, TOTAL AND ANNUAL - \$2012).							
GLACIER LOON PROJECT	ALTERNATIVES						
	ALT. B		ALT. C		ALT. D		No ACTION
	TOTAL	ANNUAL	TOTAL	ANNUAL	TOTAL	ANNUAL	TOTAL
Indirect and Induced	56	14	48	12	36	9	\$0
Total	119	30	103	26	77	19	\$0
LABOR INCOME CONTRIBUTED (\$M2012) FOR TIMBER HARVEST ACTIVITIES							
Direct	\$2,900	\$725	\$2,517	\$629	\$1,884	\$471	\$0
Indirect and Induced	\$1,895	\$474	\$1,645	\$411	\$1,231	\$308	\$0
Total	\$4,794	\$1,199	\$4,162	\$1,040	\$3,116	\$779	\$0
PART AND FULL TIME JOBS CONTRIBUTED FOR ALL ACTIVITIES							
Direct	69	17	61	15	44	11	\$0
Indirect and Induced	58	14	51	13	38	9	\$0
Total	128	31	112	28	83	20	\$0
LABOR INCOME CONTRIBUTED (\$M2012) FOR ALL ACTIVITIES							
Direct	\$3,137	\$772	\$2,770	\$680	\$2,043	\$503	\$0
Indirect and Induced	\$1,982	\$491	\$1,740	\$430	\$1,297	\$321	\$0
Total	\$5,119	\$1,264	\$4,510	\$1,110	\$3,340	\$824	\$0

Alternative B results in the most jobs created or maintained on a total and annual basis, as well as the highest labor income. Alternative B results in 128 total jobs and \$5.1 million in labor income spread over the life of the project, with 31 jobs and \$1.3 million annually. Of that, 119 jobs and \$1.2 million are associated with the timber harvest activities, with the balance going to other activities. Alternatives C and D, follow respectively, with the largest factor affecting income and jobs being commercial volume removed. Other factors are an increase in road decommissioning costs adding slightly to the non-timber harvest numbers; however in Alternative D those gains are offset by reductions in pre-commercial thinning. Alternative A – No Action creates no jobs and no labor income.

If implementation takes longer than anticipated, the total impacts would remain the same, but the annual contributions would be less. The opposite is true if implementation were to happen sooner. The analysis assumes that the timber volume is processed within Flathead and Missoula timber processing areas, and if some or all of the timber were processed outside the region, a portion of the jobs and income would be lost by this region's economy.

ALTERNATIVE D CUMULATIVE EFFECTS

Management of the Flathead National Forest has an impact on the economies of local counties. There are many additional factors that would influence and affect the local economies:

- Changes to industry technologies,
- Management of adjacent national forests and private lands,
- Economic growth, and
- International trade.

The jobs and labor income associated with timber harvest, restoration, and reforestation activities in the action alternatives, would contribute to the stability of the local economy during the life of the project. The magnitude of these effects derived from the action alternatives is represented in the Economic Impacts Section of the direct and indirect effects section above.

Cumulative economic effects would be seen within the local community as a result of ongoing and reasonably foreseeable projects that could affect local economies including, but not limited

to, the following: Hemlock Elk, Summit, Cooney McKay, Meadow Smith, Miss'n Dog, Lion's Paw, Sixmile, Porter Mount, Cold Jim, Wild Cramer, Red Whale, Island South, East Shore, Belton, Red Whale, Soldier Addition, Firefighter, Spotted Bear River, Middle Fork, Granite Lodgepole, Beaver Lake, Corduroy, Sharp-Tail, Gregg-Plume, Valley Face, Reid Creek, Cyclone Products, Round Bug, Lost Cliff, Lost Mountain, West Logan, Griffin Creek, and Johnson Peak Projects. These projects are related to commercial harvest activities on the Flathead National Forest. In addition, cumulative economic effects would be seen from state and private timber harvest and harvest on other Federal lands as it occurs within the economic area.

EFFECTS OF MANAGEMENT AREA CHANGE

Alternatives C and D include a proposed change to the Management Area (MA) for a portion of the Glacier Loon Project Area along Lindberg Lake, including the highly visible portions of the project area from the lakeshore to the slope break totaling approximately 221 acres. The proposal would change 213 acres from MA 15, which consists of timberlands where timber management with roads is economical and feasible as currently assigned, to MA 5, which consists of roaded timberlands in areas of high scenic value. The other 8 acres would be changed from MA 15C, timberlands with emphasis on white-tailed deer summer range, to MA 5.

This change would, in the long run, reduce the capacity of this analysis area to contribute economically to the economic community. Timber harvest would occur only when designed to improve or retain the scenic qualities of that area. Timber harvest designed as such would typically be less frequent, at a lower intensity with less harvest volume yield, and less efficient in terms of PNV due to considerations for access and Design Criteria, which would limit economically feasible harvest opportunities. The effects of this change are included in the direct and indirect effects section, as well, due to changes in the action alternatives associated with this change such as reduction or deferral of harvest opportunities within this area.

REGULATORY FRAMEWORK AND CONSISTENCY

One goal of the Flathead National Forest Plan 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 1985). The action alternatives offer varying levels of commercial harvest and are consistent with being both cost effective and responsive to the needs of the local economy.

CIVIL RIGHTS AND ENVIRONMENTAL JUSTICE

Neither of the action alternatives would be expected to negatively affect the civil rights of consumers, minority groups, low-income groups, women, or American Indian tribes. Subsistence activities would not be disproportionately reduced for any of the identified groups. The Flathead Indian Reservation is less than 25 miles from the Glacier Loon Project Area. No environmental health hazards are expected to result from implementation of any alternative. This project should not disproportionately affect one income group over another.

This project is in compliance with EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." Environmental justice issues were considered in all steps of the NEPA process including public participation, alternative development, determining the affected environment, project design, and analysis of environmental consequences. At no step were minority, low-income, or tribal populations negatively affected by any of the proposed actions in any of the alternatives.

REQUIRED DISCLOSURES

POTENTIAL CONFLICTS WITH PLANS AND POLICIES OF OTHER JURISDICTIONS

CULTURAL RESOURCES

The laws and policies that govern cultural resource protection on Federal lands are coordinated with the SHPO of Montana, who serves in an advisory capacity. The policies for Forest Service and SHPO are consistent. The Forest Service would inform and consult with the Confederated Salish and Kootenai Tribes on proposed activities, site information, and potential impacts.

WILDLIFE

The Forest Service and the MDFW&P work together to manage wildlife, but with differing missions. The Forest Service manages the land and affects wildlife habitat by modifying the structure and composition of the vegetation and by creating and restricting access. The State of Montana manages the animals, and they affect wildlife by adjusting hunting seasons, harvest and day limits, and enforcing other rules that affect fish and wildlife populations.

The Forest Service works with the USFWS for the recovery of Threatened and Endangered Species. The Forest Service consults with the USFWS when Threatened, Endangered, and Proposed Species may be affected.

WATER QUALITY

Section 313 of the Clean Water Act requires Federal agencies to comply with all Federal, State, interstate and local requirements, administrative authority, and process and sanctions with respect to the control and abatement of water pollution. Executive Order 12088 also requires the Forest Service to meet the requirements of the Act. All action alternatives would comply with the Clean Water Act and Montana State Water Quality Standards. These alternatives would incorporate reasonable Soil and Water Conservation Practices, avoid channel degradation, and comply with the Forest Plan.

AIR QUALITY

The prescribed underburning of harvest units under all action alternatives has the potential to affect local air quality. This activity is conducted in accordance with the State of Montana air quality guidelines administered by the Montana/Idaho State Airshed Group, made up of industry, State and Federal Agencies, and local Health Department Representatives.

Potential conflicts occasionally exist between National Forest concerns for meeting land management goals and the commitments of the State Agencies for clean air.

Other sources of potential conflict exist between private landowners within Montana, State land management agencies, and other adjoining National Forests competing for the limited number of suitable burning days. When such conflicts are identified, the Forest Service does not burn.

PROBABLE ENVIRONMENTAL EFFECTS THAT CANNOT BE

AVOIDED

Implementation of any alternative would inevitably result in some adverse environmental effects. The severity of the effects can be minimized by adhering to the features of the alternatives, such as the BMPs. If management activities occur, some effects cannot be avoided. Even Alternative A – the No Action Alternative has effects.

CULTURAL RESOURCES

There is no assurance that every cultural resource site would be located in advance of all planned management activities. Some ground-disturbing activity may affect an undiscovered historic or prehistoric site. Sites discovered in this manner would be protected immediately from further disturbance.

WILDLIFE

The availability of stand structure, composition, patch size, and specific wildlife habitat elements is dynamic and changes over time. Consequently, wildlife populations associated with specific habitat conditions also change with time. All action alternatives would move habitat conditions within/towards historic ranges. Changes in habitat availability can cause changes in local population numbers of specific species. Proposed action alternatives can directly harm species through timber harvest and associated activities. Species primarily affected would be birds, amphibians, and small mammals. Although the proposed actions may affect individuals, it is not expected to cause a loss of population viability.

AIR QUALITY

Temporary seasonal effects on air quality are unavoidable under any of the action alternatives. Prescribed fire is an integral part of ecosystem management, fuel treatment, and site preparation for reforestation. These activities would be scheduled when air dispersion is good.

RELATIONSHIP BETWEEN SHORT-TERM AND LONG-TERM PRODUCTIVITY

Short-term uses are those that generally occur annually. Long-term productivity refers to the ability of the land to produce a continuous supply of a resource.

WATER QUALITY

The duration of the effects of timber management on the water resource is highly variable and dependent on land and vegetation types. Stream channel conditions may be altered because of short-term direct and indirect effects of management activities.

WILDLIFE

As explained above, the availability of stand structure, composition, patch size, and specific wildlife habitat elements is dynamic and changes over time. The appropriate scheduling of timber harvest and treatment of specific timber stands and habitat conditions can provide for and help sustain a mosaic of habitat conditions representative of historic ranges.

VEGETATION

Managed stands produce a higher volume of wood fiber through time than unmanaged stands. Regeneration of desired fast-growing species, planting of genetically improved trees, stocking control to reduce competition and improve growth of individual trees, and intermediate treatments to maintain the health and vigor of stands are silvicultural means of maintaining the long-term yield of forest stands.

In the short-term, harvesting stands that are at a high risk of mortality captures economic value that would otherwise be lost. Timely reforestation puts the land back into a productive growing condition.

Depending on the level of timber harvesting and the site preparation method that follows, reductions in organic matter could reduce long-term site productivity. Silvicultural prescriptions include measures designed to maintain varying levels of organic matter. Reforestation of harvest areas could change plant succession, stand development, and species composition.

AIR QUALITY

The temporary impacts of smoke from prescribed debris burning and road dust from vehicles associated with proposed activities would have minor short-term effects on visual quality and recreation use. The short-term impacts are traded for by minimizing the risks from wildfire and long-term increased site productivity. The short-term impact of prescribed burning is required to decrease the risk from wildfire on these sites. Wildfires generally provide significantly more air pollution. Silvicultural treatments and prescribed burning would increase long-term site productivity.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible commitment of resources refers to the loss of production or use of a non-renewable resource due to a land use decision that, once executed, cannot be changed. An irretrievable commitment of resources applies to loss of production or use of renewable resources for a time.

SOIL PRODUCTIVITY

Best Management Practices would be used to avoid soil productivity losses from timber harvesting and associated temporary road/skid trail construction. Temporary roads would constitute an irretrievable commitment of resources even though they would be reclaimed. The soil mixing and disturbance that would be associated with temporary construction would lower soil productivity. While plant and tree growth on these sites would occur over the short term, growth rates may be slower within the temporary road template. Full productivity recovery would take decades.

AIR QUALITY

The impact of prescribed burning would have temporary seasonal impacts on the air quality in all alternatives except Alternative A – No Action.

SCENIC RESOURCES

Irretrievable changes in the existing appearance of the landscape would occur under the action

alternatives. These changes would become progressively less noticeable as vegetation recovered in harvested areas and along roads.

WILDLIFE

The loss or modification of habitat for certain wildlife species is an irretrievable commitment of resources. As treated vegetation recovers, associated habitat would also recover. However, the timeframe for this to occur may be many decades for mature and old growth-related species.

CULTURAL RESOURCES

Any activity that would disturb a cultural resource is an irreversible commitment.

SPECIFICALLY REQUIRED DISCLOSURES

EFFECTS OF ALTERNATIVES ON SOCIAL GROUPS

Executive Order 12898, issued in 1994, ordered Federal agencies to identify and address the issue of environmental justice (i.e., adverse human health and environmental effects of agency programs that disproportionately impact minority and low income populations). At this time, no minority or low-income communities have been identified in the Glacier Loon Project Analysis Area.

Based on experience with similar projects on the Swan Lake Ranger District, none of the alternatives would substantially affect minority or low-income individuals, women, or civil rights. The implementation of this project is expected to provide job opportunities in communities such as Swan Lake, Condon, Seeley Lake, Bigfork, Columbia Falls, and Kalispell, Montana. Some of these communities include minority populations that may benefit from the economic effects. Small or minority-owned businesses would have the opportunity to compete for some of the work.

EFFECTS ON FLOODPLAINS AND WETLANDS

Floodplain areas constitute all of the wetlands in the analysis area and are protected as RHCAs. Wetlands may occur in the form of seeps, springs, and small bogs; however, the exact locations of all these have not been identified prior to unit layout. These seeps, springs, and small bogs are not evident through aerial photography and are probably less than 0.25 acre in size. These areas would be protected by adhering to the Montana Stream Management Zone Regulations, INFISH, BMP Practices, and Section 404 of the Clean Water Act (33 CFR 323). See the Hydrology Section of this EA for more specifics.

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF ALTERNATIVES

The energy required to implement the alternatives in terms of petroleum products would be insignificant when viewed in light of the production costs and effects of the national and worldwide petroleum reserves.

EFFECTS OF ALTERNATIVES ON PRIME RANGELAND, FOREST LAND, AND FARM LAND

The alternatives presented comply with Federal Regulations for prime lands. The definition of

prime forestland does not apply to lands within the National Forests. Lands administered by the Forest Service in the analysis area do not include prime farmlands or range lands. In all alternatives, Federal lands would be managed with the appropriate consideration to the effects on adjacent lands.

MIGRATORY BIRD TREATY ACT

On January 10, 2001, President Clinton signed an EO outlining responsibilities of Federal agencies to protect migratory birds. Upon review of the information regarding neo-tropical migratory birds in the project file, there would be no significant loss of migratory bird habitat from the implementation of any of the action alternatives.

All action alternatives move stand structure, composition, patch size, and specific wildlife habitat elements within/towards historic ranges. Changes in habitat availability can cause changes in local population numbers of specific species. Proposed actions are expected to maintain sufficient amounts and types of habitat to allow migratory birds to continue to inhabit and reproduce within the Glacier Loon Project Analysis Area.

The action alternatives contain practices that avoid or minimize, to the maximum extent practicable, adverse impacts on species of migratory birds. However, proposed actions would create short-term disturbances and may cause harm to some species. Therefore, proposed actions may harm individuals, but are not likely to cause a loss of population viability of associated migratory birds.

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