United States Department of Agriculture
Forest Service

Marshall Woods Restoration Project

Environmental Assessment

Missoula Ranger District, Lolo National Forest, Missoula County, MT

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SUMMARY

This Environmental Assessment (EA) analyzes the potential effects of implementing four different alternatives (i.e., sets of land management activities) for the Marshall Woods Restoration Project. The 13,000-acre Marshall Woods project area lies immediately northwest of Missoula, MT; it includes Marshall Creek, Woods Gulch, and portions of the Lower Rattlesnake Creek drainage. Approximately 4,400 acres, or 34%, of the project area, is located within the non-wilderness portion of the Rattlesnake National Recreation Area (RNRA). The project area also includes about 5,600 acres of privately-owned and City of Missoula lands. Activities are proposed only on National Forest System (NFS) lands, which consist of about 56% of the project area, and they include vegetation management (using commercial harvest, non-commercial tree cutting, and prescribed fire), road and trail treatments, and noxious weed treatments.

This project was designed to address the following four objectives:

- Restore functioning ecosystems by enhancing natural ecological processes.
- Emulate fire's natural role on the landscape through vegetative treatments including using prescribed fire.
- Provide education opportunities to build support for restoration.
- Provide for diverse trail-based recreation opportunities and reduce road density in section 31.

The project was initiated in 2008 through working with the Lolo Restoration Committee which is a diverse group of volunteers interested in collaborating with the Lolo National Forest on land management planning. This EA is the outcome of this group's hard work, along with input from many other interested individuals and entities, as well as the team of Forest Service resource specialists (i.e., Interdisciplinary Team or IDT) who conducted the analysis. This EA includes concise summaries of the specialists' reports for each resource; the full reports are posted on our website at http://www.fs.usda.gov/projects/lolo/landmanagement/projects.

We hope that you will carefully examine this EA and submit comments during the specified 30-day comment period. After the IDT reviews and responds to the comments, the Deciding Official will issue a decision (i.e., Decision Notice) identifying which of the four alternatives will be implemented.

Chapter 1 Purpose and Need for Action

Introduction

The purpose of this Environmental Assessment (EA) is to comply with the National Environmental Policy Act (NEPA) and to provide sufficient evidence, analysis and basic conclusions for the Deciding Officer to determine whether to prepare an environmental impact statement (EIS) or a finding of no significant impact (FONSI) [1]. This EA provides a "hard look" at the question of whether the consequences of the proposed action, given the intensity and the context of the impacts, are "significant." **All numbers throughout this EA are approximations**.

The resource reports cited in this EA and additional project documentation can be obtained from the Lolo National Forest's website at fs.usda.gov/goto/lolo/projects. The abbreviation "PF" is used in this document to cite information located in the project file, along with a document specific identification. The project file is available at the Missoula Ranger District, 24 Fort Missoula Road, Missoula, MT.

Background

The 13,000-acre Marshall Woods project area includes Marshall Creek, Woods Gulch, and portions of the Lower Rattlesnake Creek drainage which lie immediately northwest of Missoula, MT (Figure 1. Marshall Woods Restoration Project Vicinity Map). Approximately 4,400 acres, or 34%, of the project area is located within the *non-wilderness* portion of the Rattlesnake National Recreation Area (RNRA). Activities are proposed on National Forest System (NFS) lands which consist of about 56% of the project area. The landownership within the project area boundary is displayed in Table 1.

Rattlesnake National Recreation Area (RNRA)

The RNRA and Wilderness was designated by Congress in 1980. The 28,000-acre area is important for its value as a portion of Missoula's municipal watershed, a dispersed recreation area, an environmental education area, and habitat for a wide variety of wildlife. About 4,400 acres of the Marshall Woods project area lies within the RNRA.

[1] 540 CFR 1508.9

Figure 1. Marshall Woods Restoration Project Vicinity Map

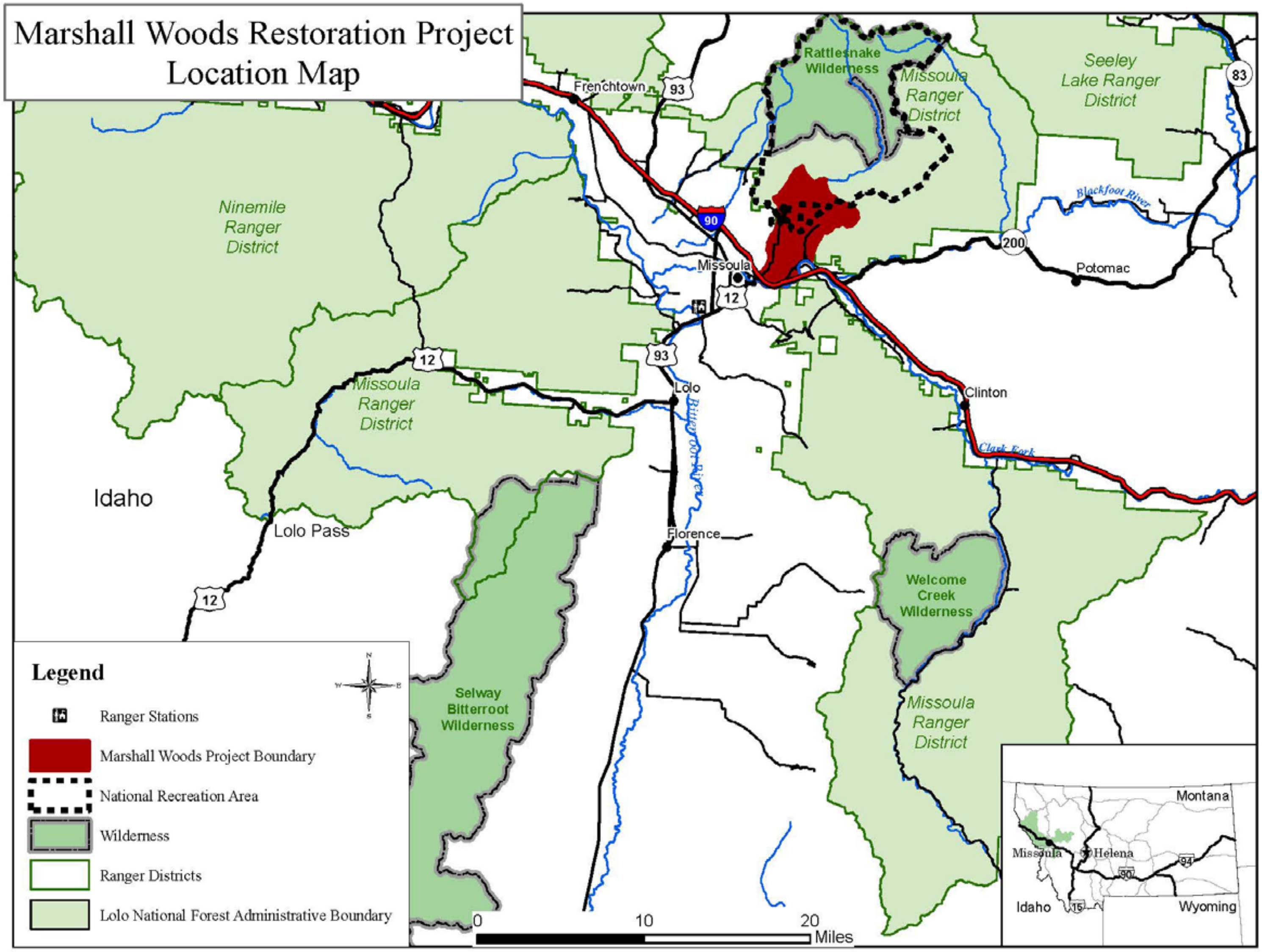


Table 1. Landownership Within the Marshall Woods Project Area Boundary.

Ownership	Acres
Lolo National Forest	7281
Plum Creek Timber Company	6
Private/City	5621
State of Montana	118
water	2

Ongoing Projects Within the Marshall Woods Project Area

In addition to routine management activities such as recreation management, two projects with previous decisions are ongoing within the project area, as described below:

Rattlesnake NRA Wildlife Habitat Improvement and Ecosystem Maintenance Burning Decision Notice (1997): This DN includes using prescribed fire to improve big game winter range, reduce fuels, and improve ecosystem health on about 2,998 acres in eight treatment units (see Project File). Five of the eight units are within the Marshall Woods project area boundary, and the other three units are adjacent to the boundary. Implementation was planned for a period of five to 10 years dependent on funding and burning conditions. Of the five units within Marshall Woods project area, Unit 2 (1,106 acres) was implemented in 1997. The Marshall Woods Proposed Action includes treatment units that overlap the Rattlesnake NRA Wildlife Habitat Improvement and EMB units although most of the treatments proposed in this analysis are more comprehensive (see Table 2 below).

Table 2. Rattlesnake NRA Wildlife Habitat Improvement project units and Marshall Woods units

Rattlesnake NRA Wildlife Habitat Improvement and EMB Decision Notice		Marshall Woods Restoration Project EA	
Unit	Treatment	Unit	Proposed Treatment
2	EMB	2, 3, 65, 71, 101	Thinning and prescribed fire Non-commercial thin and underburn Non-commercial thin, hand/machine pile and underburn EMB
5	EMB	62	Non-commercial thin and underburn
6	EMB	62	Non-commercial thin and underburn
7	EMB	61	Non-commercial thin and underburn
8	EMB	60	Non-commercial thin and underburn

The decisions made in the Rattlesnake NRA Wildlife Habitat Improvement and EMB Decision Notice will occur regardless of the decisions made in this analysis; they are included in the No Action Alternative for this analysis, and they are discussed as reasonably foreseeable actions in the cumulative effects analysis for this project.

Section 31 Decision Memo (2008): This DM included multiple components (see PF), many of which have already been implemented. The DM included the obliteration (i.e., decommissioning by recontouring) of three road segments totaling about 1.2 miles, which have not been implemented.

Section 31 was acquired in 1999 from Plum Creek Timber Company (and prior to PCTC was formerly owned by Champion International) and it has been heavily logged and roaded. The decommissioning work was delayed since it was known that the Marshall Woods project was upcoming and the three roads might be needed to implement potential vegetation management treatments prior to decommissioning. Decommissioning these three road segments will occur regardless of the decisions made in this analysis; these activities are included in the No Action Alternative for this analysis, and they are discussed as reasonably foreseeable actions in the cumulative effects analysis for this project.

PURPOSE AND NEED FOR ACTION

This project is proposed to address the following four objectives:

1) **Restore functioning ecosystems by enhancing natural ecological processes.**
    a. Maintain and enhance resilience and resistance of vegetative communities while ensuring visual quality.
    b. Maintain and enhance terrestrial habitats for forest vertebrates.
    c. Maintain and enhance aquatic habitats and water quality.

a.) The forested vegetation patterns visible today within the Marshall Woods area were shaped primarily by human-caused events. Namely, extensive timber harvest, settlement and occupation of the Rattlesnake Valley, a large scale human-caused fire in 1919, and subsequent timber harvest by Montana Power Company in the 1950s and 1960s, all prior to Forest Service ownership of these lands, led to the establishment of much of the forests that occupy the analysis area. Additionally, Champion Timber and Plum Creek owned three sections of land until the 1990s and 2000s, respectively, managing them as industrial timber lands as recently as the last decade.

The fire of 1919 and continued use and occupation by homesteaders until 1937 resulted in conditions consistent with the stand initiation (regeneration) phase of stand development over a large portion of the analysis area (Oliver and Larsen, 1996). The type, size, scale, arrangement, duration, intensity and species affected in subsequent disturbance events will dictate how forest development patterns emerge within the analysis area. Following 95 years since the most significant disturbance, much of the forested area has moved into the stem exclusion phase of stand development. During stem exclusion, intense inter-tree competition precludes the establishment of most new individuals (Oliver and Larsen, 1996). Much of the forests within the Marshall Woods area are presently experiencing extreme physiological competition, consistent with stem exclusion, and corresponding losses to insects and disease due to poor vigor and resilience to insect attack and root disease. Shade-intolerant pines are losing live crown ratio, thinning from the center and experiencing increasing losses. As ponderosa pine crowns thin, more diffuse light reaches Douglas-fir or other shade-tolerant species in the understory allowing their survival. Over time, the competitive advantage shifts to Douglas-fir as pines struggle with the demands placed on their limited photosynthae and succumb to insects, disease, and competition (Oliver and Larsen, 1996).

Without frequent low intensity fire as a disturbance agent, over time, these forested lands shift towards, overstocked stands with an increasing shade-tolerant Douglas-fir component. This vastly increases susceptibility to root disease, spruce budworm, and bark beetles. The Douglas-fir response in the understory has resulted in considerable ladder fuel accumulations. Mortality from ensuing insect and disease losses increases surface fuel loading and the potential for severe fire behavior. Growing space freed by mortality would be occupied by existing cohorts onsite or, depending on the level of disturbance, facilitate the establishment of a new one. These conditions predispose stands to stand-replacing fire events and insect and disease epidemics (Graham et al., 2004).

b.) A variety of habitat types are present for wildlife on the Marshall Woods landscape. Lower elevations along Rattlesnake and Marshall Creeks provide habitat for riparian-associated species. South-facing slopes generally provide open, dry grass/shrublands interspersed with open, dry forest types where ponderosa pine and Douglas-fir are dominant. In some areas, these warmer aspects provide scattered large diameter trees with grassy understories, providing habitat for species such as flammulated owls, pileated woodpecker, elk, mule deer, and others. Cooler aspects are also often dominated by Douglas-fir or ponderosa pine, with lodgepole pine intermixed, and shrub understories (ninebark, snowberry, huckleberry). These areas provide habitat for a number of birds and mammals, including grouse, black bear, and summer habitats for deer and elk. The high elevation areas at the heads of the Rattlesnake and Marshall Creek watersheds support subalpine fir, lodgepole, and Englemann spruce forests which provide summer habitat for big game and year-round habitat for multiple species including snowshoe hare and lynx. Vegetation management activities included in the Marshall Woods project are designed to maintain and enhance these terrestrial habitats.

In addition to providing a variety of vegetation types, the Marshall Woods project area provides structural vegetative diversity with varying canopy covers. Nearly half of the area used to evaluate the project's potential effects on wildlife is covered by relatively dense forest (>=40% canopy cover), which provides habitat for species that prefer more closed-canopy forests for portions of their life-cycles (i.e., goshawks). Much of the analysis area consists of drier forest types (ponderosa pine/Douglas-fir), which under natural fire regimes would have low-to- moderate (25-39%) canopy cover. Given that many of these stands currently have dense canopies, they do not currently provide optimal habitat for wildlife species that evolved to live in these forest types (e.g., flammulated owls). In the past several decades, disturbance has been minimal in the project area, and many of the stands in the drier habitats that typically would have received non-lethal fires at 5-50 year intervals are grown in with dense seedling/sapling thickets that reduce the nesting and foraging potential for open forest associates, particularly flammulated owls. Without active management, in the long term wildlife diversity could be decreased due to the lack of disturbance, resulting in decreased habitat and forest resilience.

c.) Road-stream crossing function, stream channel conditions, channel connectivity, and fish habitat on the Lolo NF have been improved in recent years through completion of several watershed improvement activities. Both on and off-Forest, the Rattlesnake watershed has been the focus of a number of projects. Since 1999, the Forest Service has replaced four culverts with bridges on upper Rattlesnake tributaries. Four irrigation diversions on lower Rattlesnake Creek have had new or updated fish screens installed. In 2001, restoration partnership efforts addressed fish passage at the Rattlesnake main water supply dam with the installation of a fish ladder. In 2002, the City of Missoula and the Greenough Park Advisory Committee sponsored a project on Lower Rattlesnake Creek that reconstructed a side channel of the creek and improved floodplain access. In 2010, the City of Missoula completed mainline construction on the Rattlesnake Valley Sewer Project, a special improvement district to connect the remaining homes in the Rattlesnake to sewer (replacing densely packed septic tanks). Most recently, in 2014 the Forest improved a small area along the Spring Gulch trail that was actively eroding into the creek, and improved and stabilized an area of intensive recreation use and trampling on Rattlesnake Creek near the main Rattlesnake trailhead to minimize a chronic sediment source (see Figure 2). Montana Fish, Wildlife and Parks have been working to improve fish passage and habitat in the Marshall Creek watershed, some of which has involved private landowners. These efforts include a fish ladder at the mouth, two culvert replacements on private property, a fish screen, large woody debris additions in four reaches, and riparian fencing on private property.

Figure 2. Recreation-based bank stabilization projects completed in 2014 to protect stream habitat within the project area.

Rattlesnake Creek user-created access point before and after bank stabilization and revegetation treatments to limit expansion of the area and reduce bank erosion (below).

Spring Gulch trail before and after bank stabilization treatments using native materials to reduce bank erosion (below).

The Marshall Woods action alternatives would help build on these water resource improvements in several ways. The proposed road upgrades, maintenance, storage, decommissioning, and culvert removals and/or replacements would help to reduce surface sediment inputs into streams in the long term. The proposed resizing of culverts, culvert removals, and proposed road decommissioning would minimize the long-term risk of mass failure and major sediment delivery following an episodic 'pulse' event (e.g., high intensity precipitation event). Proposed silvicultural treatments could help return water yield to historic levels.

2.) Emulate fire's natural role on the landscape through vegetative treatments including prescribed fire.

a. Promote ecosystem health with prescribed fire to distribute beneficial fire effects to areas within the wildland-urban interface (WUI).
b. Integrate project objectives with the Missoula County Wildfire Protection Plan (CWPP).
c. Decrease high intensity wildfire potential; enhance firefighter efficiency and safety within the WUI.

The Marshall Woods Restoration project is designed to promote ecosystem health and decrease high intensity wildlife potential which aligns with multiple initiatives including the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy). This is a bold, new national approach to the increasingly complex reality of wildland fire, land management, and fire response. The Cohesive Strategy was developed in response to growing concern over mounting annual costs of fighting wildfires, devastating wildland fire losses to communities, and concern about overall landscape health. The Cohesive Strategy recognizes that fire is a natural process, necessary for the survival of many ecosystems, and focuses on attempting to reduce the conflict between fire-prone landscapes and people. The Cohesive Strategy takes a holistic approach by simultaneously looking at the role of fire in the landscape, the ability of humans to actively manage these landscapes, plan for and adapt to living with fire, and the need to be prepared to respond to fire when it occurs. One of the primary tools to achieve the goals of the Cohesive Strategy is Community Wildfire Protection Plans (CWPP). Missoula County CWPP (2005) is a county level document emphasizing collaborative efforts to reduce hazardous fuels. The CWPP has an overall rating for communities based on two subcomponents: wildfire risk and human safety factors. Wildfire risk is based on critical infrastructure, water supplies, transportation corridors, fuels, slope, and facilities. Human safety risk factors are based on population density, critical egress, and fire response capabilities. The combination of these two risk factors establishes the overall risk rating. The overall risk rating for the Rattlesnake portion of the Marshall Woods Project is second out of eight areas at high risk for wildfire impacts.

The Marshall Woods area has unique fire management considerations which include: multiple high values-at-risk, the project's physical orientation on the landscape and its relation to the prevailing winds, and the potential for increased wildfire behavior with time. The Marshall Woods project area includes numerous residences mainly within the southwest portion. Within the project area there are approximately 10,164 acres under multiple ownerships that are deemed WUI. Fuels treatments within 1.5 miles of private ownership are needed to reduce the potential for crown fire initiation and fire intensities. Many of these private lands are adjacent to or near NFS lands proposed for treatment in the Marshall Woods project.

The project area's physical landscape orientation in relation to the prevailing winds is noteworthy. The Rattlesnake and Marshall drainages run to the south and southwest. This is the inverse direction of the prevailing winds as indicated from Missoula and Point 6 Remote Automated Weather Stations (RAW Data 1984-2008 from LNF Wildfire Guidebook 2010). The combined effects of topography, prevailing winds, and daytime up-valley and upslope winds could quickly escalate fire behavior leading to significant control problems in the WUI in the Marshall Woods project area.

The landscape around the project area has seen several large fires since 2003. The Lolo Complex, West Riverside, Black Cat, Black Mountain, Mineral Prim and Cooney Ridge fires have burned over 75,000 acres causing significant impacts to Missoula and the WUI.

While the Rattlesnake WUI along with additional private land and developments dictate significant values-at-risk to fire management, other values-at-risk within the project area include the Rattlesnake National Recreation Area and its associated trails/developments as well as overhead powerlines. Values-at-risk adjacent to and outside the project area include Mineral Peak Lookout, Sawmill Gulch Trailhead, Macro Flats fishing access, Sha ron fishing access, the Rattlesnake Wilderness Area and the Missoula Municipal Watershed. It is highly probable recreationists could be utilizing these lands during the beginning stages of some future, escalating wildfire even, which could significantly elevate the fire operation’s complexity.

Studies indicate the most appropriate fuel treatment strategy for reducing hazardous fuels includes forest thinning (removing ladder fuels and decreasing tree crown density) followed by prescribed burning, piling and burning of fuels, or other mechanical treatments (e.g., Peterson, 2005). Other research shows that treating areas before fire begins can decrease the severity of fire (Strom and Fule, 2007; Peterson, et. al, 2005; Omni and Martinson, 2004; Agee and Skinner, 2005; Graham, 2004; Pollet and Omni, 2002; Fule et. al 2001). However, in extreme weather conditions, such as drought or very high winds, fuel treatments may do little to mitigate fire spread or severity (Pollet and Omni, 2002).

Treatments on NFS lands in the project area would reduce potential fire intensity and crown fire potential, but may not directly protect all homes. Wildfire mitigation focused on structures and their immediate surrounding may be the most effective at reducing structure ignitions (Cohen, 1999, 2000, and 2002; Scott, 2003). In 2001 the Missoula County Fire Protection Association (MCFPA) spearheaded a partnership project to reduce high hazard fuel buildups on private land in the Rattlesnake Creek and Grant Creek subdivisions. The goal of this project was to reduce Douglas-fir encroachment around homes in the targeted area using the assistance of the homeowners and agency partners. The intention was to help reduce the potential for crown fires, additionally, in conjunction with other local projects, to create a fuel break between NFS lands and private property. From 2001 through 2002, thirty Rattlesnake homeowners took part, and 220 Grant Creek homeowners participated.

While individual home-by-home treatments can help reduce the risk of structure loss, relying solely on such treatments could forego strategic opportunities for suppressing wildfires within the WUI. Although homes in the path of wildfire are often the most recognized value-at-risk, treatments need to go beyond the areas immediately surrounding individual homes to protect other resource values that make up the forested setting including soil stability, wildlife habitat, water quality, timber value, and landscape aesthetics (Graham, 2004).

Studies have found that the loss of structures and other resource damage from wildfires can be limited by fuel treatments conducted prior to fires (Graham, 2009). In addition to modifying wildfire intensity, the severity of effects to vegetation and soils in previously treated areas can be lower than in areas not treated prior to wildfire. Studies have also found that by modifying fire behavior, lower impact suppression methods can be used. Because of the lower burn intensity in treated areas, firefighters can more readily suppress spot fires ignited ahead of the wildfire. Therefore, fuel treatments, like those proposed in this project, can be used to create irregular forest structures and compositions that produce forests that are more resilient to wildfire.

3.) Provide education opportunities to build support for restoration.

a. Provide examples of forest restoration activities for education and interpretation (e.g., develop brochures for self-guided tours of treatment areas, use local news media, interpret sites within the Upper Rattlesnake Historic district along with the project implementation, etc.).

The Marshall Woods Restoration project has been developed collaboratively with the Lolo Restoration Committee, which is primarily a volunteer consensus-based group that was formed in 2007 to help guide the restoration of Montana's National Forests in partnership with the U.S. Forest Service. The group's mission is guided by 13 restoration principles that they developed to help guide the restoration process in Montana (visit http://www.montanarestoration.org/). These principles include engaging community and interested parties in the restoration process to enhance the ability to achieve restoration on the ground. They also include enhancing education activities to build support for restoration. The Marshall Woods project area was intentionally selected to showcase restoration activities because of its proximity to Missoula and the high level of use it receives. For these reasons and because the project area includes a National Recreation Area whose associated management direction and Forest Plan guidance includes providing opportunities for environmental education and interpretation, this project will demonstrate restoration activities and build support for restoration.

4.) Provide for diverse trail-based recreation opportunities and reduce road density in Section 31, consistent with NRA management plan.

Section 31 was acquired from Plum Creek Timber Company (PCTC) in 1999. Prior to coming into NFS land ownership, it was managed as industrial timberland by both PCTC and Champion International, and it has been heavily logged and roaded. Because this section is surrounded by the Rattlesnake NRA on three sides, the decision was made to manage the area in such a way to bring it to a similar condition as the adjacent NRA. While the existing land forms and features (such as roads) do not reflect this management area direction fully, the Lolo NF feels this is the appropriate management direction for the section due to its proximity to the NRA and current recreational use.

This area is a special place for mountain bikers, hikers, horseback riders, hunters and neighboring landowners. A road and trail rehabilitation project was initiated in 2008 which took a landscape scale look at roads and trails in this section in order to identify how best to do some rehabilitation and naturalization in this parcel as well as address reported conflicts between mountain bikers and hikers. Following public involvement and analysis, the resulting decision included obliterating numerous road segments and building a new trail to connect existing trails (Section 31 DM, 2008 – Project File). The Marshall Woods project builds on these efforts by affirming the decision to implement portions of the 2008 decision that have not yet been implemented and including additional activities to manage the roads and trails in this section.

Proposed Action

The Proposed Action served as a starting point for the interdisciplinary (ID) team of Forest Service resource specialists and gave the public and other agencies specific information on which to focus comments during scoping (August, 2010). Using these comments, additional field reconnaissance, and preliminary analysis, the ID team later modified the Proposed Action, which became Alternative B, as described in Chapter 2 and analyzed in Chapter 3 of this document. The more noteworthy changes between the Proposed Action and Alternative B as presented in this EA include:

- Minor changes in treatment acres and road miles due to additional field reconnaissance.
- Dropping Unit 83, which had been proposed for young stand thinning and prescribed burning, because it was determined to be Canada lynx habitat.
- Removing 10 acres in the northern tip of Unit 81, which was proposed for young stand thinning and prescribed burning, because it was determined treatment would not comply with RNRA Opportunity Class 2 standards (refer to the Forested Vegetation Specialist's Report). This change is not displayed in the vegetation treatment tables or acknowledged in the effects analysis for most resources as this was discovered late in the analysis process and reflects a minor change resulting in decreased effects. See Table 10 - Resource Protection Measure #31 in Chapter 2.
- Removing the proposed obliteration of 4.9 miles of illegally user-created trails in the north portion of Section 36 (T14N, R19W) because this work can be done without analyzing and approving it in conjunction with this project (and some of the work has been done already).
- Removing the proposed streambank rehabilitation on Rattlesnake Creek next to the horse trailhead bridge on Road 99/Trail 515 from this project because this work could be done without analyzing and approving it in conjunction with this project (and the work was completed in Spring 2014).
- Adding a site-specific Forest Plan amendment for a Management Area designation correction in Section 33.
- Changing the slashing diameter for the noncommercial thinning and underburning units (i.e., Units 60-66) from less than 8" diameter at breast height (dbh) to less than 10" dbh based on past experience with similar treatments which has shown that slashing to a 10" dbh is more effective in meeting project objectives (e.g., providing adequate large coarse wood debris and growing space for residual trees).

Alternative B, as presented and analyzed in this EA, is briefly summarized in Table 3 below and shown on Figure 11.

Table 3. Marshall Woods Alternative B

Activity	Amount
Proposed Vegetation Treatments (acres)	
Thinning Treatments and Prescribed Fire	740
Ecosystem Maintenance Burning Preceded by Understory Slashing or Thinning	1275
Non-commercial Thinning and Underburning	(961)
Non-commercial Thinning and Hand/Machine Piling and Burning	(314)
Young Stand Thinning and Prescribed Fire	477
Non-commercial Thinning and Handpiling and Burning	248
Meadow and Aspen Restoration	40
Ecosystem Maintenance Burning (no slashing, thinning or other tree cutting)	729
Total proposed treatments (acres)	3,509

Other Proposed Vegetation Treatments (acres)	
Site preparation and tree planting	450
Noxious weed treatments (ground-based, aerial, and biological control)	760
Ground-based and/or aerial noxious weed treatments on NFS land in Sections 1 and 12 (T13N, R18W)	160
Yarding Systems (acres)	
Ground-based yarding only	225
Skyline yarding only	140
Skyline/Ground-based yarding	375
Estimated timber harvest volume (mmbf)	1.7
Proposed Road and Trail Treatments (miles)	
Decommission Unneeded Road	7.4
Add existing road to official road system (not stored)	1.1
Add existing road to official road system and store until needed	4.8
Convert road to trail	1.4
Store system roads until needed	1.9
Re-align, add to official road system, and store	0.1
Add existing trails to official trail system	0.4
Construct system trail to connect Road 53414 (to be converted to a trail) to Road 2122	0.2
Construct Temporary Road	1.0
Reconstruct Nonsystem Road as Temporary Road	0.1
BMP/maintenance	9.8
Other Road/Stream Channel Treatments (each)	
Upgrade the culvert on Rd. 2122 just past the junction with the Marshall Canyon Road (Rd. 357) to allow fish passage and accommodate Q100 flows	1
Improve drainage on Rd. 17150 near Woods Gulch Trailhead (about 0.25 mile) (e.g., road blading and shaping, installing water bars and drainage dips).	0.25 mi.
Site-specific Forest Plan Amendments	
Visual Quality Objective of Retention in Rattlesnake NRA would not be met in short-term.	
Management Area Designation Correction is needed in Section 33.	

Regulatory Direction

Forest Service Manual (FSM) 2020 provides foundational policy for using ecological *restoration*[2] to manage National Forest System lands in a *sustainable*[3] manner. The aim is to reestablish and retain ecological *resilience*[4] of NFS lands and associated resources to achieve sustainable management and provide a broad range of *ecosystem services*[5]. Healthy, resilient landscapes will have greater capacity to survive natural disturbances and large-scale threats to sustainability, especially under

[2] The process of assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed. Restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions (FSM 2020.5).

[3] Meeting needs of the present generation without compromising the ability of future generations to meet their needs (FSM 2020.5). Sustainability is composed of desirable social, economic, and ecological conditions or trends interacting at varying spatial and temporal scales, embodying the principles of multiple-use and sustained-yield (FSM 1905).

[4] The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks (FSM 2020.5).

[5]5 **B**enefits people obtain from ecosystems (FSM 2020.5).

changing and uncertain future environmental conditions, such as those driven by climate change and increasing human uses (FSM 2020.20).

The Northern Region Overview (1998) sets priorities for ecosystem restoration and focuses the Forest Service Natural Resource Agenda to the NFS lands of the Northern Region. For forest vegetation, the overview establishes indicators of risk to the proper functioning conditions of this ecosystem. Risk indicators include: (1) the loss of species composition at the cover type level, (2) the change in landscape level fragmentation, and (3) stand level structure as measured by density and seral stage/size class distribution. The overview also describes the importance of restoring ponderosa pine, western larch, and whitebark pine (USDA, 1998).

The Forest Service Roadmap for Responding to Climate Change (2010) identified the agency's management response as threefold: (1) adaptation, (2) mitigation, and (3) sustainable consumption. The agency is responding to climate change through adaptive restoration—by restoring the functions and processes characteristic of healthy ecosystems, whether or not those systems are within the historical range of variation. Through restoration, conditioning and repairing the key functions of ecosystems across landscapes so that they can withstand the stresses and uncertainties associated with climate change.

Adaption strategies include: (1) Building resistance to climate-related stressors [6] such as drought, wildfire, insects, and disease; (2) Increasing ecosystem resilience by minimizing the severity of climate change impacts, reducing the vulnerability and/or increasing the adaptive capacity of ecosystem elements; and (3) Facilitating large-scale ecological transitions in response to changing environmental conditions. Resistance strategies are for short-term protection of high-value resources. Resilience strategies are longer term and broader in scale, designed to help ecosystems return to a healthy condition, often within the historic pattern of stressors. Transitions are the longest term approach, responding to changes in environmental conditions and a concomitant need for ecosystems to adapt by moving or changing, often adopting a trajectory beyond the historical conditions (USDA, 2010).

Activities proposed in the Marshall Woods Restoration Project tier to the 1986 Lolo Forest Plan, which provides guidance for managing the Forest. Treatments are primarily proposed within MAs 1, 13, 16, 19, 23, 25, and 28. Table 4 summarizes the Forest Plan Management Area direction for the project.

[6] Any physical, chemical, or biological entity that can induce an adverse response (Joyce et a,. 2008)

Table 4. Management Areas Within the Marshall Woods Project Area Boundary

Reference	Goal
MA 1 – Non-forest (Forest Plan, page III-2)	Maintain near-natural conditions.
MA 13 - Riparian (Forest Plan, page III-56)	1. Manage riparian areas to maintain and enhance their value for wildlife, recreation, fishery and aquatic habitat, and water quality. 2. Provide opportunities to improve water quality, minimize erosion, and strengthen or protect streambanks through specifically prescribed vegetation manipulation and/or structural means. 3. Provide opportunities to improve fisheries and wildlife habitat through specifically prescribed vegetation manipulation and/or structural means. 4. Provide for healthy stands of timber and manage timber to give preferential consideration to riparian-dependent species on that portion of the management area classified as suitable for timber production.
MA 16 - Timber Management (Forest Plan, page III-70)	1. Provide for healthy stands of timber and optimize timber growing potential. 2. Develop equal distribution of age classes to optimize sustained timber production. 3. Provide for dispersed recreation opportunities, wildlife habitat, and livestock use. 4. Maintain water quality and stream stability.
MA 19 – Wildlife Winter Range (w/o roads) (Forest Plan, page III-78)	1. Optimize deer, elk, and sheep winter range. 2. Provide opportunities for dispersed recreation.
MA 23 - Partial Retention (Forest Plan, page III-112)	1. Achieve the visual quality objective of partial retention. 2. Provide optimal cover:forage ratios for deer, elk, and bighorn sheep winter range within the constraints of Goal 1. 3. Maintain healthy stands of timber within the constraints imposed by Goals 1 and 2.
MA 25 - Partial Retention (Forest Plan, page III-127)	1. Achieve the visual quality objective of partial retention. 2. Provide for healthy stands of timber and optimize timber growing potential within the constraints imposed by Goal 1, while providing for dispersed recreation opportunities, wildlife habitat, and livestock use.
MA 28 –Non-wilderness Portion of Rattlesnake NRA (Forest Plan, page III-144)	1. Provide for a wide variety of dispersed recreation opportunities in a forest setting available to a wide segment of society (i.e., hiking, camping, backpacking, hunting, fishing, horseback riding, and bicycling). 2. Provide for acceptable levels of water quality in the municipal watershed. 3. Provide opportunities for environmental education and interpretation. 4. Provide for management of wildlife habitat, historical, scientific, ecological, and other values in a manner consistent with recreational objectives.

Decision Framework

This assessment discloses the environmental consequences of implementing No Action (Alternative A), Alternative B, Alternative C, and Alternative D. The Deciding Official reviews the anticipated consequences of the alternatives to determine whether a significant effect on the quality of the human environment is likely to occur (FSH 1909.15, Chapter 40, Part 43.1). If the Deciding Official determines that the Selected Alternative would have a significant effect on the quality of the human environment, an environmental impact statement (EIS) would need to be prepared. If not, then the Deciding Official would evaluate and choose a project alternative based on the following criteria:

- The extent that each alternative addresses the purpose and need for action;
- Consistency with the goals and finding of Forest policy, including standards, goals, and objectives of the Forest Plan and legal mandates;
- How an alternative addresses environmental issues and concerns identified by the public, other resource management agencies, and Forest Service resource specialists; and
- Effects of the Selected Alternative relative to other alternatives considered.
- Details of the Deciding Official's decision will be disclosed in the DRAFT Decision Notice and associated Finding of No Significant Impact (FONSI). These will be distributed to interested publics and made available via the internet on the Lolo National Forest's website fs.usda.gov/goto/lolo/projects.

Public Involvement

The Council on Environmental Quality (CEQ) defines scoping as "….an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action" (40 CFR 1501.7). Scoping is to begin early and continues until a decision is made.

The Marshall Woods project has been developed in collaboration with the Lolo Restoration Committee (LRC). The LRC, which is a diverse group of local volunteers including representatives of environmental organizations, motorized users, outfitters, timber industry, state government, and the Forest Service, was formed in 2007 and is a private initiative not convened or managed by the Forest Service. The LRC has collaborated with the Lolo National Forest (LNF) on several restoration projects. To learn more about the LRC and its parent organization, the Montana Forest Restoration Committee (MFRC) visit http://www.montanarestoration.org/home .

In 2008 as part of the LNF's collaborative efforts with the MFRC, then Forest Supervisor Deborah Austin agreed to provide an opportunity for the LRC to select a project area for restoration activities. Project area selection was identified by the MFRC as an important tool for developing community support for forest restoration and management. Developing projects that are consistent with the MFRC's 13 Restoration Principles was also identified as important to gaining support for forest management activities

In response, LNF resource specialists and LRC members examined several areas across the Missoula and Ninemile Ranger Districts for restoration opportunities. After careful deliberation, the Marshall Woods project area was selected by the LRC because of its close proximity to the City of Missoula and unique opportunities to conduct forest restoration treatments within a National Recreation Area (NRA).

In September 2009, an Interdisciplinary Team (IDT) was assembled to evaluate resource opportunities in the project area. In February 2010, the Missoula District and the LRC jointly hosted two open houses to introduce the project and collect ideas to formulate the proposed action. During the public scoping period, the LNF and LRC jointly hosted two public field trips to share information about the proposals on the ground and collect comments and ideas. Collaborative work with the LRC has been ongoing and will continue throughout the planning for this project as well as into project implementation and monitoring.

Marshall Woods Project Public Involvement Summary

- January 30, 2009- LNF resource specialists and LRC members met to examine areas across the Missoula and Ninemile Ranger Districts for restoration opportunities.
- May 26, 2009 - LNF resource specialists and LRC members met at the project area to discuss potential restoration opportunities.
- February 3 and 24, 2010 – LNF and LRC jointly host public open houses to introduce the Marshall Woods project and collect ideas to formulate the proposed action. Postcards were delivered by mail carriers through a local directory service to 1,724 residences, which included 664 homes in the the Fox Farm, Lincoln Hills and Rattlesnake Drive areas; 410 residences in the upper Rattlesnake (Sawmill, Wood's Gulch, etc.) and 650 houses mostly located up Duncan Dr.
- August 3 and 5, 2010 - LNF and LRC jointly host public field trips to the Marshall Woods project area to share information about the proposals and collect comments and ideas (see Figure 3).
- August 23, 2010 - Scoping letter sent to 91 individuals, organizations, agencies, and the Nez Perce and Confederated Salish and Kootenai Indian Tribes. The legal notice, published in the *Missoulian*, ran concurrently with the scoping letter. Thirty-nine comments were received.
- In addition, as part of the public involvement process:
- The Marshall Woods project was listed in the Lolo NF Schedule of Proposed Actions website and publicly distributed since March 2010 through quarterly reports.
- Information about the project (e.g., scoping letter, maps) is posted on the Lolo NF Plans and Projects webpage.

Figure 3. Field trip participants discuss streambank conditions on Rattlesnake Creek.

Key Issues

In response to scoping, the Forest received 39 comments from the public. Some of those who commented support the project, although several expressed specific concerns and desires about the project. Based on comments received during scoping, preliminary issues were identified as well as potential effects that might result from implementing the proposal. Further analysis and project development addressed comments either by developing project design criteria and resource protection measures to avoid, offset, or reduce any potential effects of the project; developing and evaluating alternatives; incorporating the comment into the analysis to check and confirm that no significant effects would be caused by the treatments; or explaining why the comments did not warrant further agency response.

Below are public concerns which were addressed through developing alternatives to the Proposed Action. Other concerns are addressed in the effects analyses under the environmental consequences sections of the Specialists' Report and the EA. A content analysis of the comments and the disposition or summary of the analysis of those comments is located in Appendix C.

Concern: Proposed treatments in the Rattlesnake NRA including concerns about: truck transportation of logs conflicting with wildlife and recreation use; perceived inconsistency of road improvements and truck use with RNRA management goals; and potential effects to the area's character.

Response: Some of the thinning and prescribed burning (2,305 acres) included in Alternative B is proposed in the RNRA. Overall management direction for the RNRA and Wilderness (RNRAW) is established in the Lolo Forest Plan. The Plan provides standards for managing the resources in the RNRA, including visitor use, wildfire, insect and disease control, range, and wildlife and fisheries resources. Within the framework of the Limits of Acceptable Change based Management Direction (USDA, 1992), which is part of the Forest Plan, there is specific direction with respect to managing resources in the RNRA. While actions proposed in this restoration project were designed to comply with management direction in the Lolo Forest Plan as amended by the Limits of Acceptable Change based Management Direction, a site-specific Forest Plan amendment would be needed for this project because not all of the proposed treatments would meet the Visual Quality Objective (VQO) of "Retention" in the short-term. This Forest Plan amendment is discussed in more detail in Chapter 2.

In response to the concerns about potential impacts to the RNRA, numerous resource protection measures were developed to avoid, offset, or reduce potential effects of the project in this and other locations in the project area. In addition, Alternatives C and D were developed which do not include removing logs or biomass along FR99/Trail 515 in the main Rattlesnake corridor (see Chapter 2 for a description of these alternatives) therefore addressing concerns about truck transportation of logs, the level of road improvements needed, and potential effects to the area's character.

Concern: A concern was expressed that temporary road construction and use could have the same long lasting and significant ecological effects as permanent roads; and these roads could potentially be "reconstructed" if needed in the future.

Response: Constructing approximately one mile of temporary road is included in Alternatives B and C. This would consist of 3 short segments (1,200 to 2,400 feet long) which are needed to remove the commercial material in Units 4, 5, and 6. These roads would be used for a period of one or two years and then obliterated. The effects of constructing and using these roads are disclosed in the effects analysis. Alternative D was developed to address this concern and includes no temporary road building. Consequently, no commercial material would be removed from Units 4, 5, and 6 under Alternative D and the units would be treated by non-commercial thinning and handpiling and burning and underburning only.

Chapter 2 Alternatives

Introduction

The focus of this chapter is to describe and compare the alternatives considered for the Marshall Woods Project under the National Environmental Policy Act (NEPA, 40 CFR 1502.14). Section 1500.2(e) of the NEPA requires the Forest Service to develop, describe, and study reasonable alternatives to the proposed action and help minimize or avoid adverse impacts on the quality of the human environment in the NEPA process.

The ID Team developed alternatives in an iterative process. Alternative development and evaluation responds to key issues identified in the public and internal scoping processes, and does not necessarily attempt to eliminate every commenter's concern.

This chapter also includes Resource Protection Measures and monitoring activities which would occur with implementation of a decision. Alternative maps are located at the end of this chapter (Figure 11, Figure 12, and Figure 13). Please visit our website at fs.usda.gov/goto/lolo/projects for larger, easier to view maps online.

Alternatives Considered but Eliminated From Detailed Study

Alternative N

This alternative was created in response to a comment that expressed the desire to leave Road 99/Trail 515 "as is", and it does not include any road maintenance or BMP work as is included in Alternatives A, B, C, and D. This alternative was considered, but not in detail because road maintenance is necessary to prevent damage to facilities, maintain safety, and to preclude adverse impacts to resources. The Forest Service conducts routine road maintenance activities based on prioritization and available funding. Road99/Trail515 is within a priority watershed and routine maintenance is necessary.

Alternatives Considered in Detail

Four alternatives were studied in detail: Alternatives A, B, C, and D.

Actions Common to All Alternatives

Maintenance and BMP work will be performed on the first 3.7 miles of the main Rattlesnake corridor Road 99/ Trail 515 and includes:

- Roadside brushing for safety and to enhance operational feasibility. It would be kept as naturally appearing as possible. Limbing saws would be used to a maximum of 10 feet in height in Alternatives A, C, and D and 14 feet in height in Alternative B (to allow log haul). In general, trees larger than 6" dbh within 3 feet from the driving surface would not be cut. Slash would either be hand-piled or treated in the same manner as adjacent treatment areas. Slash could also be used for building slash filter windrows near creeks in areas where needed.
- Stream access would be eliminated at MP 0.3 and 0.315 (which is an existing crib wall location on both sides) by placing slash on these areas.
- Stream access at the Spring Creek Bridge (MP 0.50) would be maintained but the surface would be hardened by reinforcing the abutments (e.g., placing 4-6" rip rap at all 4 quadrants

as shown by the green arrows in Figure 4 below) and vegetation would be transplanted around the stream edge where possible to prevent sediment from sloughing off from these areas into the creek.

Figure 4. Proposed Spring Creek bridge abutment hardening.

- Spot graveling would occur at numerous locations from MP 0.99 to MP 3.35 using ¾ inch minus material. This equals about 10% of the road's length.
- Improve surface drainage by constructing drivable drainage dips (i.e., waterbars) at 4 locations from mile 2.5 to mile 3.4. These drainage features would be constructed so they are easy to negotiate on a bike or a snowmobile with a grooming attachment.
- Over-sized surface cobbles would be removed.
- Bioengineered rip rap (cobbles/boulders angular rock that locks together) and vegetation would be placed on the edges of the abutments of the Frazier Creek Bridge.
- Areas outside the road bed that are disturbed by project activities would be revegetated by seeding and mulching.

This work is needed regardless of any possible timber haul activities included in the Marshall Woods project and is categorized as routine maintenance.

Maintenance and BMP work on other National Forest System Roads and Trails in the project area will continue to occur subject to maintenance objectives and available funding (which does limit the maintenance that is performed).

The above activities are included in this analysis for disclosure purposes and for consideration in the analysis of cumulative effects for this project as reasonable foreseeable actions.

Need for Site-specific Forest Plan Amendment for Management Area Designation Correction – Section 33 of the Marshall Woods project area was acquired by the Lolo NF through the Montana Legacy Project in 2010. The land was formerly owned by Plum Creek Timber Company and was logged in 2003 and again in 2014 after it was purchased by The Nature Conservancy (there was a fiber supply agreement whereby The Nature Conservancy had rights to the timber). Upon acquiring this parcel, Management Areas (MA) were assigned by a team of FS specialists in an office exercise based on management assigned by the Forest Plan to adjacent lands with the intent to update these assignments if subsequent field verification indicated the need to. Following this preliminary designation, field investigations found that the areas in Section 33 assigned MA 23 (winter range, Partial Retention) were not appropriate for that use and the MA assignment of MA 25 (Partial Retention) would be more appropriate. This project includes a site-specific non-significant Forest Plan amendment to correct this MA designation. Due to the heavy logging under prior ownership, this area does not meet the Visual Quality Objective of Partial Retention; however, the activities proposed in this project (e.g., tree planting and road decommissioning) would help the area meet the objective over time.

Alternative A – No Action

Alternative A is the No Action Alternative. The Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14(d)) require that a "no action" alternative be analyzed in every environmental assessment or environmental impact statement. This alternative represents the existing condition against which the other alternatives are compared.

Under the No Action Alternative, no restoration, fuels reduction, or reforestation activities would be implemented to accomplish project goals. However, ongoing forest management activities would continue. The No Action Alternative would not implement the road or trail treatments proposed in this analysis; however, the activities described above under ACTIONS COMMON TO ALL ALTERNATIVES would still occur as well as the ongoing projects in the project area as discussed in Chapter I.

Actions Common to All ACTION Alternatives (Alternatives B, C, and D)

Road and Trail Treatments

All action alternatives include activities to improve the area's road system to optimize future infrastructure needs balanced with reducing roads and their effects on wildlife and aquatic resources. For some of the roads on the recently acquired lands to be kept or added to the official road system, water quality BMPs would be implemented or individual roads or road segments would be placed in Storage (drainage culverts removed and waterways and road surfaces storm-proofed, seeded, etc.) Other management activities proposed include road decommissioning for aquatic and wildlife benefits, and stream crossing replacement to meet Q100 flows (i.e., 100-year flood event) and aquatic organism passage.

All action alternatives also include proposals to provide or enhance diverse trail-based recreation opportunities through providing trail connections by way of adding select user trails to the official trail system, by converting unneeded roads to trails, and by constructing a short trail connector to provide a loop opportunity. The trail treatments are the same in each action alternative.

Travel Analysis Process

Interdisciplinary, science-based process used to inform decisions for managing road systems that are safe, responsive to public needs and desires, affordable and efficiently managed, have minimal negative ecological effects, and are in balance with available funding.

A "Travel Analysis" Process was completed for the Marshall Woods project. The purpose of Travel Analysis is to provide Line Officers with information for: (a) identifying the minimum road system needed for long-term National Forest use and management; and (b) for designation of routes (roads and trails) and areas for motorized travel. Travel analysis is an interdisciplinary, science-based process that identifies opportunities, risks, needs, and priorities relating to the transportation systems for the project area for the Line Officer to consider for further study during the environmental analysis process. This process was particularly important for this project due to the high recreation use and the roads that came with the newly acquired lands (e.g., Sections 31 and 33).

Specifically for Travel Analysis, information is provided to inform decisions for managing road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, have minimal negative ecological effects on the land, and are in balance with available funding for needed management actions.

Recommendations, and ultimately decisions, include consideration of the Lolo NF Plan and interim direction and guidance, mitigation needs and expenses, long-term maintenance needs and expenses (and likelihood of maintenance occurring), travel management enforcement needs, near-term access needs (for example, for recreation, vegetation treatments, or fuel treatments), as well as reasonably foreseeable future access needs (e.g., wildfire suppression access).

To provide guidance for road management during the Marshall Woods environmental analysis process, a numerical rating matrix was developed for individual road segments to disclose issues related to economic values, human uses, and aquatic and wildlife criteria. All of this detail is captured by individual road segmen, in the Travel Analysis documents (see PF, Item K10). Following is a brief summary of the road decommissioning and storage treatments proposed for the Marshall Woods project (other treatments include retain, reconstruct, construct temporary roads, etc.). Approximately 7.4 miles of road (both system and non-system roads primarily located on the recently acquired lands) throughout the project area would be decommissioned and about 1.9 miles (system roads) would be stored under Alternatives B, C, and D (Table 5, and Appendix E).

Decommissioned roads are removed from the transportation system inventory and physically treated depending on condition and location. Some roads would be allowed to "naturally" decommission while others, generally those associated with streams and riparian areas or located on steep slopes and erosive soils, would be recontoured using heavy equipment. Both decommission level 3 and 5 include weed spraying and the application of large woody debris and native seeding.

- Decommission level 3: The entrance is obliterated and the entire road surface is decompacted and stabilized with all drainage-ways restored and culverts removed.
- Decommission level 5: The entire road prism is recontoured and drainage ways are restored.
- Decommission level 3-natural: Roads are deemed stabilized with little to no watershed or aquatic risk and are left "as is" and removed from the Forest road system inventory.
- Stored roads remain on the Forest's transportation system inventory because future use is anticipated. These roads would not be open to motorized public access and usually drainage structures are removed or protected. Storing mitigates watershed, aquatic and wildlife concerns while maintaining flexibility for future use.
- Storage level 3: The surface is decompacted and stabilized, culverts are removed and drainage ways are recontoured.
- Storage level 3–natural: Recontouring of drainage ways and surface decompaction is not warranted, roads are deemed stabilized with low risk to environmental disturbance.

Table 5. Summary Road/Trail Treatments – Alternatives B, C, and D* (see Figure 11, Figure 12 and Figure 13 at end of this Chapter).

Proposed Treatment	Approx. Miles
Decommission unneeded roads	7.4
Add existing road to official road system (not stored)	1.1
Add existing road to official road system and Store until needed	4.8
Convert Road to Trail	1.4
Store system roads until needed	1.9
Re-align, add to official road system, and Store	0.1
Add existing trails to official trail system	0.4
Construct System trail to connect Road 53414 (to be converted to trail) to Road 2122	0.2
Reconstruct non-system road for temporary road (Alternatives B and C ONLY*)	0.1
Construct temporary roads (Alternatives B and C ONLY*)	1.0

* Note: No temporary road construction in Alternative D

In addition to the road treatments described above, one undersized culvert on FS Road 2122 just past the junction with the Marshall Canyon Road (Rd. 357) would be replaced to allow for fish passage and accommodate Q100 flows. Additionally, drainage would be improved on Road 17150 near Woods Gulch Trailhead (about 0.25 miles by road blading/shaping, waterbarring, installing drain dips, etc.).

This project does not include proposals to construct any new permanent roads, although one short section of Road 63233 where it is steep and eroding, right off of Road 19050 in acquired Section 33, is proposed for re-routing to an acceptable grade to prevent continued resource damage.

Noxious Weed Treatments

Noxious weeds would be treated on haul routes, decommissioned roads, landings, and other areas where ground-disturbance occurs as a result of this project (as discussed in Resource Protection Measure #20 later in this chapter). Weeds would also be treated (aerial and ground-based application and bio-controls) on about 160 acres of NFS lands in Sections 1 and 12 (T13N, R18W) subject to the City of Missoula and Montana Department of Fish Wildlife and Parks cooperatively treating their land at the same time to make a logical geographic unit. Weed treatments would occur as follows (see Table 6).

Table 6. Proposed Noxious Weed Treatments

Method of Application	Acres (approx.)
Truck/ATV	78
Backpack	2
Aerial	625
Biological Control	55
Total	760

These treatments would meet Forest Plan Amendment 11, which puts in place a weed control program based on weed prevention through specific management requirements, and reduces the risk of noxious weed spread by treating the transportation system used to access and manage vegetation and roads that would be mechanically stored or decommissioned.

Need for Site-specific Forest Plan Amendment for Visual Quality Objectives in Rattlesnake NRA - Some of the vegetation management treatments included in Alternatives B and C (2,305 acres) are proposed in the Rattlesnake NRA. A Forest Plan amendment is needed for the Marshall Woods project; the amendment is for this project only and would make the following changes to the Lolo National Forest Plan (1987):

Alternatives B and C of the Marshall Woods Restoration Project, specifically the proposed temporary roads, landings, skyline corridors, and commercial vegetation treatment units located within the NRA would not meet the visual quality objectives of *Retention/Partial Retention* specified in the Forest Plan in the short term and so a site-specific Forest Plan amendment is needed. *Retention/Partial Retention* requires that "human activities are not evident to the casual Forest visitor or remain visually subordinate" (US Department of Agriculture. Agriculture Handbook 462. National Forest Landscape Management, v. 2, chapter 1: The Visual Management System, 1974). This objective would not be met and visual effects of project activities would be visible in some areas. Treatments in these areas are designed to maintain a pleasing recreation setting in the long term while getting the area into a more natural sustainable condition so that it could be maintained in the future using only hand thinning and prescribed fire. A portion of the proposed treatments would create a decrease in scenic integrity to the public viewshed for a period of time greater than one year. However, with no treatment, beetle infestation and fire risk could increase over larger portions of the landscape, thus increasing the risk of a reduced scenic integrity for the foreseeable future. Lolo NF land associated with Marshall Woods project Units 2, 3, 4, 5, and 6 assigned *Retention/Partial Retention* visual quality objectives would be dropped one to two levels to *Modification* for a 10-year period.

Alternative B – Proposed Action

Alternative B includes various vegetation treatment activities designed to restore functioning ecosystems by enhancing natural ecological processes, emulate fire's natural role on the landscape through vegetative treatments including prescribed fire, and provide education opportunities to build support for restoration. Alternative B also includes reforestation on land previously under timber industry ownership that was acquired by the Lolo NF in 2010.

Vegetation Treatment

In Alternative B, vegetation treatments would occur on approximately 3,959 acres as follows (see Table 7 below):

- Commercially harvest ponderosa pine/Douglas-fir stands and mixed conifer (western larch, Douglas-fir, ponderosa pine and lodgepole pine) stands on approximately 740 acres using ground-based (tractor) harvest and skyline yarding. Harvest may be followed by thinning or slashing non-commercial understory trees, biomass removal, chipping, mastication, handpiling slash or mechanical removal, and/or prescribed burning. Harvest methods may include thinning from below, single tree selection, creating openings, removing trees to improve species composition and residual tree quality, and removing individual dead, dying, or diseased trees.
- Ecosystem maintenance burn approximately 1,275 acres preceded by non-commercially thinning young stands and then handpiling and burning or machine piling and underburning.
- Ecosystem maintenance burning on approximately 729 acres.
- Non-commercially thin, handpile and burn approximately 248 acres.
- Meadow and aspen restoration on about 40 acres.
- Site preparation and reforestation on about 450 acres.

Table 7. Alternative B - Vegetation Treatment Summary (see Figure 11)

Unit	Silvicultural Prescription	Fuels Treatment	Acres	Logging System
Thinning Treatments & Prescribed Fire				
1	IC	HPB/UB	266	SL/T
2	STS	UB	184	T
3	IC	UB	41	T
4	STS	UB	46	SL
5	STS	UB	94	SL
6	IC	UB	109	SL/T
Subtotal			740	
Ecosystem Maintenance Burning Preceded by Understory Slashing/Thinning				

Non-commercial Thinning and Underburning				
60	STT/EMB	UB	38	N/A
61	STT/EMB	UB	144	N/A
62	STT/EMB	UB	234	N/A
63	Slash/EMB	UB	254	N/A
64	STT/EMB	UB	137	N/A
65	STT/EMB	UB	91	N/A
66	STT/EMB	UB	63	N/A
Subtotal			961	
Non-commercial Thinning and Handpile/Machine Pile and Burn				
70	STT/EMB	HP/MP/UB	85	Excavator*
71	STT/EMB	MP/UB	229	Excavator
Subtotal			314	
Subtotal			1275	
Young Stand Thinning Followed by Prescribed Fire				
80	YST	LS	27	N/A
81	YST	LS	185	N/A
82	YST	LS	230	N/A
84	YST	LS	35	N/A
Subtotal			477	
Non-commercial Thinning & Handpiling & Burning				
90	STT	HPB	106	N/A
91	STT	HPB	73	N/A
92	STT	HPB	69	N/A
Subtotal			248	
Meadow and Aspen Restoration				
100A	Slash/JPB/Fence	JPB/HPB	19	N/A
100B	Slash/JPB/Fence	JPB/HPB	21	N/A
Subtotal			40	
Ecosystem Maintenance Burning				
101	EMB	UB	729	N/A
Subtotal			729	
Site Preparation & Reforestation				
200	Site Prep/Plant	UB/BB/JPB	450	N/A
Subtotal			450	
Grand Total			3959	

IC = Improvement Cut; CT = Commercial Thin; STS = Single Tree Selection; YST = Young Stand Thinning: STT = Small Tree Thinning; LS = Lop and Scatter; EMB = Ecosystem Maintenance Burn; JPB = Jackpot Burn; UB = Underburn; BB = Broadcastburn; MP = Machine Pile; PB = Pile Burn; HPB = Hand Pile and Burn; T = Tractor; SL = Sky Line

* See Table 10 Resource Protection Measure #60: Equipment (e.g., excavator) will be allowed to operate from Road 99/Trail 515/parking lot only (no “cross-country” movement).

Vegetation Treatment Descriptions

Prescribed Fire - Prescribed fire is proposed in all treatment units (approximately 3,959 acres). Nonfire fuel treatments (e.g., **chipping or mastication** which rearranges fuel complexes and also facilitates decomposition and nutrient cycling) may be implemented in conjunction with prescribed fire. Ecosystem Maintenance Burning (EMB) is the treatment of fire-dependent ecosystems to meet multiple resource objectives identified in Forest Land Management Plans. EMBs can be accomplished by a variety to means including **jackpot burning, broadcast burning**, and **underburning**, as described below. Prescribed fire could mean any of the following:

- **Jackpot burning** is a fuel reduction/site preparation treatment in which a continuous fuel bed is not present. Jackpot burning is conducted when fuels tend to be scattered with isolated accumulations distributed across the treatment unit. It is proposed for use in areas where stand conditions necessitate its use to reduce the risk of scorching or stressing residual trees.
- **Broadcast burning** is a prescribed fire burning through a continuous fuel cover. It would be used minimally, in areas with larger fuels where there is less concern for killing or damaging residual trees.
- **Underburning** would be used in areas where the fuel bed is fairly continuous and generally small (≤3" diameter) and conditions are such that fire would spread in a predictable and consistent manner. Underburning implies that there is a live overstory present and often a live understory as well. Underburning would also be used to raise the base height of live crowns, which is desirable to reduce crown fire initiation. Prescriptions for underburning usually include an acceptable mortality level in the live component.
- **Hand piling and burning** provides even greater protection to residual trees, but is more labor intensive and costly. Material is piled by hand and piles are burned under conditions when the risk of fire spread is minimal.
- **Machine (e.g., excavator) piling and burning** provides the same benefits as hand piling and burning, but is utilized to treat larger diameter fuels that cannot be effectively manipulated by hand. Material is piled by machine and piles are burned under conditions when the risk of fire spread is minimal.

Thin and use prescribed fire (740 acres) - These sites are predominantly dense, mid-aged ponderosa pine/Douglas-fir and mixed conifer (western larch, Douglas-fir, ponderosa pine, lodgepole pine) forests (see Figure 5 and Figure 6 and Figure 7). Overstory trees would be thinned to reduce stand density, create structural diversity, favor ponderosa pine and western larch, and increase

Figure 5. Unit 1

vigor and resilience to insects and fire. Some trees would be removed from the site as biomass or other wood products. The proposed treatments include: crown thinning or thinning from below; single tree selection, creating small openings, removing trees to improve species composition and residual tree quality (i.e., improvement cutting), and removal of individual dead, dying and diseased trees. The residual overstory may have some small openings. Understory density and ladder fuels would be reduced through thinning or slashing where necessary to facilitate prescribed burning and protect the overstory from crown fire. Within the unit perimeters, if areas are excluded due to blind leads or harvest system restrictions, they would still be treated non-commercially with thinning or burning applications. Biomass and slash disposal may include a variety of methods such as mechanical removal, mastication, hauling as sawlogs, biomass utilization, disposal on site, piling and burning, burning, or chipping. Individual treatments or a combination of treatments may occur. Sawlog removal would involve ground-based, skyline or helicopter yarding. Removing this material from Units 2 and 3 would require closing the main Rattlesnake Trail (Road 99 / Trail 515) to users for short periods during project implementation.

Figure 6. Unit 1

The thinning treatments are designed to: 1) favor fire and disease-resistant ponderosa pine and western larch first and 2) thin stands from below second. Healthy ponderosa pine and western larch in each canopy layer would be featured and retained over larger, less disease and fire-resistant Douglas-fir. Thinning from below (low thinning) involves removing trees from the lower part of the forest canopy, leaving the largest, healthiest trees to occupy the site. The treatment mimics the mortality caused by surface fire or inter-tree competition and concentrates the site resources to the largest, dominant ponderosa pine and western larch trees. Thinning from below primarily removes overtopped and intermediate trees, trees that are shorter and receive a limited amount of light. In a heavy low thinning, the main canopy may also be thinned to reduce competition, density, and crown fire potential. This type of treatment has been shown to accelerate diameter growth resulting in large diameter trees sooner than no treatment.

Figure 7. Unit 6

Thinning would be applied using an average residual target basal area ranging from 50 to 80 square feet per acre in order to accomplish resource objectives. This would equate to removing approximately 30 to 60% of the existing crown cover. Most of the trees that would be removed are from the intermediate crown classes with all or a portion of their crowns overtopped by larger dominant and co-dominant trees. Treatments are designed to favor ponderosa pine and western larch and reduce wildfire hazard over the long term by rendering stands more resilient to natural fire occurrence and disturbances. Integrated weed treatments would continue in these areas.

Constructing three segments (generally 1,200 – 2,400 feet long) of new temporary road totaling about 1.0 miles would be needed to remove the larger material in units 4, 5, and 6. These roads would be used for a period of one to two years or less and then obliterated. All roads would be constructed over 300 feet from any live stream with road grades less than 10 percent and on side slopes less than 60 percent.

Young stand thinning followed by prescribed burning (477 acres) - Thinning is proposed in young ponderosa pine, Douglas-fir, and western larch stands on predominately acquired lands in Sections 31 and 33 (see Figure 8). The sites were intensively managed and the treatment is designed to reduce stand density, enhance growth and vigor; reduce competition for sunlight, water, and nutrients; and modify stand conditions to lessen the risk of potential mountain pine beetle-caused mortality and stand-replacing fire in the future. The treatment is also designed to promote irregular spacing, favor shade-intolerant species and restore fire as a process to these intensively managed areas. The treatment would thin small diameter trees that would be felled to a stocking of approximately 150 to 200 trees per acre favoring the most vigorous, dominant and best-formed trees. Only small diameter (less than 8" diameter at breast height) trees would be cut. In addition, fuels would be treated by lopping and scattering tops and limbs to speed decomposition. Hand piling and burning piles or underburning would be completed in areas where the fuel loading is determined to be an unacceptable risk. Invasive weeds would be treated along roadsides and in adjoining forest openings.

Figure 8. Unit 82

Ecosystem maintenance burning preceded by understory slashing or small tree thinning (1,275 acres) – This treatment involves "**non-commercial thinning and underburning**" (961 acres) and "**non-commercial thinning and handpile/machine pile and burn**" (314 acres). This treatment is proposed on sites that were historically occupied by very open to moderately open ponderosa pine or ponderosa pine and Douglas-fir communities with an average fire frequency of 5 to 50 years. Presently, these sites support moderate to heavy understory vegetation with thickets of conifer encroachment below the main canopy. Douglas-fir is the primary understory conifer species. Some very dry inclusions that were historically occupied by grassland communities currently support moderate noxious weed populations including spotted knapweed, leafy spurge, and cheatgrass. Some sites are classified as non-forested. The proposal includes prescribed burning which may include slashing or understory thinning prior to fire application. Understory density and ladder fuels would be reduced through slashing/thinning to protect the overstory from scorch or crowning where deemed necessary. Only small diameter (less than 10" diameter at breast height) trees would be cut in Units 60-66. All thinning work would be accomplished by hand using chainsaws. No biomass removal using heavy equipment is proposed in Units 60-66. Slash would be treated by lopping and scattering tops and limbs, hand piling and burning, or underburning. Machine piling or mechanized biomass removal could occur in Units 70 and 71 on slopes less than 35% with existing roads; however, within Unit 70, mechanized equipment would only operate from Road 99/Trail 515 or the Main Rattlesnake Trail parking area to discourage new user-created trail development (see Resource Protection Measure #60). Invasive weeds would be treated along roadsides, trails and within open forested sites or adjacent forest openings. Individual treatments or a combination of treatments would occur.

Ecosystem maintenance burning (729 acres) - This site is classified as predominately non-forested and is within the boundaries of the NRA along Strawberry Ridge. The area is steep and rocky with open scree slopes with stringers of forested inclusions composed of predominantly ponderosa pine and Douglas-fir with lesser amounts of western larch. Understory composition includes a seedling/sapling component, bunchgrasses, and ninebark. Scree openings are dominated by a patchy distribution of aspen, ninebark, and huckleberry. Noxious weeds are present, but have been treated by biological agent and herbicides in the last decade. An ecosystem burn was completed in 1997.

The proposal includes prescribed fire application and integrated weed treatments. Incidental slashing or small tree thinning (Douglas-fir < 6” dbh) may occur to create a fuel bed to carry the prescribed burn (although the portion of Unit 101 that is within Opportunity Class 1 – in the northeast corner – would not be thinning or slashed). Prescribed fire treatment would involve broadcast or underburning. Aerial ignition devices could be used to ignite fire in a strip or spotty pattern to achieve the desired fire intensity. Prescribed fire treatment would involve a backing or flanking fire that is generally of lower intensity than a head fire. Rolling material on steep slopes could cause uphill runs that create pockets of higher intensity fire behavior.

Non-commercial thin, handpile, and burn piles (248 acres) - This treatment is designed to reduce hazardous fuels in mid-aged mixed conifer stands immediately adjacent to private land with limited road access. The treatment is designed to reduce crown fire initiation and improve public and firefighter safety. The treatment would only thin small diameter trees underneath the main canopy (trees less than 10” diameter at breast height). All thinning work would be accomplished by hand using chainsaws. No heavy equipment or product removal is proposed in these treatment areas. The treatment is designed to reduce ladder fuels and surface fuel loading through thinning or slashing and hand piling and burning. The treatment would not markedly reduce crown continuity as the canopy cover would be reduced by approximately 5 to 25%.

Figure 9. Unit 100A/B

Meadow and aspen restoration (40 acres Figure 9) – This treatment is proposed along the main Rattlesnake Trail and in the Poe Meadows area (Units 100A and 100B). Tree encroachment is converting these homestead meadows into forested areas and resulting in the decline of small aspen groves. To maintain the meadow and aspen components, the proposal would reduce or remove conifer encroachment in the meadows and around aspen. Trees would be cut and left on site. The slash would be treated by lopping and scattering, hand piling and burning, and/or chipping. Where aspen are present, parent trees would be retained and surrounding conifers would be felled to provide sufficient light to stimulate aspen regeneration. Felled trees would be jack-strawed (loosely propped up) around aspen clumps to reduce browsing pressure on regenerating sprouts. Light jackpot burning and construction and maintenance of a small exclosure may also occur to stimulate suckering and protect young aspen trees from big game browsing. Integrated weed treatments would continue in these areas.

Site Preparation and Reforestation (450 acres) – Section 33 was acquired from The Nature Conservancy (TNC) in 2010 under the Montana Legacy Project. The site was previously owned by Plum Creek and harvested in approximately 2003. TNC harvested this area again in 2014. The best adapted dominant and co-dominant overstory trees were harvested from the site and suppressed and intermediate sub-merchantable trees were retained (see Figure 10). No reforestation investments for natural regeneration or planting occurred. On this site, the proposal is to complete a site preparation burn to prepare the site for planting. Some trees would be slashed to create a fuel bed to carry the burn. The site would be planted with locally-adapted stock. Western larch would be the primary species planted. Animal damage netting may also occur.

Figure 10. Unit 200

Road Treatment

In addition to the road maintenance and BMP work on Road 99/Trail 515 described in *Actions Common to All Alternatives* above, haul-related maintenance/reconstruction and BMP work (e.g., brushing, grubbing, blading and shaping, spot widening, and surface drainage improvements) would be applied to about 9.8 miles of road to be used for log haul (PF, Item K10-8). These applications would provide longer-term benefits to the transportation system after the project, as most would be on roads that would remain in an open state. (Table 5)

Alternative C

Alternative C was developed from concerns and issues expressed from public scoping, through working with the LRC, and subsequent public meetings and field trips. This alternative was primarily developed to address concerns about the effects of using mechanized equipment in the main Rattlesnake corridor. Concerns about this included the potential effects of commercial logging on recreation use and questions about the consistency of project activities with the management goals of the RNRA.

To address these concerns, the proposed vegetation treatments in the main Rattlesnake corridor (Road 99/Trail 515) proposed in Alternative B that required using equipment were changed to hand work only in this area resulting in:

- Treatment proposed for Units 2, 3, 70, and 71 was changed to non-commercial thinning (less than 8" dbh), handpiling, and burning, and/or underburning (see Table 8 below).

In addition to the road maintenance and BMP work on Road 99/Trail 515 described in ACTIONS COMMON TO ALL ALTERNATIVES above, haul-related maintenance/reconstruction and BMP work (e.g., brushing, grubbing, blading and shaping, spot widening, and surface drainage improvements) would be applied to about 5.9 miles of road to be used for log haul (PF, Item K10-8).

Table 8. Alternative C - Vegetation Treatment Summary (see Figure 12)

Unit	Silvicultural Prescription	Fuels Treatment	Acres	Logging System
Thinning Treatments & Prescribed Fire				
1	IC	HPB/UB	266	SL/T
4	STS	UB	46	SL
5	STS	UB	94	SL
6	IC	UB	109	SL/T
Subtotal			515	
Ecosystem Maintenance Burning Preceded by Understory Slashing/Thinning				
Non-commercial Thinning and Underburning *				
60	STT/EMB	UB	38	N/A
61	STT/EMB	UB	144	N/A
62	STT/EMB	UB	234	N/A
63	Slash/EMB	UB	254	N/A
64	STT/EMB	UB	137	N/A
65	STT/EMB	UB	91	N/A
66	STT/EMB	UB	63	N/A
Subtotal			961	
Non-commercial Thinning and Handpile and Burn *				
2	STT/EMB	HPB/UB	184	N/A
3	STT/EMB	HPB /UB	41	N/A
70	STT/EMB	HPB/UB	85	N/A
71	STT/EMB	HPB /UB	229	N/A
Subtotal			539	
Subtotal			1500	
Young Stand Thinning Followed by Prescribed Fire				
80	YST	LS	27	N/A
81	YST	LS	185	N/A

82	YST	LS	230	N/A
84	YST	LS	35	N/A
Subtotal			477	
Non-commercial Thinning & Handpiling & Burning				
90	STT	HPB	106	N/A
91	STT	HPB	73	N/A
92	STT	HPB	69	N/A
Subtotal			248	
Meadow and Aspen Restoration				
100A	Slash/JPB/Fence	JPB/HPB	19	N/A
100B	Slash/JPB/Fence	JPB/HPB	21	N/A
Subtotal			40	
Ecosystem Maintenance Burning				
101	EMB	UB	729	N/A
Subtotal			729	
Site Preparation & Reforestation				
200	Site Prep/Plant	UB/BB/JPB	450	N/A
Subtotal			450	
Grand Total			3959	

* Slashing diameter is less than 8” dbh.

Alternative D

Alternative D was developed in response to public comments expressing concerns about the perceived impacts of building temporary roads. The comment alleges that temporary road construction and use could “have the same long lasting and significant ecological effects as permanent roads”. Concern was also expressed that even though the temporary roads would be decommissioned after the timber harvest was complete, there was likelihood that they could be “reconstructed for the next round of mechanical treatments.” This alternative was also developed to address the issue raised about the proposed use of machinery in the main Rattlesnake corridor (Road 99/Trail 515). Concerns about this included: the potential effects of commercial logging on the area’s character and recreation access; conflicts with wildlife and quiet recreation; consistency of project activities with the management goals of the RNRA; and user conflicts and safety issues.

To address these concerns, the vegetation treatments in the main Rattlesnake corridor proposed in Alternative B that required using equipment were changed to handwork only. In addition no temporary road construction would be included resulting in dropping all of the commercial treatments and changing proposed vegetation treatments to hand work only as listed below:

- Treatments proposed for Units 1, 2, 3, 4, 5, 6, 70 and 71 were changed to non-commercial thinning (less than 8” dbh), handpiling and burning and underburning (see Table 9).
- Since no mechanized equipment, commercial harvest, or log hauling would occur in this alternative, the only BMP work included for the project in this alternative is the road maintenance and BMP work on Road 99/Trail 515 described in ACTIONS COMMON TO ALL ALTERNATIVES above (about 3.7 miles).

Table 9. Alternative D - Vegetation Treatment Summary (see Figure 13)

Unit	Silvicultural Prescription	Fuels Treatment	Acres	Logging System
Ecosystem Maintenance Burning Preceded by Understory Slashing/Thinning				
Non-commercial Thinning and Underburning*				
60	STT/EMB	UB	38	N/A
61	STT/EMB	UB	144	N/A
62	STT/EMB	UB	234	N/A
63	Slash/EMB	UB	254	N/A
64	STT/EMB	UB	137	N/A
65	STT/EMB	UB	91	N/A
66	STT/EMB	UB	63	N/A
Subtotal			961	
Non-commercial Thinning and Handpile and Burn*				
1	STT/EMB	HPB/UB	266	N/A
2	STT/EMB	HPB/UB	184	N/A
3	STT/EMB	HPB/UB	41	N/A
4	STT/EMB	HPB/UB	46	N/A
5	STT/EMB	HPB/UB	94	N/A
70	STT/EMB	HPB/UB	85	N/A
71	STT/EMB	HPB/UB	229	N/A
Subtotal			945	
Young Stand Thinning Followed by Prescribed Fire				
80	YST	LS	27	N/A
81	YST	LS	185	N/A
82	YST	LS	230	N/A
84	YST	LS	35	N/A
Subtotal			477	
Non-commercial Thinning & Handpiling & Burning				
6	STT/HPB	HPB	109	N/A
90	STT/HPB	HPB	106	N/A
91	STT/HPB	HPB	73	N/A
92	STT/HPB	HPB	69	N/A
Subtotal			357	
Meadow and Aspen Restoration				
100A	Slash/JPB/Fence	JPB/HPB	19	N/A
100B	Slash/JPB/Fence	JPB/HPB	21	N/A
Subtotal			40	
Ecosystem Maintenance Burning				
101	EMB	UB	729	N/A
Subtotal			729	

Site Preparation & Reforestation				
200	Site Prep/Plant	UB/BB/JPB	450	N/A
Subtotal			450	
Grand Total			3959	

* Slashing diameter is less than 8” dbh.

Resource Protection Measures

As mentioned under the Public Involvement section the ID Team carefully considered all of the comments received on the proposed action and identified issues. One way issues were resolved was by modifying existing design criteria or adding additional site-specific protection measures that will reduce to negligible or eliminate the potential effects. These measures are called **Resource Protection Measures** in this document (see Table 10 below).

Appendix C shows how Resource Protection Measures were used and developed for the Proposed Action (Alternative B) to minimize potential effects and address comments made during scoping.

These Resource Protection Measures are objective based. This means that the desired condition or the condition to be avoided will be described. Ways that this objective can be met are also described in the table; however, another method, determined to be equally or more effective in meeting the mitigation objective by a resource specialist and approved by a Line Officer, could also be used.

Table 10. Resource Protection Measures for Marshall Woods Restoration Project

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
Soils	**Standard Soil Practices** *To maintain soil productivity, forest floor integrity, and reduce detrimental soil disturbance during project implementation*	R1 Soil and Water Conservation Practices, Standard Soil Operating Procedures, Best Management Practices (BMPs) for Forestry and Streamside Management, and Timber Sale Contract language, would be implemented (Soil File 6). Soil Specialist Report Appendix B contains definitions and guidelines for summer and winter ground-based commercial harvest.	All Activity Units	1	C	S	
“	**Large Woody Material in YST units**	Due to low levels of organic matter, all material cut would be left on site to slowly release nutrients to the soil,	Young Stand Thinning Units 80, 81, 82, and 84	2	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	To ensure adequate woody material is left on the ground for nutrient cycling	improve water retention, and provide future soil organic matter. Prescribed fire or slash piling would not be applied to these units unless the unit is reviewed by the Forest Soil Scientist or fire is prescribed greater than 5 years after the thinning treatment.					
"	**LWM in Unit 200** *To ensure adequate woody material is left on the ground for nutrient cycling, site amelioration, and forest floor development*	Due to low levels of organic matter and forest floor development, the site preparation and reforestation prescription would leave large woody material in the 13-18 tons/acre range where available. Large woody material would consist of both down and standing wood.	Unit 200	3	C	P	
"	**Temporary Road Location and Obliteration Treatments** *To maintain soil productivity and reduce detrimental soil disturbance in units on acquired*	Special C provisions C6.632# and C6.633# New temporary roads would be located where they can be successfully rehabilitated. To the greatest extent possible, avoid the nose of ridges, shallow soils, open grasslands/scablands.	Temporary roads in Units 4, 5, and 6 (Alternatives B, C)	4	C	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	lands or with past harvest activity	Temporary roads would use existing road prisms to the extent possible.			C	S	
		Drainage improvements would be applied to temporary roads that remain on the landscape through a winter season.			C	S	
		Temporary road construction would include stockpiling of the forest floor, top soil (upper 6 -10 inches including the duff/litter layer) and slash along the temporary road to the greatest extent possible. This material would be pulled back over the road surface after site preparation is completed with the top soil first, followed by the forest floor, and any slash. Any berms would be pulled back over the road prism with the top soil.			S	P	
		The temporary road surface would have site preparation to a depth of at least 18 inches and/or be totally re-contoured.			C	S	
		Place slash, mixed sizes greater and less than 3 inches diameter, over approximately 65–70% of the temporary road to a depth of approximately 2–3 inches (at a			S	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		minimum) where available (approximately 10-15 t/a). Most slash would be in direct contract with the soil surface.					
		Consider planting conifer seedlings at the Silviculturist's discretion in the decommissioned road bed.			S	P	
		If monitoring indicates, additional amelioration would be prescribed on a site-specific basis as needed to meet R1 SQS or other resource concerns.			S	P	√
Soil, Visual, Cultural and Recreation Resources	**Commercial Thinning Activities – Harvest Operations** *To maintain soil productivity and reduce detrimental disturbance and weed impacts*	Conventional mechanical felling and skidding (Clipper/Saw and Grapple Skidder) would be limited to periods when snow depth or frozen ground is adequate to protect soils (**Winter Operating Period**). ***OR*****,** during **Summer Operating Conditions using In-Woods Processing.**	Units 2, 3 (Alternative B only)	5	C	S	
		During Dry Season Operations. Machinery would operate over a slash mat of approximately 5-6 inches where available.			C	S	
		At the end of operations, the slash mat on the skid trail would be approx. 2-3 inches deep (at a minimum), in contact					

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		with the soil surface, and cover approx. 65-70% of the skid trail where bare mineral soil is exposed. Litter, duff, soil, and woody debris displaced from the trail would be placed back on the skid trail to the greatest extent possible.					
		During Dry Season or Winter Operations. Harvesting and skidding operations would not occur unless specified conditions (dry soil, adequate snow depth, or frozen ground) exist over approximately 85% of the harvest unit (including landings). Soil moisture would be evaluated at the bottom of the root-tight layer if one exists or within the top 6-12 inches of the soil surface (Refer to Table B1 in the Soil Specialist Report for a definition of dry soil by soil texture).			C	S	
		Equipment would be allowed to operate on slopes averaging 35% or less, and would also be allowed to operate on slopes of 35-40% (less than 100 feet in length) as approved by the Timber Sale Administrator (TSA) in coordination with the Soil			C	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		Scientist.					
“	**Commercial Thinning Activities – Harvest Operations** *To maintain soil productivity and reduce detrimental disturbance and weed impacts*	**Summer Operating Conditions** Where they exist and are safe, existing skid trails would be used unless approved by the TSA. Operation of skidding equipment off of designated trails would be minimized unless dispersed skidding is approved during winter periods. Harvesting and skidding operations would not occur unless specified conditions (i.e., dry soil) exist over approximately 85% of the harvest unit (including landings). Soil moisture would be evaluated at the bottom of the root-tight layer if one exists or within the top 6-12 inches of the soil surface (Refer to Table B1 in the Soil Specialist’s Report for a definition of dry soil by soil texture). Equipment would be allowed to operate on slopes averaging 35% or less, and would also be allowed to operate on slopes of 35-40% (less than 100 feet in length) as approved by the TSA in coordination with the	Ground-based portions of Units 1, 4, 5, and 6 (Alternatives B and C)	6	C	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		Soil Scientist. Existing landings would be re-used to the extent possible.					
”	**Skid Trail - Location, Construction, Use, Rehabilitation** *To maintain recreation and cultural resources, visual quality, and soil productivity as well as reduce detrimental soil disturbance and improve the recovery of native vegetation*	During Dry Season Operations. Where they exist and are safe, existing skid trails would be used unless approved by the TSA. Operation of skidding equipment off of designated trails would be minimized unless dispersed skidding is approved by the TSA during winter periods. Any skid trail crossings will be perpendicular to system trails. The skid trail will curve as soon as feasible to minimize the distant view. Slash and debris will be placed within the skid trail for at least the “line-of-sight” to discourage use by recreationist.s If new skid trail construction is required in Units 2 or 3, the archaeologist will be informed and at that time decide whether field monitoring is necessary.	Within 100 feet of system trails and dispersed campsites in all ground-based harvest units Ground-based portions of Units 1, 4, 5, 6 (Alternatives B and C) Units 2 and 3 (Alternative B only)	7	C C S C	S P P P	
”	**Log Landings - Location,**	Where practicable, landings would be constructed, piled, and burned in	Within 100 feet of system trails and	8	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	Construction, Pile Burning, Rehabilitation *To maintain recreation and cultural resources, visual quality, and soil productivity as well as reduce detrimental soil disturbance and improve the recovery of native vegetation*	areas where detrimental soil disturbance already exists (i.e., previous log landings, skid trails, and roads associated with past activity). If possible locate landing piles outside of sensitive viewsheds. The archaeologist would be informed regarding landing location and at that time decide whether field monitoring is necessary for operations in Units 2 and 3. When activities occur along open trails, slash will be treated within 100 feet of the corridor within 6 months and no longer than 1 year. If "curtain" (incinerator) burning is used, locate burning pit in an interior location in the stand where it is not visible from trails or creeks. Do not develop access routes that follow a straight line of sight, curve the route to limit distant view. Use of the access route would occur over a slash mat. Where landing piles will be burned on-site the following rehabilitation is required.	dispersed campsites in all ground-based harvest units Units 2 and 3 (Alternative B) Ground-based portions of Units 1, 4, 5, 6 (Alternatives B and C)		C O S	P P P S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		Treat the landing for weeds, After the piles are burned, rehabilitate the landing by site scarification (hand or machine 6-12 inches deep, subsoiling may be prescribed by the Forest Soil Scientist), Seed the landings in the fall, or as practicable, with native seed composed of species similar to the surrounding area (check with botanist or native plant coordinator), Place slash over the site to a depth of 2-3 inches covering 65-70 percent of the landing. Ensure the slash is in contact with the soil surface, and Plant the landing with tree seedlings. Monitor the landing for the first 5 years to ensure re-vegetation is successful and self-sustaining.			C S/O S S C S O	S P P S P P	√
”	**Machine Piled Slash - Location, Construction, Pile Burning, Rehabilitation**	Machine piling would be limited to periods when snow depth or frozen ground is adequate to protect soils (**Winter Operating Period**). ***OR,*** during **Summer Operating**	Within 100 feet of system trails and dispersed campsites	9	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	To maintain recreation and cultural resources, visual quality, and soil productivity as well as reduce detrimental soil disturbance and improve the recovery of native vegetation	**Conditions.** Where practicable, slash would be piled and burned in areas where detrimental soil disturbance already exists *(i.e*. previous log landings, skid trails, and roads associated with past activity). If possible locate slash piles outside of sensitive viewsheds. When activities occur along open trails, slash will be treated within 100 feet of the corridor within 6 months and no longer than 1 year. Slash would not be removed from skid trails or landings to discourage off trail use.	Units 70* and 71 (Alternative B) *See RPM #60				
		Seed the scorched area in the fall, or as practicable, with native seed composed of species similar to the surrounding area (check with botanist or native plant coordinator), and			C	S	
		After seeding, place slash over the site to a depth of 2-3 inches covering 65-70 percent of the scorched area. Ensure the slash is in contact with the soil surface.			O	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
”	**Hand-Piled Slash - Location, Construction, Use, Rehabilitation** *To maintain recreation and cultural resources, visual quality, and soil productivity as well as reduce detrimental soil disturbance and improve the recovery of native*	**In areas beyond 50 or 100 feet of system trails and dispersed campsites.** Prior to hand piling, slash would be left through one winter after cutting to allow for initial decomposition and nutrient leaching **OR**, in lieu of this, material less than 1” diameter at breast height would be lopped and scattered and not piled and burned. Exception: units adjacent to private land or those identified in the silviculture prescription with insect concerns may be piled and burned as soon as possible to reduce fire hazard	50 feet for Units 61, 64, and 90 100 feet for Units 60 and 70	10	O	P	
		Where practicable, slash would be piled and burned in areas where detrimental soil disturbance already exists (*i.e.* old log landings, skid trails, and roads associated with past activity).			C	P	
		Handpiles would be constructed so they are no larger than about 6 feet in diameter and 6 feet high.			C	S	
		For locations within 50 or 100 feet of system trails and dispersed camp					

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		sites.			C	P	
		Where practicable, slash would be piled and burned in areas where detrimental soil disturbance already exists (*i.e*. old log landings, skid trails, and roads associated with past activity). To the greatest extent practicable, slash piles would not be constructed on shrubs patches or other areas of dense understory vegetation.			C	S	
		Handpiles would be constructed so they are no larger than about 6 feet in diameter and 6 feet high.			C	P	
		Locate piles outside of sensitive viewsheds where feasible.			O	P	
		When activities occur along open trails, slash will be treated within 100 feet of the corridor within 6 months and no longer than 1 year.			C	P	
		Slash would not be removed from skid trails or landings to discourage off trail use.					
		After burning, scarify the scorched area (6-8 inches deep without turning			S	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		over the soil) and seed. Ideally seeding would be done in the fall, or as practicable. Use native seed composed of species similar to the surrounding area (check with botanist or native plant coordinator). Slash would be placed over the burn pile covering 65-70% of the scorched area to a depth of 2-3 inches.					
Soils, Aquatics	**Ephemeral Draws within Harvest Units** *To protect draws*	Seasonally moist areas and ephemeral draws within units have sensitivity related to deep, fine textured soils, high soil moisture content, and proximity to flowing water. Provide a 50-foot no-equipment buffer from the centerline of the drainage or to the top of the inner gorge. Trees can be harvested with directional felling or pulling line. Draws would be crossed at designated crossings.	Units 2, 3, 6	11	C	S	
Soils, Noxious Weeds	**Delay Underburning** *To provide time for weed control and re-seeding efforts to be successful*	Delay underburning until weed control and vegetation re-seeding is successful. Prescribed fire would only be allowed once native vegetation is established, effective groundcover exceeds 60% of the surface area, and plants and plant roots can withstand	Unit 64	12	O	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		fire.					
Soils, Recreation	**Closure of Temporary Roads when Not in Use** *To reduce the risk of the temporary roads becoming user trails and to reduce erosion and weed spread*	Close the temporary roads when not in use with berms, slash, logs or other methods for at least line of sight to prevent unwanted use by the recreating public. Monitor to ensure the closure is effective	Units 4, 5, and 6	13	C	S	
Visual Quality	*To minimize the visual impacts of skyline corridors*	• To the greatest extent possible, fell trees first and establish corridors in openings. • Vary the distance between cable corridors • Establish corridors more frequently than every 75 feet to minimize residual damage and allow for narrower (less visible corridors) • Retain irregular clumps of leave-trees- leave some larger clumps oriented up and down slope, lay out corridors	Skyline harvest portions of Units 1 and 4-6	14	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		between, not through the leave-clumps, if feasible, to the greatest extent practible.					
“	*To minimize the visibility of tree marking after treatment*	• Use cut tree marking so that no paint will remain visible after implementation. • Use secondary cut tree color (yellow) or tertiary cut tree color (green) (FSH 2409.12 timber cruising handbook.) to be less visible than blue (primary cut tree color). • Use alternative unit boundary marking (tree tags) that doesn't use paint or only uses stump marks.	Units 1, 2, 3, 4, 5, and 6	15	C	P	
“	*To minimize slash piles and residue that appears man-made*	Flush cut stumps (8" or less in height).	When visible, up to 100' from system roads or trails in ground-based yarding units.	16	O	P	
“	*To reduce visual impacts of bridge abutment re-enforcement*	Design will be coordinated with Forest Landscape Architect, and will consider design features such as: • Use natural materials such as	Spring Creek Bridge	17	C	P	

Primary Resource	**Resource Protection** **Measure Objective**	**Resource Protection Measure***	**Units/Location**	**RPM#**	**Sale (C), Service (S), Other[1]**	**S/P[2]**	**V[3]**
		rounded (non-fractured) boulders or timbers with backfill to stabilize road/trail. • Avoid use of gabions which are not natural-appearing at close range. If use of concrete is necessary, integrate color and texture.					
"	*To minimize visual impact of culvert replacement in terms of form, line, color and texture*	Design will be coordinated with Forest Landscape Architect. Consider design features such as: • Culvert will have mitered ends to reduce exposed surface area • Exposed metal surface of the culvert will be painted flat black or brown to reduce visibility and glare or an oxidizing treatment will be applied. • If visible any use of concrete would be colored or textured to appear less dominant in the landscape.	Marshall Creek Culvert	18	S	P	
TES Plants	*To reduce impacts*	If plants of local concern, such as rare or sensitive plants, are detected in the	Project Area	19	C	S	

Primary Resource	**Resource Protection** **Measure Objective**	**Resource Protection Measure***	**Units/Location**	**RPM#**	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	to native flora	project area, the Forest Botanist would be contacted so that protective measures may be revised or newly prescribed. This could include addition of buffers or the imposition of activity timing restrictions.					
Noxious Weeds	*To reduce or eliminate the introduction or spread of weeds*	Treat weeds on haul routes, decommissioned roads, landings, and other areas where ground disturbance would occur as a result of this project.	Project area	20	C	S	
"	*To reduce or eliminate the introduction or spread of weeds and the impacts of herbicide treatments*	Weed treatments will tier to Lolo National Forest Integrated Weed Management Plan (USDA Forest Service, 2007), including approved herbicides, treatment strategies and mitigation measures. Implement mitigation measures 1-48 (starting on page 28 of the Lolo National Forest Integrated Weed Management Plan 2007). These include evaluating the weed site for sensitive plant habitat, implementing Region 1 weed prevention practices and BMPs (FSM 2081.2), revegetating sites with a seed mix that includes native species, following herbicide application law, and posting signs where herbicides	Project area	21	C	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		are being applied.					
"	"	Skyline corridors and skid roads will not be located in patches of leafy spurge.	Units 1, 2, and 6, mapped locations, and wherever it occurs	22	C	P	
"	"	Burn piles will be seeded in the fall, or as practicable, with native seed composed of species similar to the surrounding area (check with botanist or native plant coordinator)	Project area	23	C	S	
Forest Vegetation	*To protect at risk and/or large diameter (21"+) trees*	Where deemed necessary by a Silviculturist, measures would be taken to protect at risk and/or large diameter (21"+) trees from excessive crown and bole scorch to the extent feasible to avoid unintentional mortality,	All units	24	C	S	
"	*To protect desirable natural regeneration*	To the extent practicable, protect areas of acceptable natural regeneration that meet stand stocking and species preference objectives from prescribed burning fire effects.	All units	25	O	P	
"	*To reduce the potential risk of annosus root*	Treat any susceptible, live ponderosa pine stumps, greater than 12" dbh with Sporax within 24 hours of	Units 1 - 6	26	O	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	disease spread	cutting.					
"	*To reduce the likelihood of Ips population buildup*	Where deemed necessary by a Silviculturist, slash piles that contain ponderosa or lodgepole pine slash would be burned in a timely fashion or baited	All units	27	O	P	√
"	"	Where prescribed by a Silviculturist, ponderosa or lodgepole pine slash creating operations may be restricted to July through November.	All non-commercial units	28	O	P	√
"	*To repel mountain pine or Douglas-fir bark beetles from individual trees or areas*	Verbenone or MCH capsules may be applied	Within the analysis area	29	O	P	√
"	*To reduce the potential for mountain pine beetle (MPB) mortality*	Where deemed necessary by a Silviculturist or Entomologist, thinning, chipping, or grinding operations may be prohibited during beetle flight (July – August); and underburning may be delayed until MPB populations are at endemic levels.	Units 1-6, 80-84, 60-71 100 A/B, and 101	30	O	P	√
"	*To avoid not meeting Opportunity Class*	Remove from treatment 10 acres in the northern tip of the unit which was proposed for young stand thinning	Unit 81	31	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	2 in the RNRA	and prescribed burning.					
Wildlife - Flammulated Owl	*To reduce disturbance to mating, nesting, or fledging flammulated owls.*	No ground-disturbing activities[7] will occur in units known to be occupied by flammulated owls from May 1 thru Aug 1. Burning may occur in May but will not occur June 1 thru Aug 1.	Units 1, 4, 5, and 6	32	C	P	
"	*To reduce potential damage to known nest trees.*	Known nest trees will be protected using methods deemed most practical during layout.	Units 1, 4, 5, 6	33	C	P	
"	*To reduce potential removal or damage of potential nest trees.*	Potential nest trees (snags >12" dbh with large 3" or greater cavities will be identified and marked for retention as wildlife trees. These trees will be retained, to the extent practicable, given logging systems and other logistics. Note: because of flammulated owl nesting presence, snag retentions will likely exceed Forest Plan standards.	Units 1, 4, 5, 6	34	C	P	

[7] Ground-disturbing activities include non-commercial and commercial thinning and road construction/decommissioning; they do not include routine road maintenance activities conducted inside the normal clearing limits.

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
“	*To promote stand conditions favorable for flammulated owls.*	Large, healthy ponderosa pine trees will be favored as leave trees. Any live trees >21” dbh will be retained, regardless of species, to the extent practicable given project objectives and implementation logistics. Due to the importance of large diameter snags for flammulated owls, with the exception of snags near roads, skylines, trails or where public and operational safety and facility protection is necessary, all dead trees greater than or equal to 21” dbh will be retained within treatment units, to the greatest extent practicable.	Units 1, 4, 5, 6	35	C	P	
“	*To maintain roosting habitat for flammulated owls.*	Within 150’ of known and potential nest trees (large snags with cavities or those marked as wildlife trees) efforts will be made to retain 3-4 thickets of young dense trees following harvest and burning. A thicket is an approximately 20’ diameter clump of sapling trees.	Units 1, 4, 5, 6	36	C	P	
Wildlife – Elk	*To reduce the potential for disturbance to elk in areas of particularly high*	Minimize spatial extent of ground-based disturbance to elk by working in phases, from Dec 1- May 1, thus, allowing for undisturbed areas as refugia for wintering elk. Conduct	Units 1, 4, 5, 6, 60-62, 64, 66, 90 and 91	37	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	quality winter range.	work in phases (Phase I = Unit 1; Phase II = Units 4, 5, 6, 60-62, 64, 66, 90 and 91). Complete Phase I work before beginning Phase II work, or vice versa.					
"	*To maintain snow-intercept cover in elk winter range habitat.*	Favor large, healthy mature trees with full crowns as leave trees.	Units 1, 4, 5, 6	38	C	P	
"	*To protect important habitat features for elk.*	If any elk wallows are identified during layout, a wildlife biologist will be consulted and the unit will be modified to meet Forest Plan standard #21.	All units	39	C	S	
Wildlife – Mule Deer	*To reduce disturbance to mule deer on winter range.*	If treatments are to occur in mule deer winter range from Dec 1- May 1, treatment will not occur in units 71 or 65 at the same time that mechanical treatment is occurring in units 2 and 3 to ensure mule deer adequate refugia from disturbance.	Units 2, 3, 65, 71	40	C	P	
Wildlife – Goshawk	*To protect important habitat features and minimize disturbance to*	If a goshawk nest is discovered within the project area during implementation, mitigation measures would be implemented to help ensure that nest sites and post-fledgling areas receive minimal disturbance. A 40-	All units	41	C	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	nesting goshawks.	acre buffer would be placed around each nest area to provide long-term nesting habitat. In addition, a 420-acres no-activity buffer would be put in place around the nest site from April 15 thru August 15.					
Wildlife	*To protect TES species*	If any threatened, endangered, or sensitive species or bear dens are located during project layout or implementation, a wildlife biologist will be notified. Management activities would be altered, if necessary, so that proper protection measures can be taken. Timber sale contract provisions that require the protection of threatened, endangered, and sensitive species would be included in the timber sale contract.	All units	42	C	S	
"	*To reduce the potential for animal/human conflicts, particularly with bears.*	Food and other animal attractant storage would be required for all contract and Forest Service personnel working in the project area from April 1 thru December 1. All personnel are required to follow forest-wide food storage order. The wildlife biologist will be notified of any suspected bear dens so	Project Area	43	C	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		appropriate measures can be determined at that time.					
“	*To ensure snag retention*	Adhere to snag retention standards from the Lolo Forest Plan (1986). Specifically, for units in moderately warm and dry sites (habitat group 2) retain 4 hard snags/acre (min 10” dbh, 15’ tall) with a min. of 1 big snag/acre (20” dbh, 40’ tall). For moderately cool and dry sites (habitat group 3), retain 3 hard snags/acre and 1 big snag/acre. Select ponderosa pine, western larch, and Douglas-fir when available, in order of preference.	All units	44	C	S	
Wildlife and Soil	*To ensure sufficient large woody debris for structural habitat diversity and forest floor function*	Follow Forest Plan standards for downed woody debris retention.	All units except Unit 200 (refer to RPM #3)	45	C	S	
Water Quality and Fisheries	*To reduce impacts to water quality/fisheries*	Best Management Practices (BMPs) will be met as a minimum for all operations to comply with the Lolo National Forest Plan.	Project Area	46	C	S	
“	*To reduce impacts to water quality/fisheries*	• Apply INFISH RHCA buffers (300 feet from perennial fish bearing streams, 150 feet from perennial	All units	47	C	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
	and cultural resources from vegetation treatments and associated road work	non-fish bearing streams and wetlands > 1 acre, 100 feet from intermittent streams and wetlands < 1 acre in the Rattlesnake Ck. priority watershed, and 50 feet from intermittent streams and wetlands < 1 acre in the Marshall Ck. non-priority watershed).). Any variations from these buffers will need to be approved by the project fisheries biologist or hydrologist PRIOR TO implementation. • The boundaries of all RHCAs will be flagged PRIOR TO on the ground activities. • Ground-based equipment is excluded from all RHCAs buffers except on existing road surfaces. • Specific to Unit 2 in Alternative B where commercial treatment is proposed adjacent to Rd #99/Trail 515 (located on a high terrace above Rattlesnake Creek), commercial harvest is limited to 75 feet from the edge of the high terrace to retain potential large					

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		woody debris. • Non-commercial thinning treatments must not occur within 50 feet of a scoured channel. • All mechanized hand tools will be refueled outside RHCAs and fuel storage will not occur within an RHCA, unless on existing road surfaces with an approved spill containment plan in place.					
"	"	• Follow mitigation measures outlined within the 2014 DRAFT Bull Trout Programmatic Biological Assessment for Road Related Activities (USDA-FS and USDI-BLM 2014). • Slash filter windrows will be applied to identified stream crossings and relief culvert outlets on haul routes BEFORE blading and haul are to occur to reduce sediment effects. • If winter hauling is to occur, snow drainage outlets will be created through snow berms PRIOR TO winter haul and kept open	Haul routes	48	C	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		throughout the duration of winter hauling. Snow drainage outlets should typically be placed at or near drain-dips or other drainage features on the road. Clear/open culverts and ditches restricted by snow or ice to allow for proper drainage and maintain 2 inches of snow on roadways during winter plowing operations to protect the road surface from mechanical disturbance. • If winter haul will occur before planned road BMPs, the Timber Sale Administrator will contact the appropriate Engineer and Hydrologist or Fisheries Biologist prior to winter operations to assure that typical requirements are sufficient to mitigate sediment effects, or if more specific BMPs would be necessary.					
“	*To reduce impacts to water quality/fisheries from rehabilitation work*	• Obliteration of roads or road segments within 300’ of stream channels will be fully recontoured, slashed, and seeded (Level V closure). • Where existing crossing structures	Temporary and decommissioned roads, stream crossings, and instream work	49	S	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		will be removed, streams will be restored to appropriate dimensions (width, depth, and slope). • Complete instream work between July 15th and September 1st or when stream is dry. • All stream crossings will be designed to meet Q100 flow conditions and Aquatic Organism Passage (AOP) requirements. • Any instream work requires a Stream Protection Act 124 Permit through Montana Fish, Wildlife and Parks					
“	*To reduce impacts to water quality/fisheries from prescribed burning*	• Follow mitigation measures outlined within the Programmatic Biological Assessment for Prescribed Fire (USDA-FS and USDI-BLM 2001), which includes specific measures regarding storage and handling of toxic materials/fuels and drafting water from streams. • Retain a duff layer within	Project Area	50	C/0	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		riparian/wetland areas. • No aerial ignition within RHCAs and no ground ignition within 50 feet of a scoured channel; however, incidental prescribed fire is allowed to creep into these areas. • Fire line will be allowed to anchor with RHCA but not to parallel within. • Burn piles are restricted within RHCAs.					
Air Quality	*To assure that air quality standards are met*	• All prescribed burning would be conducted in compliance with State, Federal, and County air quality standards. • Prescribed burning ignition days would be regulated by ID/MT Airshed Group and Missoula County Air Quality Regulations for Airshed 3A and 3A/M to mitigate the smoke effects. • Fire Management staff would generate public notice information	Project area	51	O	S	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		just prior to burn days					
“	“	All prescribed burning generated by this project would be accompanied by an approved prescribed burn plan.	Prescribed burning including landing and pile burning	52	O	S	
Recreation Wildlife	*To minimize impacts to recreational users and wildlife*	Stage implementation in phases (for example, harvesting would not occur in Units 1, 4, 5, and 6 at the same time as Units 2 and 3).	Project area	53	C	P	
Recreation	*To keep the public informed and reduce safety concerns*	Notify the public of area, road or trail closures due to project activities that will be occurring. Use signing, local newspapers, news broadcasts, and Forest Web page and other social media platforms. Direct contact will be made with cooperators/partners to inform them of ongoing activities and closures.	Project area	54	O	S	√
		Additional permanent signs will not be permitted without prior approval from the Missoula Ranger District Resource staff. Educational material will be provided in brochure or fieldtrip form (keeping within group size limits).	Project area	55	O	P	√

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]

	To minimize both short and long term impacts to recreation use and public safety	• Coordinate treatment and timing with Missoula Ranger District Resource Staff to minimize conflicts with recreation use (including other recreation areas).
		
		• Warning signs will be placed on all trail access points and along the trail where activities are occurring. Warning sign placement must be coordinated with and approved by Missoula Ranger District Resource Staff. No placement of signs on trees or existing signs and information boards.
		
		• Log hauling will not occur:
		  • From 3 pm Friday to midnight Sunday.
		  • From 5 pm on the day preceding a State or Federal holiday to midnight of the holiday.
		  • When school is in session, from 6 am to 8 am Monday through Friday (for Units 2 and 3 only) or from 5 pm to 6
			Project area	56	C/O	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		pm Monday through Thursday					
“	“	Dust abatement will occur where deemed necessary by the Timber Sale Administrator.	Project area	57	C	S	
	“	Avoid removal of ponderosa pine or western larch with a diameter larger than 21 inch dbh (to the greatest extent possible) when locating landings, skid trails and skyline corridors. Unique character trees (e.g.,” Three Larches”, trees along TR515) would be featured and retained within the project. If mature trees must be removed along TR515 to accommodate log haul, the recreation specialist will coordinate with the timber sale administrator to agree to the clearing limits and brushing to ensure character trees and the character of the trail are maintained to the greatest extent practicable.	Project area	58	C	P	
	“	All flagging and boundary signs will be removed upon completion of each phase of the project.	Project area	59	S	P	
“	“	Cut material would be left on-site unless material was removed by keeping equipment on the Trail	Unit 70	60	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		515/Road 99/parking lot only (no “cross-country” movement).					
Recreation (Rattlesnake Limits of Acceptable Change)	*To be in compliance with the Management Direction in the RNRA*	Recreation and silviculture staff will flag specific areas of concern within 100 feet from where trails intersect in order to reduce encounters between recreationists and to prevent new trails from forming by “trail cutting” between trails. Thinning or brushing will not occur in these flagged areas	RNRA	61	C	P	
	“	Maintain visual separation between dispersed campsites; it is recommended that a 100 foot buffer be maintained around each campsite (see map in PF).	Unit 3 (Poe Meadows)	62	C	P	
	To be in compliance with the Management Direction in the RNRA and to minimize impacts to wildlife and visual quality	Feather vegetation, slash, or large woody debris within 100 feet of the trail corridors to provide screening and discourage off-trail use.	RNRA	63	C	P	
	“	Minimize overlaying skid trails/haul roads on non-motorized system trails. If trails are to be used as skid trails/haul roads, prior approval from	Project area	64	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		Recreation staff is required. If trails are used as skid trails/haul roads, trails must be restored to their original width/tread condition and re-opened immediately to reduce resource impacts from associated user trail development.					
	"	Trails locations, alignment and surfacing will be retained. Trails will not be straightened or have their surface changed to an alternate material unless such actions are needed to enhance the trail and protect resources. If these actions are needed they must be coordinated with the Missoula Ranger District Resource Staff.	Project area	65	C	P	
	"	If trails are temporarily closed due to project activities, trail tread will be cleared of all slash immediately upon the trail being re-opened and cessation of harvest activities.	Project area	66	C	P	
	"	To minimize losses of vegetation and reduce trail width expansion, equipment will not be staged off the main trail (TR515) within 0.8 miles of the main trailhead unless in the	Project area	67	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		parking lot on graveled surfaces. No equipment will be staged within 100 feet of the restrooms at Spring Gulch Junction, School House Junction or Poe Meadows. Existing open areas, which will be recommended by Recreation staff, will be used for staging.					
		User created non-system trails will not be re-opened if lost due to project activities	Project area	68	O	P	
		A parking plan for use along Road 99/Trail 515 will be developed and required for vehicles that are operating in conjunction for both the commercial and non-commercial portions of the project. This will include agency vehicles used during hand thinning and burning operations.	Road 99/Trail 515	69	O	P	
		Ensure access for Road 99 road and dam maintenance/inspections and maintain administrative access.	Road 99/Trail 515	70	C	P	
		A landing plan will be developed prior to implementation through coordination with the Contracting Officer's Representative, Recreation Staff and Timber Sale Administrator,	Project area	71	C	P	

Primary Resource	Resource Protection Measure Objective	Resource Protection Measure*	Units/Location	RPM#	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		and Contractor.					
Heritage	*To protect cultural and heritage resources*	Do not cut or mark historic telephone poles up the creek and along Rd 99 that look in some cases like old tall stumps or broken off snags.	Units 2, 3 and 71	72	C	P	√
"	"	If previously unknown heritage resources are encountered during project implementation, activities in that area will be halted and the Archeologist will be notified immediately.	Project area	73	C	S	
	Cultural Resource protection flagging	All site features within areas of potential disturbance will be flagged prior to implementation and avoided during implementation. Flagging will occur by archaeologist within a reasonable time period prior to implementation, to reduce attention and possible removal of feature/flagging by recreationalists.	Project area	74	C	S	
	Tree Cutting	Do not cut large ponderosa pine with barbed wire grown into them.	Unit 71	75	C	P	
	Hand Piling	Avoid piling on cultural resource features (e.g. can dumps, foundation remains, ditches, root cellar	Units 2, 3, 65, 70, 71, 100a, and 100b	76	O	P	

Primary Resource	**Resource Protection** **Measure Objective**	**Resource Protection Measure***	**Units/Location**	**RPM#**	Sale (C), Service (S), Other[1]	S/P[2]	V[3]
		depressions)					
	Burning	Apply fire suppression activities during prescribed burning treatments near ponderosa pine with barbed wire grown into the bark and telephone poles.	Units 2,3,65,70,71, 100a, 100b	77	O	P	
Other	*To protect an ongoing research site during project implementation*	Apply a 200-foot buffer around site.	Near Spring Gulch (see Project File)	78	O	P	

*A resource protection measure may be a design feature that was identified before the project was developed to eliminate or avoid potential undesired effects, or it may be a project-specific design feature or mitigation measure developed to minimize or eliminate a known potential effect of this particular action. Another method, determined to be equally or more effective in meeting the resource protection measure objective recommended by a resource specialist and approved by a line officer, could be used.

[1] C = timber sale or other contract; S = service; O = other such as FS force account crew, silvicultural prescription, or treatment unit layout. [2] S = standard operating procedure, meaning it is something the Missoula Ranger District routinely does. P = project-specific measure meaning this is a resource protection measure developed by the ID Team specifically for the Marshall Woods Restoration Project. [3] √ = potential volunteer or partnership opportunity

MONITORING

FOREST PLAN MONITORING AND BMP AUDITS

The Forest conducts post-project implementation monitoring per guidance in the Forest Plan. Typically, a project with the scope and breadth of Marshall Woods would have several elements and treatments evaluated per Forest Plan Monitoring guidance.

Another form of monitoring that could occur on portions of the Marshall Woods project is the State BMP audit. This audit is conducted by an interagency team of personnel well-versed in BMP implementation and effectiveness. It would typically focus on timber harvest and associated transportation system elements and implementation. Typically about 10 larger projects on NFS lands in the state are evaluated each year.

MARSHALL WOODS PROJECT-SPECIFIC MONITORING

This section provides a summary of project monitoring. Additional information and more specific monitoring details are contained in individual specialists' reports which are available in the Project File and at fs.usda.gov/goto/lolo/projects.

- In the RNRA, monitor to ensure Opportunity Class Standards and Indicators are being met during project implementation – if these standards and indicators are being exceeded (negatively) operations will stop and reevaluated (see Forest Plan Appendix O-4 for "Limits of Acceptable Change based Management Direction for the Rattlesnake National Recreation Area and Wilderness," PF).
- Monitor the effectiveness of the closures on the temporary roads in Units 4, 5, and 6.
- Monitor log landings, decommissioned roads, burn piles and other areas disturbed during project implementation for the first five years after harvest to ensure re-vegetation is successful and self-sustaining.
- Monitor to determine if road maintenance and road BMP effectiveness measures were implemented and to determine their effectiveness.
- Monitor to determine if timber BMP and INFISH buffers were implemented and to determine their effectiveness.
- Follow the monitoring guidelines outlined in the Lolo NF Integrated Weed Management project (USDA FS 2007, pp. 32-34), and FSM BMPs regarding noxious weeds (FSM 2081.2) (USDA FS 2001).
- Monitor weed treatments for efficacy and re-treatment needs.
- Monitor and assess heritage site conditions before and after project implementation in the Rattlesnake Drainage. Lolo NF Heritage Program staff would flag any cultural resources to be avoided prior to mechanical and/or hand treatment. Following implementation, Heritage Staff would visit the area to ensure site damage has not occurred.

Figure 11. Marshall Woods Restoration Project Alternative B (see page 82)

Figure 12. Marshall Woods Restoration Project Alternative C (see page 83)

Figure 13. Marshall Woods Restoration Project Alternative D (see page 84)

Chapter 3 Existing Condition and Environmental Consequences

Introduction

This section summarizes the direct, indirect, and cumulative effects of Alternative A (No Action) and Alternatives B, C, and D, providing the information and analysis necessary for the Deciding Officer to determine whether to prepare a finding of no significant impact or an EIS (40 CFR 1508.9). For resources of highest interest or concern for the Marshall Woods project, more detail is provided here. Additional information about existing conditions, methodology for analysis, the determination of the effects analysis boundaries, and more details of the effects analysis, are contained in the individual resource Specialist's Reports which are available online at www.fs.usda.gov/goto/lolo/projects or in the PF located at the Missoula Ranger District. Information from the Transportation Planning Specialist is used throughout the reports for the other resources and is not summarized in this chapter. Specific road treatments are summarized in EA Appendix E.

Past, present, and reasonably foreseeable actions were considered for analysis of cumulative effects where appropriate for each resource. Table D-1 in Appendix D provides a summary of activities that were considered in the cumulative effects analyses and includes those that occurred in the past, are still occurring, may occur, or may continue for an undetermined amount of time into the future. These actions are displayed in Figures D-1 and D-2 (see Appendix D).

Forested Vegetation

Existing Condition

The forested vegetation patterns visible today within the Marshall Woods area were shaped primarily by human-caused disturbance events. The area has a long history of extractive use since the early 1880s when the Northern Pacific Railroad arrived in Missoula and then entrepreneur Thomas Greenough 'tie hacked' the Rattlesnake to provide ties for the railroad as it established its way through the Missoula area (Reardon, 1975). In the early 1900s, approximately 140 people lived on homesteads/farmsteads within the main Rattlesnake corridor primarily along the Spring Creek and Rattlesnake Creek bottomlands (Poe, 1992). For decades following, the area provided the principle wood source for heating in Missoula. Montana Power Company purchased the municipal water system in 1936 and gave private homesteaders a year to vacate. The Montana Power Company harvested upwards of 25 million board feet (MMBF) in the Rattlesnake drainage and upper headwaters (outside the analysis area) between 1956 and 1964. The Forest Service, in cooperation with Montana Power, harvested approximately 1 MMBF in salvage and road-right-of way clearing in conjunction with Montana Power Company's harvesting operations (Reardon, 1975). No harvest in the RNRAW within the project area has occurred since 1964 (Martin, 1988). In addition, a long history of active fire suppression, to protect values-at-risk, precluded natural perturbations that likely would have created greater structural and age class diversity across the analysis area which is characterized by a historically frequent low intensity fire regime.

In August 1919, Quast, a rancher in Grant Creek was burning haypiles when the fire escaped his control. The fire burned from Grant Creek eastward to Gold Creek affecting upwards of an estimated 20,000 acres (Poe 1992; Missoulian 1919 as cited in Comer, 2003). The fire burned through the analysis area roughly from the main Rattlesnake Trailhead and Woods Gulch northward and east to the western ridge that incises Marshall Canyon. Virtually all the units proposed for treatment with the exception of units 64, 1, 200, and 84 lie within the fire perimeter. The 1919 fire burnt over an area with an extensive history of human extractive use and habitation. The 1919 fire is the origin for most of the forested stands that presently occupy the area. Evidence suggests that homesteaders and fuel wood collectors harvested virtually all the surviving mature trees. A few incidental remnant trees that established circa 1890, post tie hacking, are present within the main Rattlesnake Creek drainage (PF, M5-8, 9, 23-25) (see Figure 14).

Figure 14. Unit 2, Rattlesnake Creek

The fire of 1919 and continued use and occupation by homesteaders until 1937 resulted in conditions consistent with the stand initiation (regeneration) phase of stand development over a large portion of the analysis area (Oliver and Larsen, 1996). The type, size, scale, arrangement, duration, intensity and species affected in subsequent disturbance events will dictate how forest development patterns emerge within the analysis area. Following 95 years since the most significant of disturbance, much of the forested area has moved into the stem exclusion phase of stand development. During stem exclusion, intense inter-tree competition precludes the establishment of most new individuals (Oliver and Larsen, 1996). Much of the forests within the Marshall Woods area are presently experiencing extreme physiological competition, consistent with stem exclusion, and corresponding losses to insects and disease due to poor vigor and resilience to insect attack and root disease. Shade-intolerant pines are losing live crown ratio, thinning from the center and experiencing increasing losses. As ponderosa pine crowns thin, more diffuse light reaches Douglas-fir or other shade-tolerant species in the understory allowing their survival. Over time, the competitive advantage shifts to Douglas-fir as pines struggle with the demands placed on their limited photosynthae and succumb to insects, disease, and competition see Figure 14, Unit 2 (Oliver and Larsen, 1996).

Natural disturbances are not disruptions in forests rather they are the norm, and warm, dry low elevation forests, like those that occupy the Marshall Woods area, are disturbance mediated. The species that occupy these forests evolved with and are morphologically adapted to very frequent disturbance, namely fire. These forests are ever-changing and dynamic; forest development typically follows an initial floristic pattern whereby species invade at approximately the same time following a major disturbance, but assert dominance at different times (Oliver and Larsen, 1996). The type, size, scale, arrangement, duration, species affected, etc. in a disturbance event dictate how forest development patterns emerge after its occurrence.

Following the 1919 fire, a nutrient rich, bare mineral soil seedbed was exposed over much of the area. Ponderosa pine and Douglas-fir established readily and colonized the low elevation bottomlands. Ponderosa pine was able to out-compete other species on dry west and south aspects (i.e., Units 60, 61, 62, 64, 65). Western larch occurs on more favorable sites and was able to establish, due to very open growing conditions with a high degree of solar radiation, and ample available moisture provided by sheltered northerly aspects. Western larch gains a competitive advantage when establishing on such sites as it has more rapid early height growth than other conifers and captures the sites where it successfully establishes (e.g., Units 6 and 92). Lodgepole pine is more frost-tolerant than the other species, is a prolific seed disperser, and it coexists in some locales with western larch and Douglas-fir, along cold air drainages, or at higher elevations.

The Marshall Woods area is at the lower elevation range of ponderosa pine in the Middle Clark Fork River watershed. The sheltered nature and mild climatic conditions of the Rattlesnake Valley, afforded by the low elevation and topography, provides ample moisture availability for natural regeneration that is atypical of ponderosa pine over most of its range in Montana. Following the 1919 fire, and departure of the homesteaders that occupied and utilized the resources in the main Rattlesnake and surrounding area, both ponderosa pine and Douglas-fir continued to establish during favorable years, until the sites were fully occupied. In the main Rattlesnake corridor, that occurred for a period of approximately 30 years, with some small pulses of regeneration following the activity in the 1950s and 1960s, likely to provide access to Montana Power's harvest activity in the headwaters of Rattlesnake Creek in now what in Congressionally-designated Wilderness.

Without frequent low intensity fire as a disturbance agent, over time, these forested lands shift towards overstocked stands with an increasing shade-tolerant Douglas-fir component. This vastly increases susceptibility to root disease, spruce budworm, and bark beetles. The Douglas-fir response in the understory has resulted in considerable ladder fuel accumulations. Mortality from ensuing insect and disease losses increases surface fuel loading and the potential for severe fire behavior. Growing space freed by mortality would be occupied by existing cohorts onsite or, depending on the level of disturbance, facilitate the establishment of a new one. These conditions predispose stands to stand-replacing fire events and insect and disease epidemics (Graham et al., 2004). Shade-tolerant species (i.e., Douglas-fir) in the Inland Northwest tend to be more prone to a variety of insects and diseases including spruce budworm, Douglas-fir beetle, root disease and dwarf mistletoe (Hessburg et al., 1994). It is well accepted that ongoing climate changes have pushed regional climates beyond the bounds of the last several centuries. Warmer climates are expected to alter stress complexes that affect forests rendering them vulnerable to increased frequency, severity and extent of disturbances, namely fire and insect outbreaks (Joyce et al., 2008).

The condition of forested vegetation within the Marshall Woods landscape will be presented by the following areas: Existing Vegetation, Structural Stages and Canopy Cover, Past Management History, and Mountain Pine Beetle and other pathogens.

Existing Dominant Vegetation

The existing dominant vegetation represents the primary tree species that occupies the main forest canopy (see Table 11 and Figure 15). As previously discussed, disturbance, subsequent tree regeneration and stand development patterns dictate what we see when we venture into the forests in the Marshall Woods area today. It is a snapshot in time, of the current condition; it is not a static state, as forests, by nature, are dynamic. Within the Marshall Woods area, frequent low intensity fires that would have served as the primary disturbance to regulate stand structure and species composition have been abated to protect values-at-risk. Given the proximity to high density wildland-urban interface (WUI) development, fire has by-in-large been excluded for 95 years, eliminating multiple return intervals. Much of the forestland has developed unchecked by the level and types of disturbances that they evolved with and have shifted to a dominance of shade-tolerant Douglas-fir and loss of shade-intolerant ponderosa pine and western larch. This shift is strikingly evident with 38% of the landscape now in a Douglas-fir cover type. The shrub representation listed in Table 11must be considered in context with the spatial resolution of the dataset, human habitation and development patterns and recent industrial harvest on private lands. Some of the area, in fact, is presently occupied by young seedling or sapling forests or residential areas that the LANDSAT dataset classified as shrub dominated.

Table 11. Existing Dominant Vegetation in Marshall Woods Project Area

Dominant Vegetation	Existing (R1 VMap)
Water	< 1%
Sparsely Vegetated	< 1%
Shrub Dominated	22%
Grass/Forb	13%
Douglas-fir	38%
ponderosa pine	18%
lodgepole pine	5%
Englemann spruce	1%
western larch	1%
subalpine fir	1%
Shade-intolerant mix	< 1%

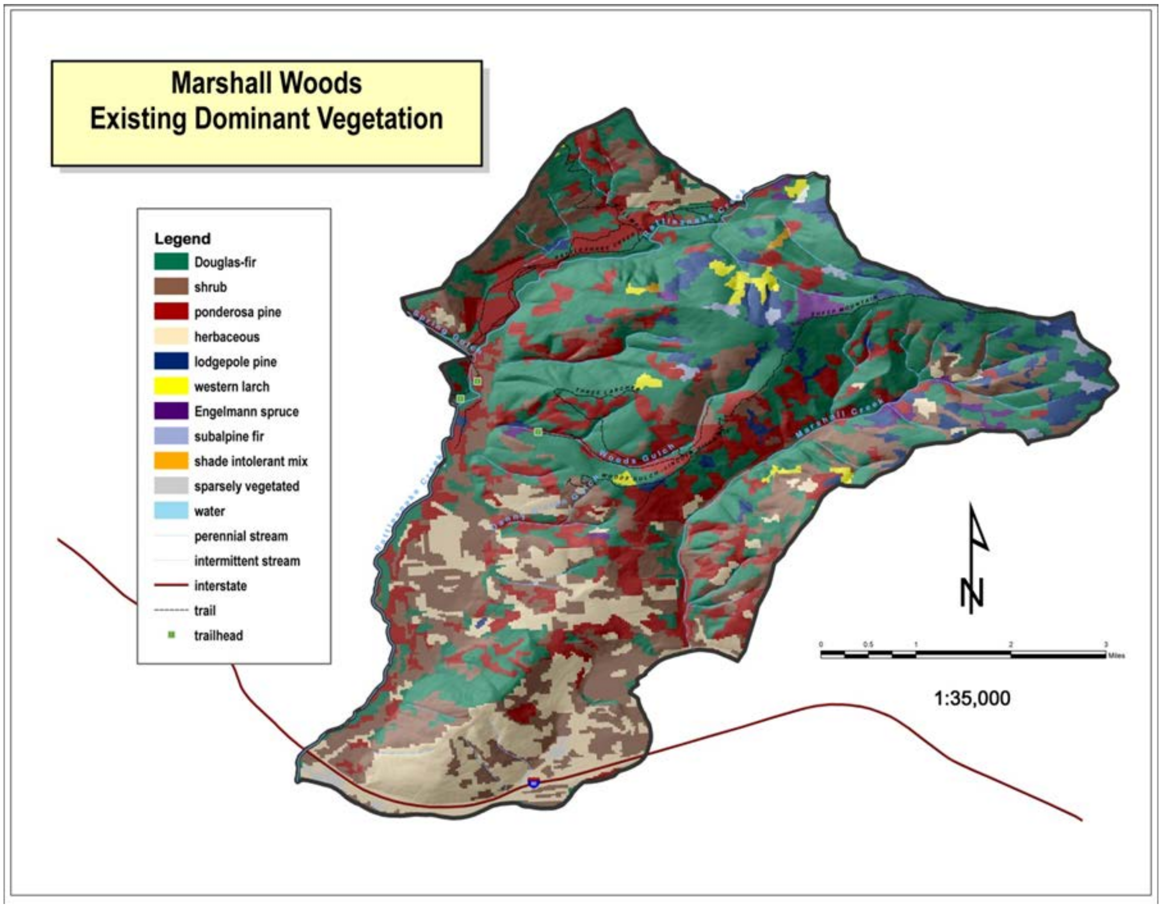


Figure 15. Existing Dominant Vegetation in Marshall Woods Project Area

Structural Stages and Canopy Cover

Table 12 and Table 13 show the current structural stage and canopy cover distribution within the Marshall Woods area. The primary characterization of the Marshall Woods area is a moderately closed to closed canopy, with mature forest occupying about one-half of the landscape (see Table 11 and Figure 16 and Figure 17). The landscape pattern is comprised of approximately one-half mid-aged, second-growth forests that regenerated (established) after disturbances in the early 1900s. Most of this area is now NFS land and is concentrated in the northern portion of the analysis area. Conversely, the shrub-dominated portion of the landscape is predominately private, City of Missoula or other ownership. Seedling/sapling or recently harvested stands are well-represented in Sections 31 and 33, as these lands were acquired from timber companies that harvested virtually all the commercial wood products from these sites in recent years. A portion of the area that is listed as shrub dominated is also occupied by young, regenerating forests.

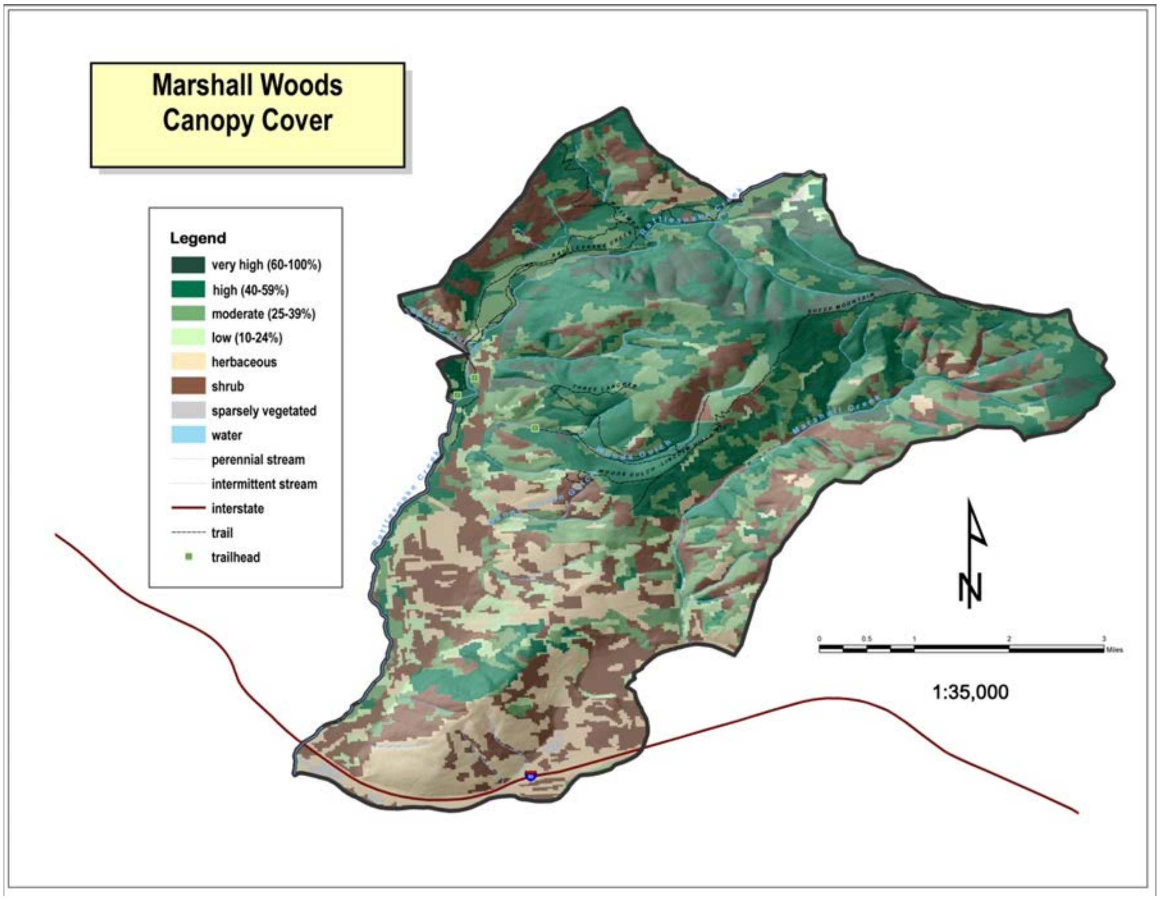
Table 12. Vegetation Structure in Marshall Woods Project Area

Vegetation Structure	Existing (R1 VMap)
Water	< 1%
Sparsely Vegetated	< 1%
Shrub Dominated	22%
Grass/Forb	13%
Seedling/Sapling Tree (< 5” dbh)	11%
Small Tree (5 – 9.9” dbh)	10%
Mature Tree (Medium – Large > 10” dbh)	43%

Table 13. Existing Canopy Cover in Marshall Woods Project Area

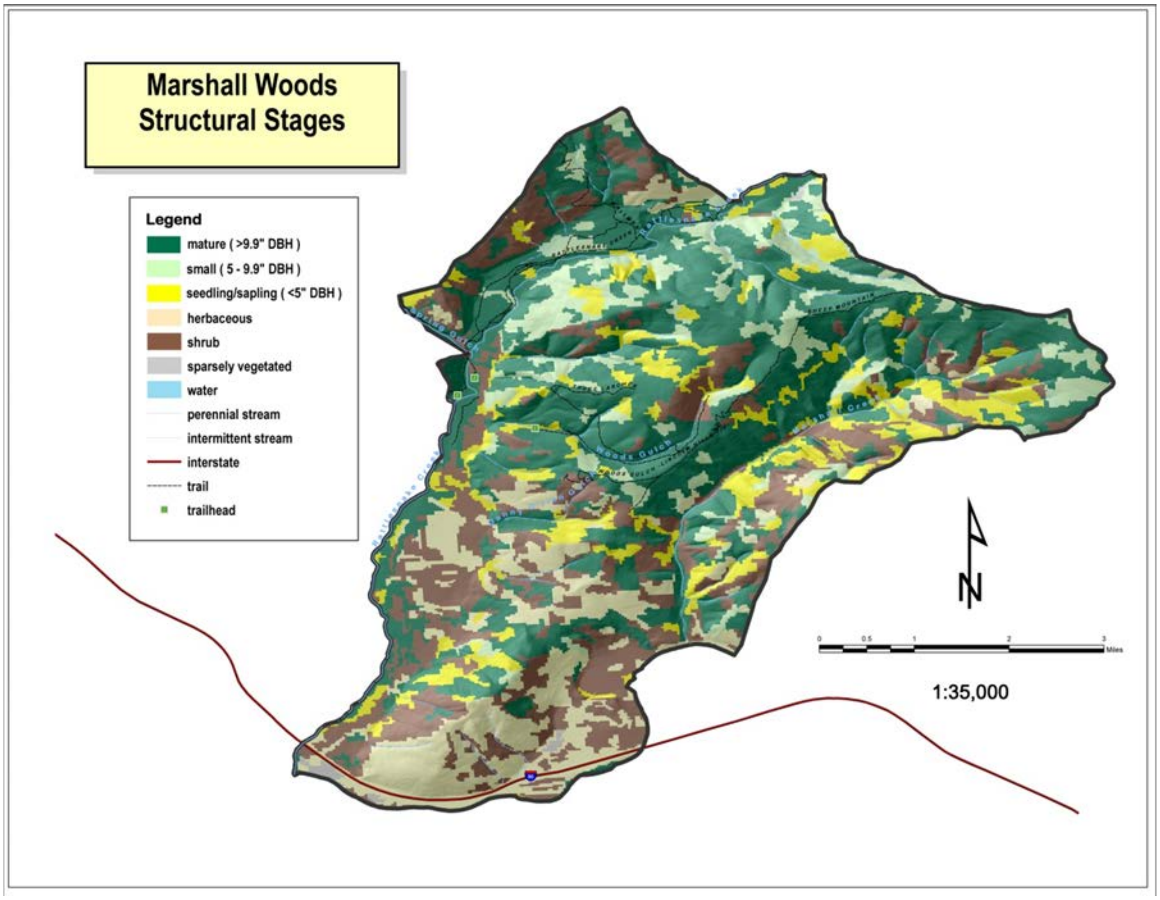
Canopy Cover	Existing (R1 VMap)
Water	< 1%
Sparsely Vegetated	< 1%
Shrub Dominated	22%
Grass/Forb	13%
Low Tree Canopy Cover (10-24%)	6%
Moderate Tree Canopy Cover (25-39%)	23%
High Tree Canopy Cover (40-59%)	29%
Very High Tree Canopy Cover (> 60%)	5%

Figure 16. Existing Canopy Cover in Marshall Woods Project Area

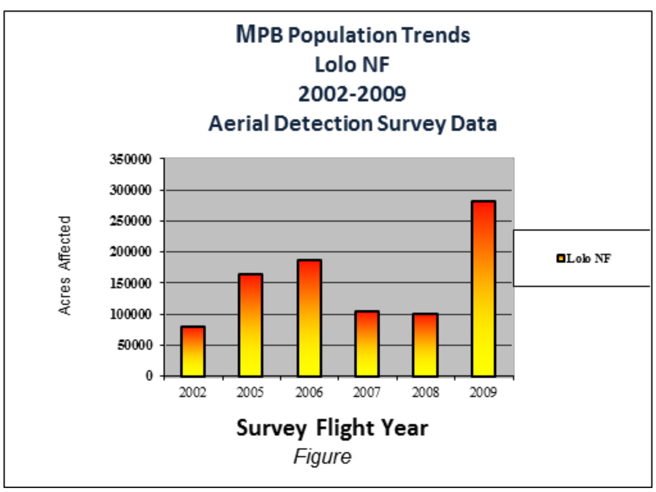


Since the early 1920s, natural processes such as fire have been abated to protect social values in the area. These disturbance mediated forests have adapted over millennia with very frequent fire and endemic insect and disease occurrence. Values-at-risk and increasing settlement and recreational use within the WUI have precluded the natural role of frequent, low intensity surface fires to continually shape vegetation patterns. The result is small patch sizes and disturbances that preclude patterns that establish landscape resilience including heterogeneity and variability in age class, species composition, forest structure and function. The majority of these are due to limited timber harvest, small-suppressed fires, and minor insect and disease occurrence. Today, following 95 plus years of successful fire suppression, the mosaic patterns of past burns and associated biological diversity has diminished. Areas that would have burned during the past 95 years have not and areas that burned during the last century are now occupied by an increased representation of mid-aged to mature stands. As a result, continuous, dense stand conditions and fuel beds across the landscape coupled with warming trends set the stage for large scale fires, as the region experienced in 2000, 2003, 2005 and 2007, and epidemic insect outbreaks as evidenced by recent MPB activity and susceptibility within the landscape (Rafta et al., 2008; Gannon and Sontag, 2010; Egan 2011).

Figure 17. Existing Structural Stages in Marshall Woods Project Area

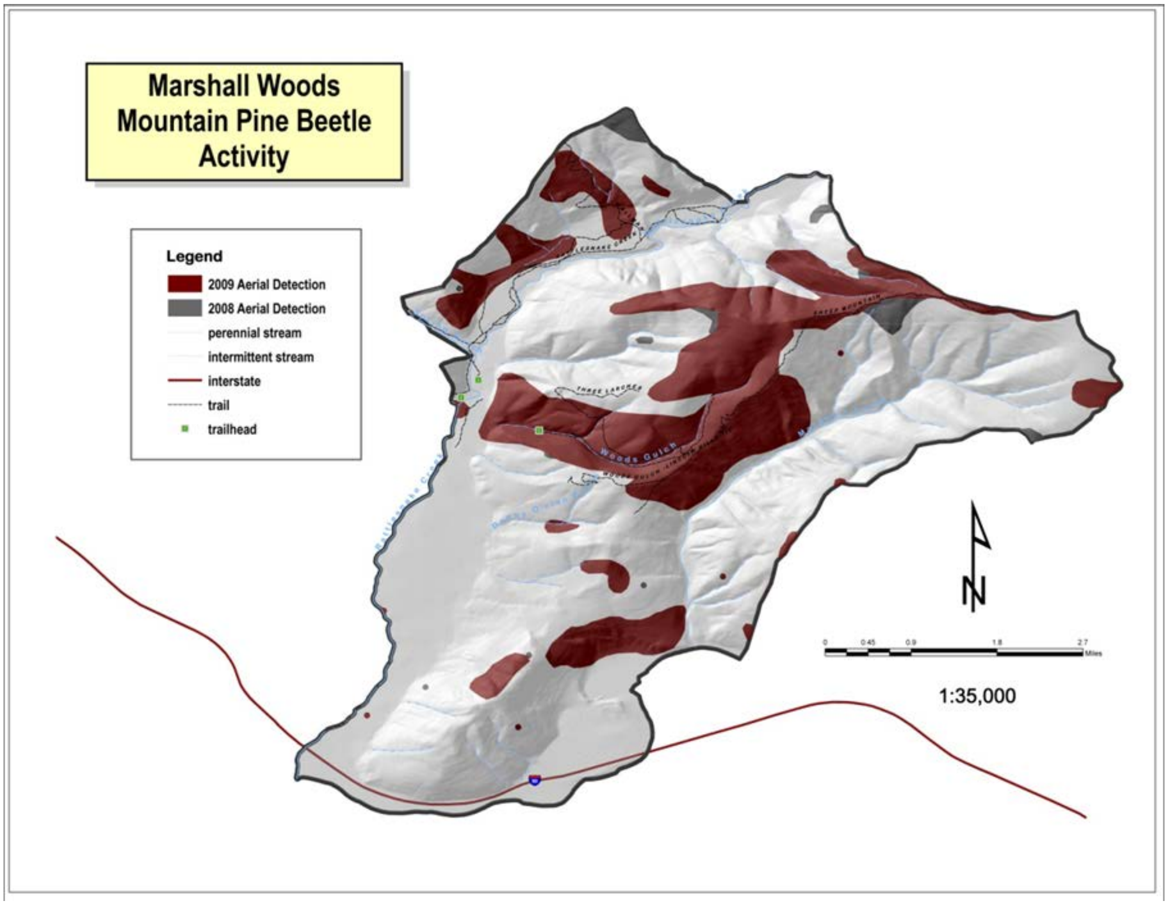


Mountain Pine Beetle (Dendroctonus ponderosae)



Mountain pine beetle (MPB) is the most aggressive bark beetle in the West (Jenkins et al., 2008). Within the Marshall Woods area, MPB activity escalated in recent years (Sturdevant and Egan, 2011; ADS, 2009; ADS, 2008; ADS, 2007; Gannon and Sontag, 2010; Gannon and Sontag, 2009; Gibson 2008; Gibson and Aquino, 2007). In 2006, MPB populations on the Lolo NF caused tree mortality on approximately 225,800 acres (Gibson, 2008). In 2007, 131,600 affected acres were mapped but, a significant portion of the Forest was not surveyed due to widespread fire activity (Gibson, 2008; ADS, 2007). Aerial detection surveys indicate that MPB populations of the Forest remained elevated in 2008, but fell from previous years with mortality occurring over approximately 105,000 acres (Gannon and Sontag, 2009). In 2009, MPB populations surged on the Lolo NF with over 331,000 acres affected, a 215% increase (see Figure above). MPB mortality occurred on over 91,000 acres on the Missoula Ranger District alone (Gannon and Sontag, 2010). Within the Marshall Woods analysis area, 1,803 acres were affected by MPB in 2008 (ADS, 2008) (see Figure 18). In 2009 MPB

Figure 18. Mountain Pine Beetle Activity in Marshall Woods Project Area



mortality was spread across 3,343 acres (27% of the analysis area), an 85% increase from 2008 (ADS, 2009) (see Figure 18). Since that time, extensive aerial detection flights have been limited due to lapses in federal funding.

Ground surveys recorded MPB-caused grouped tree mortality from 2008-2011 in approximately 10-30% of the ponderosa pines within Marshall Woods project area along the main Rattlesnake Trail corridor (Sturdevant and Egan, 2011; Egan 2011). Since 2012, MPB activity has subsided across the analysis area, presumably due to cooler and wetter conditions across the region. Nonetheless, aerial detection and ground surveys indicate that MPB are active across the area where suitable hosts are present at endemic or incipient levels and mortality should be expected in years when weather and other conditions are suitable for beetle activity given the high MPB hazard in the project area (ADS, 2012; ADS, 2013; Egan 2011). MPB-caused tree mortality is anticipated to increase in subsequent years within the project area without active management. Short-term management activities available to protect high-value trees from MPB include infested tree removal, pheromone application, and/or preventative pesticide sprays (Sturdevant and Egan, 2011). In 2012 and 2014, large ponderosa pine at the trailhead and along the main Rattlesnake Trail corridor were treated with Carbaryl to prevent bark beetle attack. The best long-term management activity to promote resilience to MPB is preventative thinning to reduce stocking levels and enhance residual tree spacing (Sturdevant and Egan, 2011).

Any recent mortality due to MPB in 2014 will be readily visible as crowns fade in the spring and summer of 2015. Successfully attacked trees often take an entire year to exhibit crown symptoms by turning pale green, yellow, orange, red, or brown as a result of beetle infestation. However, effective cambial girdling occurred far earlier at which time the trees were imminently dead. For this reason, imminent tree mortality in trees with green crowns would be assessed at the time of tree marking (for removal) and continue throughout the duration of the project. On seemingly healthy trees when foliage has not turned, successful MPB or Douglas-fir bark beetle (Dendroctonus pseudotsugae Hopkins (DFB)) attacks on at least 50% of the bole circumference of the tree would be considered imminently dead. A site-specific determination approved by a silviculturist or entomologist would be made to verify when trees can be considered dying outside of this guideline.

MPB hazard is defined as the ability of a stand to support MPB populations. Factors including tree size, age, stand basal area (BA), and injury enhance stand susceptibility to attack and provide the most suitable breeding material for bark beetle populations. Generally, the higher the stand BA, the higher the susceptibly for MPB attack. Evidence suggests that the threshold for high stand susceptibility is 110-120 square feet/acre (Schmid et al., 2007; Schmid and Mata, 1992; Schmid et al. 1994). Heterogeneity in stand density is an important element to consider in overall susceptibility. Stands with one or more locations of high susceptibility (greater than 110 square feet/acre BA [8]) are highly susceptible even if the average stand BA is less than 110 square feet (Schmid et al., 2007). MPB typically attack lodgepole pine and ponderosa pine greater than seven inches diameter at breast height (dbh). MPB do not exclusively attack larger diameter trees, but as populations move toward epidemic conditions, the percent of attacked trees is larger in the largest diameter classes (Schmid et al., 2007).

Applying this standard, based on stand exam data[9], where suitable ponderosa pine and lodgepole pine hosts are present, 100% of these stands are rated highly susceptible. Furthermore, within the analysis area, where suitable ponderosa pine and lodgepole pine hosts are present in mature stands with high canopy cover high stand susceptibility can be assumed. The level of MPB mortality present within the analysis area today is not a static phenomenon. As long as stands are highly susceptible and population levels are elevated the mortality trend is likely to continue in the near term (Sturdevant and Egan, 2011). Risk expresses the likelihood that an epidemic (outbreak) will cause significant economic or environmental damage to a stand. In outbreak conditions, stands with moderate to high hazard are at extreme risk for infestation due to proximity to current populations.

Other Pathogens

[8] When average diameter is greater than or equal to 10 inches
[9] Collected in 2011 on 348 acres proposed for treatment along the main Rattlesnake Trail corridor

Figure 19. Unit 71, Rattlesnake Creek

Evidence of root disease affecting both Douglas-fir and ponderosa pine hosts was confirmed along the main Rattlesnake Trail corridor (Units 2, 70, 71) (Lockman, 2012). Armillaria ostoyae (also recognized as A. solidipes) root disease is present within the analysis areas and areas proposed for treatment; the infection was confirmed in Units 71 and 2 (see Figure 19- Armillara pocket along main Rattlesnake Trail, Unit 71). Phaelous schweinitizii was also confirmed along the main Rattlesnake Trail corridor and is expected in Unit 200. These two agents often co-exist, with P. schweinitzii infecting the tree very early in its life, causing an overall decline in the vigor as the tree ages. A. ostoyae readily infects P. schweinitzii-infected trees, hastening the decline and death of the host tree (Lockman, 2012). Root disease infected trees are stressed and very attractive to bark beetles, specifically DFB, that subsequently attack the trees. Armillaria root disease is a "disease of the site" (Hagle, 2008). That is, established mycelia of this fungus are essentially permanent, so the best course to minimize losses is to manage tree species that will survive on infested sites. Douglas-fir is very susceptible to Armillaria; although ponderosa pines dying from Armillaria root disease were observed, it is the preferred species on this site if density is reduced. Densely stocked ponderosa pines are often stressed, rendering them susceptible to attack by agents such as bark beetles and root diseases. Although ponderosa pine is considered tolerant to Armillaria root disease, it is not immune. Pines are quite susceptible as young trees; their tolerance is acquired over time becoming fairly tolerant by 25 to 30 years of age. Observational evidence suggests that this tolerance can be compromised if trees experience long-term stress, from dense stocking, drought, and other agents. Lack of fire over many years has allowed a buildup of biomass on the site, stressing the pines and allowing them to occasionally succumb to root disease (Lockman, 2012).

Annosus root disease has not been confirmed within the analysis area, but its presence is suspected. Forest Health and Protection personnel did an Annosus survey of ponderosa pine stumps on the Lolo NF in 2003 and 2004 and found evidence of the fungus in 25% of the stands. This is sufficient evidence to warrant treating susceptible ponderosa pine stumps. The current recommendation is to treat all ponderosa pine stumps 12" or greater in diameter within 24 hours of cutting with the currently registered product (Sporax®) for preventing Annosus root disease (Lockman, 2012). Alternatives B and C were designed to include stump treatment to prevent Annosus infection.

Elytroderma deformans needle disease is affecting ponderosa pine at varying levels in the analysis area. Along the main Rattlesnake Trail, brooms from E. deformans are small and confined to the lower crowns of infected trees. Elytroderma is most damaging to trees with poor crowns. When the proportion of the crown infected is 25% or less, damage is fairly minimal. When the proportion of the crown infected is >25% but less than 75%, these trees are thought to be very attractive to bark beetles. Trees with >75% of their crowns infected are often killed outright by the disease (Childs et al., 1971). The main recommendation is to remove heavily-infected individuals during silvicultural treatments as included in Alternative B (Units 1-6) and Alternative C (Units 4-6).

Comandra blister rust (Cronartium comandrae Pk.) is affecting ponderosa pine along the main Rattlesnake corridor. It causes cankering on ponderosa and lodgepole pines, leading to branch mortality, top-kill or whole tree mortality (Lockman, 2012). The alternate host is bastard toadflax (Comandra umbellata), which grows on hot dry, south-facing slopes (Zentz and Jacobi, 1989), as found throughout the lower elevations of the Marshall Woods analysis area. Management recommendations to reduce the level of comandra blister rust are to remove infected individuals when treating stands, as included in Alternative B (Units 1-6) and Alternative C (Units 4-6). Bastard toadflax is a rhizomatous species, and would likely respond favorably to burning. It is possible that the prescribed burning could increase the amount of comandra, and thus increase the incidence of comandra blister rust (Lockman, 2012).

In some portions of the Marshall Woods project area light to heavy dwarf mistletoe infection is present. Dwarf mistletoe infection spreads to uninfected trees and causes reduced tree vigor and growth. Dwarf mistletoe is present in western larch and Douglas-fir hosts within the Marshall Woods project area and has moderately to heavily-infected individuals in some of the areas proposed for treatment. Branches with large mistletoe brooms are more brittle than non-infected branches and tend to break and fall to the ground. This is especially true during wind events and heavy snow load years. Some heavily-infected trees are present near the main Rattlesnake Trailhead and along the high traffic area of the Rattlesnake Trail (Unit 70) (Lockman, 2012). Alternative B proposes removing some of these trees along the trail.

Western spruce budworm, western pine beetle, and DFB are also present within the Marshall Woods project area. Western spruce budworm was not abundant during the 2011 survey; however, in the last two years it has caused significant mortality and dieback in Douglas-fir hosts within the areas proposed for treatment in Woods Gulch – Marshall Canyon area (see Figure 20, boundary between Unit 6 and Unit 82). Although western spruce budworm is a native insect that has co-evolved with western spruce-fir forests, extensive damage and mortality from budworm can occur especially during drought periods and in areas where fire has been suppressed. Silvicultural treatments that reduce stocking density, number of canopy layers, and increase individual tree vigor and species composition are the only long-term solution to budworm management (Sturdevant, personal communication). Western pine beetle is also attacking ponderosa pine within the area, at times, in conjunction with MPB. Recommendations for MPB would reduce losses from western pine beetle as well. Incidental DFB is also present in Douglas-fir hosts within the analysis area. Some high hazard stands are proposed for treatment in Alternative B and C. Reductions in stand density can dramatically reduce stand susceptibility to attack

Figure 20. Units 6 and 82

(Negron et al., 1999).

Environmental Consequences

To achieve the purpose and need, stand treatments were designed to: 1) Reduce crown fire potential and restore fire as an ecological process focusing on low intensity, high frequency and mixed severity fire regimes; and increased resilience to surface fire and bark beetles; 2) Maintain or increase the species composition of fire-resistant shade-intolerant species (e.g., western larch, ponderosa pine); and design treatments to retain large diameter, old ponderosa pine and western larch trees and create stand conditions that could provide large trees in the future; and 3) Provide for age class, species and structural diversity to reduce vulnerability to stressors (e.g., fire, insects, and disease).

Each alternative was analyzed for its ability to address the following measures of success to meet the purpose and need: resilience, resistance, species composition, structure and function, and restoration of fire as a process. Project design employs an adaptive approach to make adjustments in the application of historical conditions as a reference point. Flexibility is incorporated to address inherent uncertainty about the local effects of climate change by enhancing the resiliency and resistance of the forests, and specific aspects of structure, composition and function (Joyce et al., 2008; Millar et al., 2007).

Resilience- Evaluation of vulnerability to stressors and ability of stands to persist through and reorganize after disturbance and maintain basic structure and function over time. Measurement indicators include resilience to fire and bark beetles (bark beetle hazard) under current and future conditions. Attributes that are consistently linked as primary factors associated with bark beetle infestations are stand density, basal area, stand density index, tree diameter and host density (Fettig et al, 2007). The temporal resilience of stands to bark beetles and fire will also be addressed.

Resistance- the ability of a forest community to avoid alteration of its present state by a disturbance. Resistance practices seek to improve forest defenses against the effects of rapid environmental changes. Resistance measures are aimed at protecting high value resources that are vulnerable to stressors.

Function- measured by functions and processes characteristic of healthy ecosystems, whether or not those systems are within the historical range of variation. Properly functioning systems can accommodate processes including fire, insects, disease, and climate change and provide a sustainable flow of ecosystem services.

Species composition– measured by percent composition of at-risk shade-intolerant species (i.e., ponderosa pine, western larch, aspen). Measures of species composition include establishment of shade-intolerant, root disease-resistant species and species diversity at the stand and landscape scale. Managing for a variety of species and genotypes provides resilience to environmental stressors (Joyce et al., 2008).

Structure- measured by the horizontal and vertical distribution of components of stands. Age class and structural diversity at the landscape scale is also a measure of forest structure. Measures used include: stand density index (SDI); age class diversity; basal area (BA) and trees per acre as measures of density; quadratic mean diameter as a measure of tree sizes; and arrangement and levels of ladder fuels and down woody debris.

A key issue that emerged through the public scoping process was a request to exclude all machinery from the area proposed for treatment along the main Rattlesnake Trail corridor, except that necessary to accomplish road improvements. Furthermore, some public comments desired complete exclusion of machinery in vegetation project design. Two alternatives to the proposed action were developed in response to this public issue. Excluding mechanized treatments and product removal along the main Rattlesnake trail corridor dramatically alters the effects of the treatments and their ability to meet the purpose and need. Therefore, the effects will be displayed, by alternative, in the main Rattlesnake trail corridor and in the Woods Gulch- Marshall portion of the project. The Rattlesnake portion of the project includes all units north or west of Rattlesnake Creek and Unit 70 (i.e., Units 2, 3, 65, 70, 71,100a, 100b, 101). The Woods Gulch- Marshall portion of the project lies east of Rattlesnake Creek in the Marshall Creek and Woods Gulch areas (i.e., Units 1, 4, 5, 6, 60, 61, 62, 63, 64, 66, 80, 81, 82, 84, 90, 91, 92, 200). Additionally, this effects analysis will compare each of the alternatives to the treatment type in the proposed action, Alternative B, to provide a direct comparison between the alternatives.

Direct and Indirect Effects

As described above, for the purposes of this analysis, the Marshall Woods area was divided into two distinct geographic areas to describe the effects of the four alternatives on the measurement indicators and ability to meet the purpose and need of the project. The key issue related to forested vegetation in the Marshall Woods area is the need for healthy and resilient forests. Indicators of a properly functioning condition include a resilient ecosystem with diverse distribution of seral stages, with composition, structure and pattern that is resilient to natural fire regimes, and insect and disease occurrence under current and future climates. The Northern Regional Overview identified significant ecological indicators of risk to forest ecosystems including: (1) the loss of species composition at the cover type level and changes in landscape distributions and (2) stand level structure as measured by density and seral stage/size class distribution (USDA, 1998). For example, ponderosa pine, western larch, and aspen are key at-risk ecological components within the analysis area. This effects analysis addresses restoration of forest structure, species composition, function, and resilience.

Managing for resilient spatial pattern requires combining reference conditions with climate change adaptation (Churchill et al., 2013). Pre-settlement forests developed following centuries of frequent disturbances and climatic variation, and serve as a guide for managers to increase resilience yet must be considered in the context of future climates to provide targets for restoration (Keane et al., 2009; Spies et al., 2010; Stephens et al., 2011). Properly functioning systems can accommodate processes including fire, insects, disease, and climate change and provide a sustainable flow of ecosystem services whether or not those systems are within the historical range of variation. Gillette and others (2014) concluded that, “Managing for biologically diverse and resilient forests is our best and only long-term, sustainable response to a multitude of stressors – insects and disease outbreaks, fires that are unprecedented in severity, and drought – that are likely to increase in frequency as climate changes. In the case of bark beetles and other stressors, this calls for greater, science-based use of silvicultural treatments that, paradoxically, require some tree mortality for the greater resilience of the entire forest.”

In summary, Alternative B would increase resilience to disturbances in the long-term as it favors shade-intolerant species, reduces stand density to increase resilience to fire and pathogens, and addresses shifts in species composition, age class and structural diversity that have occurred at the landscape level in both the main Rattlesnake corridor and Woods Gulch-Marshall areas. The treatment would: reduce density via stand thinning; use prescribed fire to modify fire behavior (as measured by the projected reduction of uncharacteristically severe wildfire effects for the forest type); and maximize the retention of large, fire-tolerant trees, to restore and promote fire-resilient stands. Alternative C attempts to meet these objectives, but is largely ineffective within the main Rattlesnake corridor. Alternative D fails to meet most of these goals across most treatment areas, and is ineffective at increasing resilience at the landscape scale (see Figure 21. Anticipated Resilience by Alternative[10]). Alternative A meets none of these objectives and does not meet the purpose and need of the project. Under Alternative A, the resilience rating of the areas proposed for treatment in Alternative B, C and D would be low.

Alternative B is the only alternative designed to reduce stand density to minimize drought effects, reduce the impact of large wildfire events, manage the potential for increased insect and disease outbreaks, and ensure a wide variety of species and age class diversity, while managing for processes to facilitate adaptation in the face of a changing climate across the analysis area (Joyce et al., 2008; Millar et al., 2007).

Additionally, Alternative B is the only alternative that effectively achieves the following restoration and resilience strategies for warm, dry forests adapted to a frequent low intensity fire regime across all treatment areas (Churchill et al., 2013; Allen et al., 2002; Chmura et al., 2011; Covington et al., 1997; Franklin and Johnson, 2012; Peterson et al., 2011; Spies et al., 2010; Stephens et al., 2010):

- Reduces surface and ladder fuels; increases crown base heights
- Reduces and maintains lower tree densities; decreases crown bulk density
- Increases composition of fire and drought-tolerant species (ponderosa pine and western larch)
- Increases mean diameter and individual tree vigor by retaining large trees with healthy crowns
- Conserves existing species and genetic diversity
- Restores horizontal spatial heterogeneity of forest structure, including openings where early-seral species can establish
- Reintroduces fire to reduce fuel loads, stimulate understory species, and maintain desired fuel beds.
- Reduces/maintains appropriate levels of pathogens, insects, and other disturbances in order to create decadence, mortality and interactions with fire that lead to regeneration of new tree cohorts and diverse understories
- Necessitates monitoring key processes including mortality, regeneration, growth, fuel accumulation and new species colonization to inform management

Alternative C is consistent with these strategies, but does not effectively meet these restoration strategies along the most heavily used recreation area around Missoula, along the main Rattlesnake corridor. Alternative D fails to meet most of these strategies across the most at-risk areas, and is ineffective at increasing resilience at the landscape scale. Alternative A meets none of these strategies and does not meet the purpose and need of the project.

[10] Resilience rating: high = falls below effects indictor thresholds and maintains resilience to fire, insects and disease over time, low hazard (i.e., SDI, BA, crown fire potential, fire-resistant species); moderate = markedly reduced hazard to fire, insects and disease yet still moderate rating and/or temporally short reduction; low = high hazard to fire, insects and/or disease over time, treatment does not effectively reduce vulnerability to one or more stressors in the near or long-term.

Effects Indicators as Displayed by Acres of Treatment

Each action alternative proposes treatment on 30.5% (3,959 acres) of the Marshall Woods landscape, 54.2% of the NFS land within the analysis area. Alternative B is designed to restore warm, dry resilient forests within the landscape via long-term (20-30 years) effective treatments across 3,701 acres or 28.5% of the landscape, with moderate, shorter-term improvement across 2% of the landscape. Alternative C would achieve these objectives on 3,162 acres or 24.3% of the landscape, but with low to moderate improvement within the main Rattlesnake Trail corridor. Alternative D aims to achieve these objectives on 2,647 acres or 20.4% of the landscape, yet fails to effectively address the most at-risk stands across the project area rendering it largely ineffective at meeting the purpose and need of the project (see Figure 21 and Table 14).

Figure 21. Anticipated Resilience by Alternative

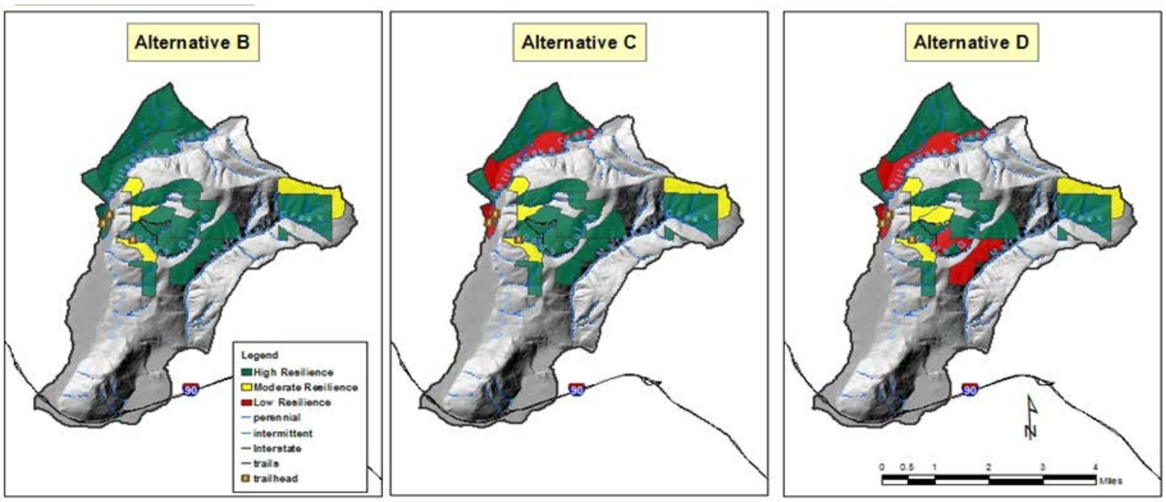


Table 14 provides a quantitative comparison of the four alternatives and their effectiveness at meeting elements of the purpose and need within the Marshall Woods landscape. Large-scale thinning to reduce stand density to minimize drought effects, reduce impact of large wildfire events, manage the potential for increased insect and disease outbreaks, and ensure a wide variety of species and age classes diversity, while managing for processes are approaches to facilitate adaption in the face of the changing climate (Joyce et al., 2008; Millar et al., 2007). Alternative A, no action, does not involve any active management adaption strategies and the landscape would remain highly vulnerable to stressors coupled with a changing climate.

Table 14. Forested Vegetation Effects Indicators

• High stand resilience to bark beetle attack and fire (30 years) • Significantly reduced bark beetle hazard • Low MPB susceptibility • At-risk shade-intolerant species and healthy, large diameter individuals featured • Fire restored as a process to fire-adapted ecosystems	Main Rattlesnake (acres)	Woods Gulch-Marshall (acres)	% landscape treated
Alternative A	0	0	0
Alternative B	225	515	5.7
Alternative C	0	515	4.0
Alternative D	0	0	0
• Moderate to high stand resilience to bark beetle attack and fire (20 years) • Moderately reduced bark beetle hazard • Low to moderate MPB susceptibility • At-risk shade-intolerant species and healthy, large diameter individuals featured • Fire restored as a process to fire-adapted ecosystems	Main Rattlesnake (acres)	Woods Gulch-Marshall (acres)	% landscape treated
Alternative A	0	0	0
Alternative B	405	870	9.8
Alternative C	91	870	7.4
Alternative D	91	870	7.4
• High stand resilience to bark beetle attack and fire • Reduced bark beetle hazard • Low MPB susceptibility maintained	Main Rattlesnake (acres)	Woods Gulch-Marshall (acres)	% landscape treated
Alternative A	0	0	0
Alternative B	0	467	3.6
Alternative C	0	467	3.6
Alternative D	0	467	3.6
• Restore sites with disease-resistant shade-intolerant species adapted for resilience to current and future climate	Main Rattlesnake (acres)	Woods Gulch-Marshall (acres)	% landscape treated
Alternative A	0	0	0
Alternative B	0	450	3.5
Alternative C	0	450	3.5
Alternative D	0	450	3.5

• Restore meadows, aspen, and open grown forests and shrublands	Main Rattlesnake (acres)	Woods Gulch-Marshall (acres)	% landscape treated
Alternative A	0	0	0
Alternative B	769	0	5.9
Alternative C	769	0	5.9
Alternative D	769	0	5.9
• Low to moderate stand resilience to MPB attack • Slightly reduced bark beetle hazard • Reduced surface fuel loading and reduced crown fire initiation potential • Moderate to high MPB susceptibility • Slight to moderate favoritism to at-risk shade-intolerant species and minimal reintroduction of fire as an ecological process	Main Rattlesnake (acres)	Woods Gulch-Marshall (acres)	% landscape treated
Alternative A	0	0	0
Alternative B	0	248	1.9
Alternative C	539	248	6.1
Alternative D	539	763	10.0

Additionally, alternative treatments were assessed based on thresholds of high stand susceptibility to MPB based on SDI and BA/acre suggested by research and the ability of each alternative to maintain levels of low stand susceptibility in the long-term. It is important to clarify that the treatments were designed to meet the purpose and need of the project and are not based on these specific measures. These measures are used to provide a quantitative comparison between the alternatives. They are based on FVS modeling of treatments, they are not absolutes, but should be viewed as relative measures to allow for reasoned quantitative comparison of the current condition, the four alternatives, and the magnitude of change and trends over time.

Crown thinning or thinning from below, as proposed in Alternative B, would not significantly lower stand growth, but should lower overall stand mortality by focusing on removing intermediate and suppressed trees (Cochran et al., 1994). Furthermore, by allocating site resources to fewer, larger trees, such treatments can accelerate the development of stands towards developing the large tree component of old growth (Cochran et al., 1994). FVS modeling results for Alternative B indicate that commercial treatments and prescribed fire reduce stand susceptibility below thresholds, resulting in and maintaining low MPB hazard and high stand resilience to attack in both the main Rattlesnake corridor and Woods Gulch - Marshall areas; whereas, Alternative C, accomplishes this in only the Woods Gulch - Marshall area (see Table 15). Non-commercial thinning followed by hand piling and burning treatments in Alternative C (Units 2,3) and Alternative D (Units 1-6) would not result in low bark beetle hazard or a significant increase in resilience to attack as they would not reduce BA sufficiently and lower SDI below 165 which is effective in reducing stand susceptibility to MPB. Additionally, within Units 70 and 71, only treatments in Alternative B would be effective at reducing and maintaining stand conditions below the threshold of high susceptibility to bark beetle attack. Alternatives C and D would only remove small diameter trees (less than 8" dbh) by hand, which is ineffective at adequately reducing bark beetle hazard (Sturdevant and Egan, 2011).

Alternative B includes the option for machine piling to enable thinning of the main canopy. In short, Alternative B is the only alternative that lowers bark beetle hazard sufficiently to meet the purpose and need to increase resilience to bark beetle and fire within the main Rattlesnake corridor.

Table 15. Treatment Effects on Stand Density Index and Basal Area/Acre

Units 1-6	Year 2018		Year 2050	
	Main Rattlesnake (SDI/BA)	Woods Gulch-Marshall (SDI/BA)	Main Rattlesnake (acres)	Woods Gulch-Marshall (acres)
Alternative A	289/127	289/127	321/161	321/161
Alternative B	123/69	123/69	168/97	168/97
Alternative C	194/114	123/69	236/142	168/97
Alternative D	194/114	194/114	236/142	236/142
Units 70 and 71	Main Rattlesnake			
	Year 2018		Year 2050	
	SDI	BA	SDI	BA
Alternative A	233	104	295	146
Alternative B	143	86	188	116
Alternative C	179	100	229	135
Alternative D	179	100	229	135

Treatments Affecting At-Risk Shade-Intolerant Species

In general, the project is designed to: focus largely on removing smaller diameter trees; retaining the largest, healthiest ponderosa pine and western larch in all age classes; and thinning and using prescribed fire to modify fire behavior, as measured by the projected reduction of uncharacteristically severe wildfire effects for the forest type to promote fire-resilient stands. All treatments proposed under Alternative B are designed to retain large, healthy trees to the degree this practice is consistent with the objective of maintaining or restoring healthy fire-resilient stands. Ponderosa pine and western larch are key at-risk species that would be featured by the treatments. Managing for a variety of species and genotypes provides resilience to environmental stressors (Joyce et al., 2008). By retaining large, healthy dominant and codominant trees, the treatments would promote long-term forest productivity and genetic quality by selecting residuals based on phenotypic expression (Howe, 1995). Alternative C is designed to achieve these same objectives; however, would not accomplish this effectively across 539 acres along the main Rattlesnake Trail corridor (Units 70, 71, 2, 3) whereas, Alternative B would. Alternative D would not accomplish this effectively on 1,054 acres treated under Alternative B. Alternative A would retain all trees onsite, but would not increase their resilience or resistance to wildfire or other disturbance agents.

Where aspen occurs in Units 100A and 100B, Alternatives B, C, and D would stimulate its regeneration. Where aspen is present in other treatment units, aspen would be featured by the treatment to the extent possible. This would occur by either removing conifer encroachment and/or prescribed burning. These actions would stimulate suckering among aspen clones increasing the aspen distribution within the treatment areas. Browse protection could also occur. Alternative B would result in the greatest benefit to aspen and its release and regeneration across the landscape as removal of competing vegetation is incorporated into alternative design. Alternatives C and D are designed to constrain some treatments with diameter limits and hence may preclude removal of competing conifer vegetation and limitations on prescribed burning due to stand density, fuel loading and potential fire behavior. In addition, diameter limits without the flexibility for young tree establishment or in-stand age class variation and heterogeneity may actually conflict with restoration of spatial patterns and other objectives in creating a resilient landscape (Churchill et al. 2013; Abella et al 2006; North et al., 2007). Alternative A would not stimulate aspen regeneration and is likely to result in a further decline of aspen.

Treatments Affecting Large Tree Retention

As described in the existing condition section, the Marshall Woods project area has an extensive history of past harvest, human occupation, human-caused stand-replacing fire, and extractive use all prior to NFS ownership. Given this history, no known old growth stands, as defined by the Forest Plan and Green and others (1992), are present within the project area. Remnant, individual old and/or large trees are a scarcity within the project area as well.

All treatments, in all alternatives, are designed to retain large, fire-resistant ponderosa pine and western larch where they occur within the limits of the treatment design (i.e. diameter limits in Alternatives C and D would prevent removing trees competing with larger, remnant trees in Units 70, 71, 2, and 3 and Units 70, 71, and 1-6, respectively, leaving them susceptible to bark beetles, fire and other stressors). Treatments in Alternative B (Units 1-6) were designed to protect large diameter (>21” dbh) ponderosa pine and western larch from the risk of stand-replacing wildfire due to ladder fuel accumulations, historically atypical stand densities, and high surface fuel loading[11]. Alternative C was designed to protect these trees within the Woods Gulch-Marshall area (Units 1, 4-6). Under the Alternatives A and D, these trees would remain susceptible to stand-replacing fire, bark beetle attack, and extreme competition for resources. In commercial treatment units (Units 1-6) under Alternative B ladder fuels would be removed in an approximately 20 – 30’ radius to protect these trees. Furthermore, the entire stand where these trees reside would be treated to reduce density and increase resilience to wildfire and bark beetles. Alternative C would protect these trees except within the main Rattlesnake corridor; protection would be afforded in Units 1, 4-6.

Monitoring data collected on the Lolo NF on silvicultural treatments designed to protect large, old trees indicated marked success over no treatment. Data collected in old growth stands between 1995 and 2005 indicate that treatments are successful at maintaining old growth structure post-treatment where it occurred (Brewer et al., 2008). Sixteen confirmed old growth stands were treated with a combination of understory thinning, prescribed fire and/or commercial harvest. Ninety-four percent of the old growth stands treated maintained old growth structural characteristics post-treatment. One stand experienced a high level of bark beetle mortality post-treatment due to the loss of a portion of the large tree component caused by mortality from prescribed fire (Brewer et al., 2008). Where deemed appropriate, duff accumulations around the base of large (21”+ dbh) trees may be ameliorated to encourage fine roots to migrate deeper in the soil profile before applying stand level prescribed fire (i.e., underburning). Kolb and others (2007) concluded that raking duff accumulations may increase fine root mortality. However, Jain and Graham (in press) studied various treatments to ameliorate duff accumulations and found that treatments when fine roots are not actively growing can mitigate unintended consequences associated with removing duff accumulations around the base of large trees (Jain, personal communication, 2011). The guidelines developed by Jain and Graham could be incorporated into treatments where incidental old trees are present. This is consistent with direction outlined in the 1986 Lolo NF Forest Plan adaptive management approach referred to as “management control

[11] Trees greater than 21” dbh may be removed to achieve stand objectives and where safety operations necessitate.

system" to consider monitoring study findings and adjust management activities accordingly. Conversely, monitoring data also indicates that 91% of the old growth stands burned by wildfires lost their old growth characteristics through a combination of direct fire mortality, delayed fire mortality, and mortality caused by post-fire agents such as bark beetles (Brewer et al., 2008). These results are consistent with the effects that would be expected under the no action alternative, Alternative A, in the event of a wildfire.

Additionally, restoration treatments in warm and dry forests with large old trees can alter stand biomass allocation providing greater resources for the overstory (Sala and Callaway, 2004). Restoration treatments in old growth stands studied include: understory slashing with pile and burn; understory slashing with underburning; and overstory thinning and understory slashing followed by underburning. These types of treatments are consistent with understory slashing, prescribed fire, and overstory thinning included in the Marshall Woods project. Results indicate that positive benefits to function and growth of the large tree component [12] of old growth stands may be accomplished primarily by removing the Douglas-fir understory that competes for resources. Results also suggest that additional positive effects on overstory function may be accomplished by thinning the overstory in addition to treating the understory as proposed under Alternative B (Units 1-6) and Alternative C (Units 1, 4-6). This study indicates a substantial positive effect on radial wood growth as a result of active management where old trees reside (Sala and Callaway, 2004). In addition, Sala and Callaway (2004) note positive measurable responses immediately following restoration treatments. Data taken five consecutive years after restoration treatments designed to modify canopy structure towards more resilient structure by removing dense Douglas-fir understory effectually allowed for allocation of resources to the largest trees and resulted in significant measurable positive effects to overstory tree function (Sala and Callaway, 2004).

These findings further ascertain the conclusion that slashing, thinning and prescribed fire treatments included in this project would not preclude stands from developing into old growth in the future. The treatments would likely hasten diameter accretion and stands may potentially provide the large tree component of old growth habitat in the future. The following project design features incorporated in this project to protect large trees include:

- Where deemed necessary by a Silviculturist, measures would be taken to protect at-risk and/or large diameter (21"+ dbh) trees from excessive crown and bole scorch to the extent feasible to avoid unintentional mortality.
- Large, healthy ponderosa pine trees would be favored as leave trees. Any live trees >21" dbh would be retained, regardless of species, to the extent practicable given project objectives and implementation logistics (Units 1, 4, 5, 6).

[12] The physiological responses of large, old ponderosa pine and western larch were studied.

Figure 22. Unit 6, Three Larches

- Avoid removal of ponderosa pine or western larch with a diameter larger than 21" dbh (to the greatest extent possible) when locating landings, skid trails and skyline corridors. Unique character trees (e.g., see Figure 22. Unit 6, Three Larches, Three Larches) would be featured and retained within the project. If mature trees must be removed along Rd 99/TR515 to accommodate log haul, the recreation specialist would coordinate with the timber sale administrator to agree to the clearing limits and brushing to ensure character trees and the character of the trail are maintained to the greatest extent practicable.
- Silvicultural prescriptions would favor the retention of the largest, healthiest dominant/ codominant trees to the degree possible to meet unit objectives. To ensure this, a Certified Silviculturist would prepare or review site-specific prescriptions and marking guides. Site-specific silvicultural prescriptions and/or marking guides may include terms such as "thin from below" or specify an upper diameter limit of trees eligible for harvest to meet this objective. This would retain large, healthy trees to the degree the practice is consistent with the objective of maintaining or restoring a given stand.

Treatments Affecting Insect Infestation

Examination of the best science available supports the idea that thinning through silvicultural management as proposed by Alternative B would reduce susceptibility to bark beetle attack. As has become commonplace, the term "thinning" is in reference to partial cuttings to reduce the number of stems or density within a forest stand (Graham et al., 1999). All tree cutting treatments under Alternative B "thin" stands to different levels using a variety of silvicultural approaches. Based on documented studies and thirty years operational bark beetle management experience, there is conviction among Northern Region entomologists and practicing silviculturists that reducing stand density through silvicultural means results in significantly less bark beetle-caused mortality.

Attributes that are consistently linked as primary factors associated with bark beetle infestations are high stand density, BA, stand density index, tree diameter and host density (Fettig et al, 2007). Since the late 1970s, entomologists have emphasized the altering of stand conditions, through silvicultural means, to ones less susceptible to bark beetle depredations (Amman, et al 1977; Fettig et al., 2014b; McGregor et al, 1985; McGregor et al, 1987; Shore and Safranyik, 1992; Shore and Safranyik, 2000; Schmid et al, 1994). This technique is in contrast to bark beetle "control," in which efforts are expended to kill as many beetles as possible in order to "halt" an outbreak. Direct control is not the purpose or goal of any treatments proposed in the Marshall Woods project. Rather, silvicultural commercial thinning treatments in Alternatives B and C are intended to enhance the vigor of trees and stands to make them less susceptible to insect attack. This approach provides long-term benefits in reducing beetle depredations; it is not a “quick fix.”

Recently, Six et al. (2014) questioned whether relevant science supports MPB “outbreak suppression”. “Outbreak suppression” is not the intent or objective of the Marshall Woods project, nor the management strategies implemented for MPB on NFS lands in the western United States as suggested by the paper (Egan et al., 2014; Fettig et al., 2014b).

Notably, warmer temperatures associated with climate change facilitate bark beetle outbreaks in two primary ways: (1) drought stress makes trees more vulnerable to attack, and; (2) populations of bark beetles can speed up their reproductive cycles potentially leading to more frequent generations (Joyce et al., 2008). Drought-induced stress reduces the number of beetles necessary for a successful mass attack, relaxing the conditions necessary for a bark beetle outbreak to occur (Bentz et al., 2010). Nonetheless, bark beetle response to climate change is highly complex and uncertain as bark beetle populations, community associates, and host trees are influenced by changes in temperature (Bentz et al., 2010). In the Marshall Woods project area, 8 out of 10 years (2001-2010) received below average precipitation; the recent decade of drought will likely continue to be a factor causing physiological stress and predisposing trees to successful MPB attack (Sturdevant and Egan, 2011).

Numerous studies demonstrate increased susceptibility to various bark beetles with increasing stand densities in a variety of conifer forests. Fettig and others (2014b) established that thinning reduces levels of ponderosa pine mortality attributable to MPB with areas of lowest tree density having less tree mortality often on both a numerical and proportional basis. In ponderosa pine, studies report increased susceptibility to MPB with increased stocking (Olsen et al., 1996; Negron and Popp, 2004). Schmid and others (1992, 1994) observed reduced mortality in partial cut stands after long-term monitoring of thinned plots. Studies in the southwest have documented ponderosa pine forests with increased tree densities resulting in eruptions of insect outbreaks (Covington and Moore, 1994). Restoration efforts in these forests have focused on reducing stand density and prescribed burning. In a thinned area, resin flow increased significantly compared to an untreated area. The authors suggest a reduction in susceptibility to bark beetles as a result (Covington et al. 1997). Kolb et al. (1998) examined various factors related to insect resistance including resin flow in plots thinned to various stocking levels 32 years earlier. The authors concluded that increased BA resulted in reduced tree resistance and that the physiological condition of the stands can be managed through silvicultural thinning. Numerous other studies with Dendroctonus bark beetles have shown that thinning can dramatically reduce bark beetle mortality through increases in tree vigor or changes in microclimate or both (Amman et al. 1988, 1988b; Cole et al. 1983; McGregor et al. 1987; Schmid and Mata, 2005; Schmid and Mata 1992; Amman and Logan 1998; Bartos 1988; Bartos and Amman 1989, Schmid et al., 2007; Fettig et al., 2007; Fettig et al., 2014; Whitehead and Russo, 2005; Whitehead et al., 2007).

Evidence suggests that thinning reduces losses to bark beetles for several reasons. Amman (1989) concluded that beetles are attracted to large, dark silhouettes and vertical cylinders. If stand conditions are altered to open up stands, still retaining the larger diameter trees, the sun is able to penetrate through the forest canopy and create subtle changes in incident radiation, temperature, light, and also wind speed (Amman, 1989). Furthermore, trees resist bark beetles by producing resin that “pitches” attacking beetles out (Rudinsky 1966; Safranyik et al. 1974). Trees that are stressed have a reduced capacity to produce large amounts of resin and are therefore more susceptible to bark beetle attack (Rudinsky, 1966).

Waring and Pitman (1985) indicated increased tree resistance with canopy reduction by insects and logging and concluded that "from this study and related ones we know that the risk of beetle epidemics can be greatly reduced by periodic thinning." In another study by Waring et al. (1980) with Douglas-fir, they present how tree vigor is reduced by increased stocking and relate these findings to their other work in which increased susceptibility to MPB in lodgepole pine with reduced tree vigor was presented.

Through silvicultural manipulations (i.e., thinning to reduce density) treatments can reduce the hazard of a stand and reduce the potential for mortality from DFB. Negron et al. (1999) established that higher stand density results in higher stand mortality due to the DFB. Negron and others (1999) also pointed out that the relationship between Douglas-fir BA and subsequent mortality is consistent with other studies for other bark beetle species. The data confirm that mortality levels associated with DFB, as with other bark beetles, are an indication of stand stress caused by overstocking (Negron et al. 1999). The relationship of BA and bark beetle mortality has also been shown to hold true at fine scales within stands. The clumped nature of DFB-caused mortality may be explained by pockets of high BA within a stand (Negron et al. 2001). Managing stands to reduce susceptibility to DFB may not be compatible with resource objectives that require the preservation of clumps with high BA (Negron et al. 2001).

Caution is suggested with the use of thinning by Hindmarch and Reid (2001); however, this relates to leaving felled trees on site thereby providing habitat for population increases of these secondary insects. Ips beetles are a secondary insect common to ponderosa and lodgepole pine, and they are at endemic levels within the Marshall Woods area. Under all action alternatives, where deemed necessary slash piles would be burned in a timely manner or baited to reduce the likelihood of Ips population buildup. In addition, ponderosa pine or lodgepole pine slash creating operations may be restricted to July through November to reduce the potential for Ips damage. Pile and burn and lop and scatter slash treatments would minimize the potential for Ips damage (Schmid, 1987).

Scientific evidence and examination of the best science available support the idea that thinning through silvicultural management reduces susceptibility to Dendroctonus bark beetles. Beetle activity is present within many of the units included in the action alternatives. Both Alternatives B and C focus on forest conditions as all commercial treatments are designed to reduce bark beetle hazard and susceptibility to attack. Commercial treatments under Alternative B (Units 1-6) and Alternative C (Units 1, 4-6) would reduce stand BA, and increase vigor and resilience to bark beetle attack in the long-term (Sturdevant and Egan, 2011). Commercial treatments would remove infested trees, reduce density to at least below 90 square feet of BA and increase resilience to attack by freeing up growing space by reducing competition for sunlight, water, and nutrients. Treatments would reduce stand density leaving the best trees rendering them more resilient to bark beetle attack through increases in tree vigor or changes in microclimate or both (Amman et al., 1988, 1988b; Cole et al., 1983; McGregor et al,. 1987; Schmid and Mata, 1992; Amman and Logan, 1988; Bartos, 1988; Bartos and Amman, 1989). Thinning also increases growth rates and individual tree vigor by reducing competition of sunlight, water, nutrients, and allowing for increased growing space. Alternatives C and D would not reduce MPB-caused mortality in mature high hazard stands within the main Rattlesnake Trail corridor as the treatments would not reduce stocking sufficiently to promote resilience to MPB. Under Alternative A, MPB cause tree mortality is likely to increase throughout the project area in high hazard areas and in and around larger diameter ponderosa pine (Sturdevant and Egan, 2011).

Silvicultural treatments that reduce stocking density, number of canopy layers, and increase individual tree vigor and species composition are the only long-term solution to budworm management (Sturdevant, personal communication). Treatments under Alternatives B, C, and D would reduce small diameter Douglas-fir and effectively reduce canopy layering in young and multi-storied stands to reduce impacts of spruce budworm. Alternative B would be the most effective across the landscape at reducing impacts and provide the only long-term solution to budworm management. Alternative C would have the same effects as Alternative B in the Woods-Gulch Marshall area. While Alternative C would have some benefit within the main Rattlesnake corridor the efficacy, when compared to Alternative B, would be greatly reduced as only trees less than 8" dbh would be removed. Alternative D would reduce layering, but like Alternative C in the main Rattlesnake, would have limited efficacy across the project area as only small diameter trees would be removed. Alternative A would not provide any benefits and spruce budworm is likely to cause continued damage and mortality in the future.

Treatments Affecting Disease

A typical disease in habitat types that support Douglas-fir and true firs is root rot. Some evidence of Armillaria ostoyae is present in the analysis area. Douglas-fir is quite susceptible to Armillaria and partial cutting may intensify root disease infection (Wargo and Harrington, 1991). Armillaria ostoyae causes tree mortality that ranges from diffuse to extensive with Douglas-fir and true firs being the most susceptible with major growth losses (Klopfenstein et al., 2009). Restoring ponderosa pine and western larch on sites where these species are adapted would reduce future mortality due to Armillaria (Hagle and Goheen, 1988).

Under current and future climates it is likely that the impacts of Armillaria root disease will increase significantly (Klopfenstein et al., 2009). Sturrock and others (2011) concluded that incidence of Armillaria root disease is likely to increase as temperatures increase and precipitation decreases (Shaw & Kile, 1991; US Office of Technology Assessment, 1993; La Porta et al., 2008; Klopfenstein et al., 2009). Klopfenstein et al. (2009) demonstrated that the area in which climate supports persistence of Douglas-fir, a major host for A. solidipes in the interior northwestern USA, is likely to decrease by 2060, and suggested that stressed Douglas-fir will also be more susceptible to Armillaria root disease. In the interior northwest, spread of Armallaria ostoyae occurs mostly through root-to-root contact and by rhizomorphs, with limited basiodiospore infection (USDA Forest Service, 1991, page 117, Wargo and Shaw, 1985). Therefore, infections will spread only a short distance from the edge of a root-disease center, via root to root contact, or by rhizomorphs traveling a short distance. Armillaria is not considered a primary pathogen of mature ponderosa pine or western larch. In fact, ponderosa pine and western larch are two of the most Armillaria-resistant species. The severity of root disease is dependent on species present. If the site has been regenerated to a root disease-susceptible species, then the severity of root disease will likely increase (i.e., Douglas-fir). Conversely, if the site has been regenerated to a root disease-resistant species, the severity of the disease will likely be lessened over time. Establishing and favoring ponderosa pine and western larch can reduce losses to root diseases (Hagle and Goheen, 1988). Where Armillaria is identified within the proposed treatments, ponderosa pine and western larch of a variety of age classes, where available, would be featured. This is the most frequently used approach to managing root disease problems in western North America (USDA Forest Service, 1991, p155).

Phaeolus schweinitzii infection is also present within the analysis area; however, its presence has not been confirmed in any of the proposed treatment units. Douglas-fir is one of the most susceptible trees to the disease and root disease infection predisposes trees to bark beetle attack. The presence of schweinitzii coupled with high density levels can weaken trees and result in subsequent DFB attack (Lockman, personal communication). Treatments are designed to reduce losses to P. schweinitzii and bark beetles. Increasing the vigor of root rot infected trees allows for more adventitous root development to compensate for some loss of main root system due to root rot (Lockman, personal communication). Commercial treatments in Alternative B (Units 1-6) and Alternative C (Units 1, 4-6) are designed to reduce BA enough to reduce susceptibility to bark beetle attack while making efforts to avoid opening stands excessively which could predispose root rot infected trees to windthrow. The treatments would favor shade-intolerant species through thinning. This is one of the most effective ways to reduce losses to root disease on infected sites (Hagle and Goheen, 1988).

Annosus root disease has not been confirmed within the analysis area, but its presence is suspected. To ameliorate the potential for spread of the disease, susceptible ponderosa pine stumps greater than twelve inches in diameter would be treated with Sporax under Alternatives B and C to prevent spread of Annosus (DeNitto, personal communication).

Dwarf mistletoe infection in western larch or Douglas-fir is present within some of the treatment areas. Dwarf mistletoe is not known to directly kill trees within a short period of time; however, it does predispose trees to bark beetles that can kill them. This is because mistletoe infection weakens trees causing them to lose vigor. Targeting the removal of trees infected with dwarf mistletoe would reduce the amount of infection within stands as well as any ensuing regeneration. Mechanical treatments under Alternatives B and C would remove western larch and Douglas-fir trees that are moderately to heavily-infected with dwarf mistletoe. This would reduce the incidence of this pathogen within stands and its spread to tree regeneration, while reducing the likelihood of bark beetle attack, resulting in more vigorous stands. Alternative A would not remove any dwarf mistletoe infected trees or reduce the incidence of the pathogen within the analysis area. In summary, Alternative B would significantly reduce dwarf mistletoe infection and increase species composition of root disease resistant species within Units 1-6 and 70 and 71. Alternative C would accomplish this effectively in Units 1 and 4-6. Alternatives A or D would not reduce dwarf mistletoe in any of these areas.

Environmental Consequences to Vegetation By Treatment Type

Ecosystem Maintenance Burning Preceded By Understory Slashing or Thinning

This treatment is proposed on sites that were historically occupied by very open to moderately open ponderosa pine or ponderosa pine and Douglas-fir communities with an average fire frequency of 5 to 50 years. Presently, these sites support moderate to heavy understory vegetation with thickets of conifer encroachment below the main canopy. Douglas-fir is the primary understory conifer species (see Figure 23, Unit 61). Some very dry inclusions that were historically occupied by grassland communities currently support moderate noxious weed populations including spotted knapweed, leafy spurge, and cheatgrass. Some sites are classified as non-forested. The proposal includes prescribed burning which may include slashing or understory

Figure 23. Unit 61

thinning prior to fire application. Understory density and ladder fuels would be reduced through slashing/thinning to protect the overstory from scorch or crowning where deemed necessary. Only small diameter trees would be cut in Units 60-66. All thinning work would be accomplished by hand using chainsaws. No heavy equipment is proposed in Units 60-66. Slash would be treated by lopping and scattering tops and limbs, hand piling and burning, or underburning. Machine piling or mechanized biomass removal could occur, under Alternative B, in Units 70 and 71 on slopes less than 35% with existing roads; however, within Unit 70, mechanized equipment would only operate from Road 99/Trail 515 or the Main Rattlesnake Trail parking area to discourage new user-created trail development. Invasive weeds would be treated along roadsides, trails and within open forested sites or adjacent forest openings. Individual treatments or a combination of treatments would occur.

No Action

The No Action alternative would allow understory vegetation to continue to develop exacerbating ladder fuel accumulations. This would result in a continuation of the shift in species composition to Douglas-fir in the understory. Where young ponderosa pine exists in the understory it would be out competed by Douglas-fir, as conditions are favorable for its dominance. Additional mortality due to MPB and western pine beetle is likely due to moderate to high bark beetle hazard. Fire occurrence could result in rapidly spreading stand-destroying crown fires due to sapling and pole thickets beneath the main canopy (Fischer and Bradley, 1987). This type of fire is likely to result in high levels of mortality in the ponderosa pine component in the understory and overstory and consume ponderosa pine seed source, potentially reducing its distribution across the landscape. In addition, such an occurrence would expand the distribution of invasive species that would occupy these sites. Overall, the effects are a degradation of ecologically at-risk native forb and bunchgrass communities and dry, open ponderosa pine and Douglas-fir communities. This alternative would move sites on their present trajectory away from the desired future condition (a reflection of ecologically sustainable conditions).

All Action Alternatives

Units 60-66, 961 acres

Implementation of Alternatives B, C or D within Units 60-66 would improve the distribution of open forestland and ponderosa pine communities and enhance ecosystem condition and function on approximately 7.4% of the analysis area. Understory density and ladder fuels would be reduced through slashing or thinning where necessary to facilitate prescribed burning and protect the overstory from crowning. Alternative B would include cutting trees up to 10" dbh, Alternatives C and D would include cutting trees up to 8" dbh. The difference in these two treatments within Units 60-66 would be minor; Alternative B would result is slightly more open stand conditions, treatment efficacy and longevity and a greater opportunity to provide large, down, coarse, woody debris to ensure long-term nutrient cycling and soil productivity.

Mechanical fuel treatments followed by prescribed burning have been shown to reduce fire severity over no treatment or prescribed burning alone (Pollet and Omi, 2002). The reintroduction of fire would reduce densities consistent with historical stocking levels and species composition. Ponderosa pine would be favored over Douglas-fir. Fire reintroduction would mimic natural process and move sites towards the desired future condition and increase their resilience to fire in the future. Increased tree vigor gained by reducing density and competition would reduce MPB and western pine beetle hazard. Density reduction followed by prescribed burning may increase noxious weed populations; however, the potential for spread would be minimized by applying integrated weed treatments.

Alternative B
Units 70-71, 314 acres

Implementation of Alternative B would have the same effects as listed above for Units 60-66, on an additional 314 acres for a total of approximately 9.8% of the landscape. To achieve these effects, trees larger than 10" dbh may be treated by machine piling to reduce stand density and achieve the purpose and need of the project. Modeling results indicate that under Alternative B, SDI would lowered to 143 and BA/acre to 86 square feet, resulting in resilience to bark beetles and stand-replacing wildfire (see Table 15).

Alternatives C and D
Units 70-71, 314 acres

Implementation of Alternative C or D would, on the 314 acres proposed for treatment, would provide some benefits over the No Action alternative, particularly with respect to crown fire initiation potential, but would not provide the resilience afforded by Alternative B along the main Rattlesnake corridor. With modeled results of the treatment indicating an average of 100 square feet of BA/acre and an SDI of 179 post-treatment, Units 70 and 71 would remain at risk to mortality from bark beetles and wildfire. This treatment would not provide long-term benefits and the stands would remain at moderate to high risk from wildfire and bark beetle attack (see Table 15; Sturdevant and Egan, 2011).

Conclusion
Under Alternative B, this treatment would result in markedly lower bark beetle hazard, increase resilience to fire and insects and diseases while favoring at-risk shade-intolerant species markedly increasing resilience and resistance of vegetative communities on 9.8% of the landscape. Alternatives C or D would accomplish this on 7.4% of the landscape, but afford limited improvement over the current condition or the No Action alternative within the main Rattlesnake Trail corridor (Units 70-71).

Ecosystem Maintenance Burning

This site is classified as predominately non-forested and is within the boundaries of the RNRA along Strawberry Ridge. The area is steep and rocky with open scree slopes with stringers of forested inclusions composed of predominantly ponderosa pine and Douglas-fir with lesser amounts of western larch. Understory composition includes a seedling/sapling component, bunchgrasses, and shrubs. Scree openings are dominated by a patchy distribution of aspen, ninebark, and huckleberry. Noxious weeds are present, but have been treated by biological agents and herbicides in the last decade. An ecosystem maintenance burn over a portion of the area was completed approximately ten years ago.

The proposal includes prescribed fire application and integrated weed treatments. Incidental slashing or small tree thinning (Douglas-fir < 6" dbh) could occur to create a fuel bed to carry the prescribed burn. Prescribed fire treatment would involve broadcast or underburning. Aerial ignition devices could be used to ignite fire in a strip or spotty pattern to achieve the desired fire intensity. Prescribed fire treatment would involve a backing or flanking fire that is generally of lower intensity than a head fire. Rolling material on steep slopes could cause uphill runs that create pockets of higher intensity fire behavior.

No Action

The No Action alternative would perpetuate the current condition. Shrub and conifer encroachment would continue, reducing the distribution of natural forest openings. Aspen regeneration would not occur. The role of fire to promote landscape resilience, regulate species composition, and structural arrangement would not occur. This alternative would move sites on their present trajectory away from the desired future condition (a reflection of ecologically sustainable conditions).

All Action Alternatives

Unit 101: 729 acres

Implementation of all action alternatives would result in a patchy maintenance burn stimulating big game forage production and maintaining open forested conditions. Vegetation density, forest continuity, and structural stages would be altered creating greater landscape age class and structural stage diversity by restoring fire as a regulating process to this fire-adapted system. Shrub and forb communities would be regenerated potentially increasing palatable forage and browse available to big game. The regeneration of aspen clones is essential to ensure this key at-risk shade-intolerant species remains an integral part of the landscape vegetation mosaic. The landscape age class and structural mosaic would be improved by breaking up landscape homogeneity and potentially introducing new seral components in an irregular distribution across approximately 6% of the analysis area. The treatment would likely result in pockets of tree mortality from direct fire effects and/or subsequent bark beetle attack. Fire would be restored as an ecological regulating process improving forest structure, composition and function within the Rattlesnake NRA. In addition, promoting a diverse age class and species mix and spatially heterogeneous and complex vegetation structure would provide a landscape that is more resilient to climate change in the longer-term (Joyce et al., 2008).

Thin and use prescribed fire - These sites are predominantly dense, mid-aged ponderosa pine/Douglas-fir and mixed conifer (western larch, Douglas-fir, ponderosa pine, lodgepole pine) forests (see Figure 24, Unit 1, Marshall Creek and Figure 25, Unit 6, Woods Gulch). Overstory trees would be thinned to reduce stand density, create structural diversity, favor ponderosa pine and western larch, and increase vigor and resilience to insects, disease and fire. Under Alternatives B and C, some trees would be removed from the site as biomass or other wood products. The proposed treatments include: crown thinning or thinning from below; single tree selection, creating small openings, removing trees to improve species composition and residual tree quality (i.e., improvement cutting), and removal of individual dead, dying and diseased trees. The residual overstory may have some small openings. Understory density and ladder fuels would be reduced through thinning or slashing where necessary to facilitate prescribed burning and protect

Figure 24. Unit 1, Marshall Creek

the overstory from crown fire. Within the unit perimeters, if areas are excluded due to blind leads or harvest system restrictions, they would still be treated non-commercially with thinning or burning applications. Biomass and slash disposal may include a variety of methods such as mechanical removal, mastication, hauling as sawlogs, biomass utilization, disposal on site, piling and burning, burning, or chipping. Individual treatments or a combination of treatments may occur.

The thinning treatments are designed to: 1) favor fire and disease-resistant ponderosa pine and western larch first and 2) thin stands from below second. Healthy ponderosa pine and western larch in each canopy layer would be featured and retained over larger, less disease and fire-resistant Douglas-fir. Thinning from below (low thinning) involves removing trees from the lower part of the forest canopy, leaving the largest, healthiest trees to occupy the site. The treatment mimics the mortality caused by surface fire or inter-tree competition and concentrates the site resources to the largest, dominant ponderosa pine and western larch trees. Thinning from below primarily removes overtopped and intermediate trees, trees that are shorter and receive a limited amount of light. In a heavy low thinning, the main canopy may also be thinned to reduce competition, density, and crown fire potential. This type of treatment has been shown to accelerate diameter growth resulting in large diameter trees sooner than no treatment.

Thinning would be applied using an average residual target BA ranging from 50 to 80 square feet per acre in order to accomplish resource objectives. This would equate to removing approximately 30 to 60% of the existing crown cover. Most of the trees that would be removed are from the intermediate crown classes with all or a portion of their crowns overtopped by larger dominant and co-dominant trees. Where two or more canopy layers of ponderosa pine or western larch are present, each canopy layer would be thinned to provide structural, canopy and age-class diversity. Treatments are designed to favor ponderosa pine and western larch and reduce wildfire hazard over the long term by rendering stands more resilient to natural fire occurrence and disturbances. Integrated weed treatments would continue in these areas.

Under Alternative D in Units 1-5 and Alternative C in Units 2 and 3, the treatment would only treat small diameter trees (less than 8” dbh) no heavy equipment would be used and all material would be retained and burned on-site.

No Action

The No Action alternative would reduce the distribution of at-risk dry ponderosa pine and Douglas-fir communities and western larch on these sites. Shifts in species composition, structure, and function would continue favoring Douglas-fir, multi-storied structures, and increasing risk to stand-replacing wildfire and insects and disease. Canopy gaps created due to mortality are likely to be rapidly occupied by existing individuals onsite as the level of competition remains extreme. Thinning would not occur resulting in a further decline in tree vigor and insect and disease resistance. Stands would remain highly susceptible to bark beetles and other pathogens. Fuel loading and fire hazard would not be reduced. Fire occurrence could result in rapidly spreading stand-destroying crown fires due to sapling and pole thickets beneath the main canopy as well as overstory density (Graham et al., 2004). This type of fire is likely to result in high levels of mortality of the ponderosa pine component in the understory and overstory (Fischer and Bradley, 1987). This further threatens the distribution of ponderosa pine, an ecologically at-risk species, across the landscape. In addition, the No Action alternative would allow understory vegetation to continue to develop exacerbating ladder fuel accumulations. Suppressed, unfavorable, unhealthy trees would be retained on-site reducing stand productivity and perpetuating dysgenic [13] stands over time. Dwarf mistletoe infection would be retained and spread. The healthiest, largest, residual trees would not be favored and free to grow with adequate light and nutrients. Bark beetle hazard and susceptibility would not be reduced (see data in PF).

Alternative B and Alternative C

Alt. B: Units 1 – 6, 740 acres

Alt. C: Units 1, 4-6, 515 acres

Alternatives B and C and would thin the live residual overstory from below to improve vigor increasing resilience to bark beetle attack. Alternatives B and C would increase the resilience of mid-aged ponderosa pine/Douglas-fir and mixed conifer (western larch, Douglas-fir, ponderosa pine) forested communities over 5.7% and 4.0% of the landscape, respectively. Alternative B would accomplish this in both the main Rattlesnake Trail corridor and Woods Gulch-Marshall portion of the project, whereas, Alternative C would only accomplish this in the Woods Gulch-Marshall area, (see Table 14). Density reductions would favor ponderosa pine, western larch and the largest, healthiest and dominant residual trees rendering them less prone to insect or disease attack and reduce risk to stand-destroying wildfire (Graham et al., 1999). Treatments would leave fewer trees, reduce ladder fuels, and break up crown continuity. FVS modeling results indicate canopy bulk density would be reduced to less than 0.10 kg m-3. Thinning below this level has been recommended to reduce the likelihood of crown fire occurrence (Agee, 1996; Graham et al., 1999). Low density canopies are less prone to rapidly spreading crown fires than very dense canopies (Graham et al., 2004). The residual trees would be larger, have thicker bark and higher crown heights making them more fire-resistant. These treatments would result in reduced potential for crown fire occurrence and less severe effects (Pollet and Omi, 2002). Stand structures would be altered to more closely mimic historic conditions that can reduce beetle depredations in the near term and the likelihood of damaging outbreaks in future years.

Figure 25. Unit 6, Woods Gulch

Fuel loading reductions would reduce fire hazard. Existing surface fuel loading and activity fuels would be reduced though consumption or removal to acceptable levels through yarding and/or prescribed fire. Reducing surface fuel amounts through prescribed fire and mechanical means reduces the risk that the overstory would ignite in a wildfire (Graham et al., 2004). Understory density and ladder fuels would be reduced through slashing or small tree non-commercial thinning where necessary to facilitate prescribed burning and protect the overstory from crowning. Mechanical thinning and fuel treatments have been shown to reduce fire severity and crown scorch

[13] tending to promote survival of or reproduction by less well-adapted individuals especially at the expense of well-adapted individuals

(Pollet and Omi, 2002). Prescribed fire would be applied primarily through underburning and jackpot burning. Fire reintroduction would mimic natural processes and move sites towards the desired future condition and increase their resilience to fire in the future.

A mix of species and age classes would provide a more resilient system to insect and disease outbreaks. Resistance to root disease would be greatly enhanced by favoring resistant shade-intolerant species (ponderosa pine, western larch and aspen). Suppressed, unfavorable, unhealthy trees would be removed in favor of healthy dominant and codominant residuals ensuring long-term stand productivity. Dwarf mistletoe infection would be reduced. Increasing vigor through reductions in density and competition would reduce Douglas-fir, MPB and western pine beetle hazard.

Large diameter trees would be retained on the landscape longer than under Alternatives A or D as they would have increased growing space, increasing their resilience to insects, disease attack and stand-replacing wildfire. A key element of restoration and resilience involves retaining large, fire-tolerant trees (Agee and Skinner, 2005; Hessburg and Agee, 2003; Taylor and Skinner, 2003). Conversely, diameter limits, as included in Alternative D and in Alternative C in Units 2 and 3, without the flexibility for young tree establishment or in-stand age class variation and heterogeneity may actually conflict with restoration of spatial patterns and other objectives (Churchhill et al., 2013; Abella et al.; 2006; North et al., 2007) in the future.

Additionally, Alternative B would reduce wildfire hazard over the long-term (20-30 years) by rendering stands more resilient to natural fire occurrence and ecosystem processes (see data in PF). Changes attributable to fire-induced mortality, bark beetle predation, and natural disturbances result in greater pattern variation and the creation of clumps, openings and regeneration over time and Alternative B is designed provide such heterogeneity (Churchill et al., 2013). Stand-based average BA and spacing based silvicultural prescriptions, especially over contiguous stands, do not restore the variation and pattern that existed when frequent fire occurred (Churchill et al., 2013). Under Alternative B the prescription would thin stands to a target average of 50-80 square feet BA per acre, but provide a greater density range across the stand (30-100 variance), and retain clumps of regeneration and small openings that are important elements of restoration and resilience (Churchill et al., 2013). Spatial heterogeneity at multiple scales, in addition to forest structure and composition, are essential to ecosystem resilience and varying the BA throughout the stand, coupled with prescribed fire mortality would provide a more resilient forest (Levin 1998, Mortitz et al. 2011, North et al. 2009, Stephens et al. 2008). Fine-scale mosaic pattern is considered a key component of resilience in dry forest ecosystems (Churchill et al., 2013; Binkley et al., 2007; Stephens et al., 2010; Stephens et al., 2008). Irregular patterns created by groups, clumps, openings and variation in fuels and canopy can reduce the potential and spread of crown fire (this pattern is analogous to strategically placed fuel treatments at the landscape scale) (Finney et al., 2007).

Frequent disturbances create openings for tree regeneration leading to local genetic diversity. Openings create variations in moisture, light and nutrient environments increasing understory plant diversity (Dodson et al., 2008; Moore et al., 2006). Where openings are created, reforesting with species tolerant to low soil moisture and high temperature using a variety of genotypes under an uneven-aged management regime creates conditions that are more resistant and resilient in a changing climate (Joyce et al., 2008). The treatment would increase the distribution of western larch and ponderosa pine (at-risk species) within the landscape though favoring all ages of development across the landscape. Prescribed fire application would emulate natural processes, stimulating forage production, creating microsites for natural regeneration, and increased resilience to fire in the future. Restoring fire as a process would contribute to landscape-scale age class and structural diversity; perpetuate landscape-scale natural diversity of plant communities; and restore sites with disease-resistant species adapted to current and future climates.

Alternative C and Alternative D
Alt. C: Units 2 – 3, 225 acres

Alt. D: Units 1-5, 631 acres

Implementation of Alternative C in Units 2 and 3 in the main Rattlesnake Trail corridor or Alternative D in Units 1-5 would provide a small improvement over the No Action alternative. Canopy gaps created due to removal of small diameter trees (less than 8" dbh) are likely to be rapidly occupied by existing individuals on-site as the level of competition remains extreme. Shifts in species composition, structure, and function would continue favoring Douglas-fir, multi-storied structures, and increasing risk to stand-replacing wildfire and insects and disease. Stands would remain highly susceptible to bark beetles and other pathogens. Fuel loading and fire hazard would remain high. Fire occurrence could result in rapidly spreading stand-destroying crown fires due to pole thickets beneath the main canopy as well as overstory density (Graham et al., 2004). This type of fire is likely to result in high levels of mortality of the ponderosa pine component in the understory and overstory (Fischer and Bradley, 1987). This further threatens the distribution of ponderosa pine, an ecologically at-risk species, across the landscape. Suppressed, unfavorable, unhealthy trees would be retained on-site reducing stand productivity and perpetuating dysgenic stands over time. Dwarf mistletoe infection would increase. The healthiest, largest, residual trees would not be favored and free to grow with adequate light and nutrients. Bark beetle hazard and susceptibility would not be markedly reduced.

Non-commercial thinning followed by hand piling and burning treatments in Alternative C (Units 2,3) and Alternative D (Units 1-5) would not effectively lower bark beetle hazard or increase resilience to attack as the treatment would not reduce BA sufficiently or lower SDI below 165 which is effective in reducing stand susceptibility to MPB. This treatment would be effective at reducing ladder fuels, fuel loading and lowering crown fire initiation potential by removing understory trees and fuels that could carry a surface fire into the forest canopy. In addition, canopy base height would increase; however, moderate changes in canopy bulk density would occur. The treatment would not thin trees sufficiently to create insect and fire-resilient stands. Changes in overstory density and BA would be minimal (for example, BA would be reduced by approximately nine square feet per acre (123 to 114)). While some localized individual tree resilience would likely occur, stand resilience to MPB would not change significantly as modeling results indicate a post-treatment average SDI of 194 and high bark beetle hazard (BA > 110).

Non-commercial Thinning followed by Hand Piling and Burning

This treatment is designed to reduce hazardous fuels in mid-aged mixed conifer stands immediately adjacent to private land with limited road access. The treatment is designed to reduce crown fire initiation and improve public and firefighter safety. The treatment would only thin small diameter trees underneath the main canopy (trees less than 10" dbh). All thinning work would be accomplished by hand using chainsaws. No heavy equipment or product removal is proposed in these treatment areas. The treatment is designed to reduce ladder fuels and surface fuel loading through thinning or slashing and hand piling and burning. The treatment would not markedly reduce crown continuity as the canopy cover would be only reduced by approximately 5 to 25%.

No Action

Fuel loading and fire hazard would not be reduced. Fire occurrence could result in rapidly spreading stand-destroying crown fires due to sapling and pole thickets beneath the main canopy as well as overstory density (Graham et al., 2004). In addition, the No Action alternative would allow understory vegetation to continue to develop exacerbating ladder fuel accumulations. Crown fire initiation potential would not be lowered. Bark beetle hazard would remain high.

All Action Alternatives

Alts. B and C: Units 90-92, 248 acres; Alt. D: Units 6, 90-92, 357 acres

Treatments would consist of slashing or thinning small diameter trees, and piling and burning material. Understory density and ladder fuels would be reduced through slashing, piling and burning. This would reduce the likelihood of a surface fire crowning over the no action alternative. Density reductions would result in a moderate increase in vigor by freeing up growing space.

Figure 26. Similar Project During Implementation, South Fork Fish, Ninemile Ranger District, Lolo NF

This treatment is effective at reducing ladder fuels, fuel loading and lowering crown fire initiation potential by removing understory trees and surface fuels that could carry a surface fire into the forest canopy. While this treatment would reduce crown fire initiation potential, it would not thin the overstory sufficiently to lower bark beetle hazard markedly (see Figure 26). A moderate increase in stand resilience in the short to mid-term is expected. In addition, canopy base heights would increase; however, moderate changes in canopy bulk density would occur. The treatment would not thin trees sufficiently to create insect and fire-resilient stands. Changes in overstory density, BA, and quadratic mean diameter would be moderate. While some localized individual tree resilience would likely occur, stand resilience to MPB would not change significantly.

Meadow and Aspen Restoration

Figure 27. Unit 100A, Rattlesnake Creek

This treatment is proposed along the main Rattlesnake Trail and in the Poe Meadows area (Units 100A and 100B). Tree encroachment is converting these homestead meadows into forested areas and resulting in the decline of small aspen groves (see Figure 27 and Figure 28). To maintain meadows and aspen, the proposal would reduce or remove conifer encroachment. Trees would be cut and left on site. The slash would be treated by lopping and scattering, hand piling and burning, and/or chipping. Where aspen are present, parent trees would be retained and surrounding conifers would be felled to provide sufficient light to stimulate aspen regeneration. Felled trees would be jack-strawed around aspen clumps to reduce browsing pressure on regenerating sprouts. Light jackpot burning and construction and maintenance of small exclosures would continue in these areas.

No Action

Under the No Action alternative, aspen, a key at-risk species, would not be regenerated and would likely decline and potentially be lost from the site. Conifer encroachment into meadows and aspen groves would continue and these key components to spatial heterogeneity and landscape diversity and resilience would likely be lost over time. Desirable individuals and at-risk species would remain at risk from competition. Landscape resilience would remain low.

All Action Alternatives

Units 100A and 100B, 40 acres

Figure 28. Unit 100A, Rattlesnake Creek

Where aspen occurs in Units 100A and 100B, Alternatives B, C, and D would stimulate its regeneration. This would occur by either removing conifer encroachment and/or prescribed burning. These actions would stimulate suckering among aspen clones increasing the aspen distribution within the treatment areas. Browse protection may also occur. The treatment would perpetuate this key at-risk species through regeneration and protection. Tree encroachment would be removed to maintain the historic meadows providing cover type and structural diversity, important elements of a resilient landscape.

Site Preparation and Reforestation

Section 33 was acquired from The Nature Conservancy (TNC) in 2010 under the Montana Legacy Project. The site was previously owned by Plum Creek and harvested in approximately 2003. TNC harvested this area again in 2014. The best adapted dominant and co-dominant overstory trees were harvested from the site and suppressed and intermediate sub-merchantable trees were retained (see Figure 29, Unit 200). No reforestation investments for natural regeneration or planting occurred. On this site, the proposal is to complete a site preparation burn to prepare the site for planting. Some trees would be slashed to create a fuel bed to carry the fire. The site would be planted with locally-adapted stock. Western larch and ponderosa pine would be the primary species planted. Animal damage netting could also occur.

Figure 29. Unit 200, Marshall Creek

No Action

Under the No Action alternative, western larch or ponderosa pine would not be regenerated and would likely decline and potentially be lost from the site. Diseased, suppressed, unfavorable, unhealthy trees would be retained on-site reducing stand productivity and perpetuating diseased, dysgenic stands over time. Root disease and mistletoe would be perpetuated infecting residual trees. Desirable individuals and at-risk species would remain at risk from competition and stressors. Regeneration and reestablishment of ponderosa pine and healthy western larch is not anticipated under the No Action alternative. Stand resilience and resistance would remain low.

All Action Alternatives

Unit 200, 450 acres

The distribution of ponderosa pine and western larch would be increased within the landscape though planting. A mix of species and age classes would provide a more resilient system to insect and disease outbreaks. Prescribed burning would regenerate decadent shrubs, and likely cause mortality in suppressed, unfavorable, unhealthy, root disease-infected Douglas-fir that were left on-site following dysgenic practices prior to public ownership. Prescribed burning would reduce competition to facilitate seedling establishment and ensure long-term stand productivity. Planting of shade-intolerant species such as western larch and ponderosa would prevent infection of mistletoe in this component of the regeneration. Reforestation of fire, drought, and disease-resistant species like ponderosa pine would provide increased resistance and resilience to potential future drought and wildfire that may be associated with a changing climate (Joyce et al., 2008).

Planting is the only reasonable course of action to restore genetic diversity and ecosystem function in cases where areas of cone-bearing donors for desirable natural regeneration are scant or absent. The planting program in the Northern Region relies on the most sophisticated seed transfer guidelines for conifers, modeling patterns of genetic variation in adaptive traits in three dimensions to capture patterns of variability and adaptation. Reforestation with desired species composition and stocking levels would ensure the productivity of the sites and enhance ecosystem resilience and sustainability. Planting ponderosa pine on the site would establish the most drought-avoidant native tree species to this southwesterly aspect to ensure adaptability in a changing climate (Scott et al., 2013).

Young Stand Thinning Followed by Prescribed Fire

Thinning is proposed in young ponderosa pine, Douglas-fir, and western larch stands on predominately acquired lands in Sections 31 and 33 (see Figure 30, Unit 82). The sites were intensively managed and the treatment is designed to reduce stand density; enhance growth and vigor; reduce competition for sunlight, water, and nutrients; and modify stand conditions to lessen the risk of potential MPB-caused mortality and stand-replacing fire in the future. The treatment is also designed to promote irregular spacing, favor shade-intolerant species and restore fire as a process to these intensively-managed areas. The treatment would thin small diameter trees that would be felled to a stocking of approximately 150 - 200 trees per acre favoring the most vigorous, dominant and best-formed trees. Only small diameter (less than 8" dbh) trees would be cut. In addition, fuels would be treated by lopping and scattering tops and limbs to speed decomposition. Hand piling and burning piles or underburning would be completed in areas where the fuel loading is determined to be an unacceptable risk. Invasive weeds would be treated along roadsides and in adjoining forest openings.

Figure 30. Unit 82, Woods Gulch

No Action

Under the No Action alternative stands would remain highly susceptible to MPB attack in the short and long term. Their ability to support stand-replacing wildfires would increase over time due to high stand density and interlocking crowns (Graham et al., 1999). Diameter growth rates would continue to decline and density-dependent mortality would increase. The genetic quality of the stands would not be enhanced. Big game winter range quality would continue to decline, as understory forage species would be reduced due to inadequate light. Due to high stem density these sites are experiencing high levels of competition and are susceptible to MPB and stand-destroying wildfire (Graham et al., 1999).

All Action Alternatives

Units 80-82 and 84, 467 acres

All action alternatives would enhance growth and vigor; reduce competition for sunlight, water, and nutrients; and modify stand conditions to lessen the risk of potential MPB-caused mortality and stand-replacing fire on approximately 4% of the landscape. Small diameter sub-merchantable trees would be felled to a stocking of approximately 150 - 200 trees per acre favoring the most vigorous, dominant and best-formed trees. Western larch and ponderosa pine would be favored. Long-term fire hazard and tree mortality from insects and diseases would be lowered as a result of this treatment. Low density canopies are less prone to rapidly spreading crown fires than very dense canopies (Graham et al., 2004). Growth rates would accelerate increasing the diameter of residual stems. The genetic quality of the residual stands would be improved by selecting residual trees based on phenotypic qualities. Surface fuel loading would be increased in the short term due to slash accumulations; however, existing fuel loading levels are extremely low since these sites were dozer-piled following the harvest activity. In addition, fuels would be treated by lopping and scattering tops and limbs to speed decomposition. Hand piling and burning piles or underburning would be completed in areas where the fuel loading is determined to be an unacceptable risk. Furthermore, treatments are designed to reduce wildfire hazard over the long term by rendering stands more resilient to natural fire occurrence and ecosystem processes.

The treatment would enhance big game winter range habitat by reducing canopy coverage allowing for more sunlight to penetrate to the forest floor. High value forage species would benefit as a result. Increases in water yield would be minor since additional available moisture would be taken up by the residual stand. The treatment would increase stand resilience to disturbance in the long term and favor shade-intolerant species addressing shifts in species competition that have occurred at the landscape level. The treatment would move the landscape towards the desired future condition.

Cumulative Effects

Past, present and reasonably foreseeable actions within the Marshall Woods project area were considered and analyzed to determine the potential for cumulative effects on sustainable forest conditions. The cumulative effects analysis summary is found in Table 16. Only past (P), present (C) and reasonably foreseeable future (F) activities within the Marshall Woods project area that are pertinent to the forest resource will be addressed in the cumulative effects. The Marshall Woods project area was used for the cumulative effects analysis area for forested vegetation since it represents a watershed scale in which to analyze a diverse array of forested communities and the incremental contribution of the proposal is negligible at the next larger watershed.

A detailed list of all activities considered in this cumulative effects analysis is located in EA Appendix D. Past harvest activities that have occurred are listed by sale name where known. The information is based primarily on historic timber sale records, the FACTS database, and aerial photographs. Many of the treatment areas have had past activities; older (30 + years) management activities in the Marshall Woods were not always entered into the historical database. This assertion is based on site visits to proposed treatment areas where evidence of past harvest was observed, historical accounts, and ownership history. Any undocumented historic harvest activities that have occurred in excess of 50 years are presently occupied by intact, regenerated forest canopies. Undocumented activities at this temporal scale would have a negligible and immeasurable effect to the forest resource when cumulatively considered with the proposal. With respect to forest vegetation, decades of vegetation treatments are grouped since a decade is a very small amount of time with respect to forest age and size class differentiation. In addition, the incremental effect of the proposal combined with small, isolated past harvesting activities would be negligible with respect to forested vegetation.

Table 16. Cumulative Effects Summary for Forested Vegetation

Project/Activity	Cumulative Effect in Conjunction with Project	P	C	F
Past FS Timber Sales (1980-2014) Total Documented: 1980s: Sanitation/Salvage: 751 acres, Marshall, Marshall Ski Area #2, Raptor II, No Sale Name Shelterwood Silvicultural System: 32 acres, Marshall	Documented past timber sales that have occurred within the last thirty years within the analysis area are listed by the amount of acres affected by various silvicultural systems or treatments. Specific sale names, where known are listed. In the 1980s approximately 751 acres of intermediate harvest have occurred within the project area. Intermediate commercial treatments are designed to enhance growth, quality, vigor, and composition of the treated stand. These treatments involved the removal of dead, dying and diseased trees in the form of salvage and sanitation. Following these intermediate treatments intact forest canopies were retained. These treatments combined with the effects of Alternative B and Alternative C, to a lesser degree, serve to enhance growth, quality, and vigor and reduce the levels of mistletoe and fuel loading within the landscape. They also increase stand resilience to stressors (insects, disease, fire). Alternatives B and C would accomplish this on approximately 740 and 515 acres, respectively. Alternatives A and D would not accomplish this. Where the shelterwood silvicultural system has occurred within the analysis area, it served to increase age class and species diversity by establishing a second age class of seedlings over approximately 32 acres, a negligible contribution to the landscape. This treatment enabled the reestablishment of a young, healthy, vigorous stand. This site was regenerated with desired species and stocking levels. None of the alternatives propose even-aged regeneration harvest, hence there is no cumulative effect associated with this treatment and the Marshall Woods project.	X		
1940s Planting	Planting that occurred prior to the 1990s was typically conducted at a very high density. Sites were frequently planted with primarily ponderosa pine that served to reestablish this component on a portion of the landscape. However, planting was uniform, dense, and the species or stock was often planted on inappropriate sites. Not until the late 1970s was local seed adaptability and transferability given extensive consideration. In the 1940s, approximately 401 acres were planted along Strawberry Ridge; under all action alternatives, the area planted is proposed for ecosystem maintenance burning. The treatment would favor the most dominant and fire-	X		

	adapted individuals on the site reducing concerns over offsite planting stock. These treatments would render sites more resilient to pathogens, as well as, wildfire over the long term. Alternative A would not improve the resilience and fire-adaptability of this site and result in no cumulative effect.			
Hand Tree Thinning	Alternatives B, C and D would enhance growth and vigor and modify stand conditions to lessen the risk of potential MPB-caused mortality and stand-replacing fire through young stand thinning on approximately 467 acres. The treatment would favor the healthiest individuals and adapted species for a given site. This would result in a cumulative benefit when considered in the context of the landscape with past young stand thinning activities within the analysis area. Under Alternative A stands would remain highly susceptible to MPB attack and their ability to support stand-replacing wildfires would continue to increase over time. No cumulative benefits would be achieved.	X		
Noxious Weed Treatments	Noxious weed treatments within the analysis area serve to reduce the percent cover and expansion of invasive plants. Alternatives B, C and D would treat weeds along roads and adjacent openings on approximately 760 acres. When noxious weed treatments are considered in conjunction with the action alternatives a small immeasurable cumulative benefit may occur as efficacy may be improved. Noxious weed treatments in the analysis area may also potentially ameliorate weed increases post-treatment. Under Alternative A no cumulative effect would occur.		X	X
Fire Suppression	The effects of past fire suppression with respect to the project and forest conditions was described in the existing condition section of this report. Alternatives B and C would restore changes in forest composition, structure and function that have occurred on approximately 740 and 515 acres, respectively. Alternative B would restore changes in forest composition, structure and function that have occurred in across the project area, including the main Rattlesnake Trail corridor. Alternative C focuses these treatments only in the Woods Gulch-Marshall portion of the project. The treatments would enable more effective fire suppression efforts in the future within and potentially adjacent to treatment areas due to changes in fire behavior attributable to reduced fuel loading. Alternatives A and D would not restore lost forestland integrity and resilience that have occurred due to altered fire regimes. No cumulative effects would occur. The ability to suppress fires where deemed appropriate in or adjacent to proposed treatment areas would not be enhanced. It may also result in more active fire suppression due to concerns	X	X	X

	over heavy fuel loading levels and potential for more extreme fire behavior.			
Prescribed Fire	Prescribed fire activities coupled with the fuel reduction and prescribed fire associated with Alternatives B, C, and D would cumulatively reintroduce fire to the landscape in controlled situations to restore it as an essential process of fire dependent communities on up to 3949 acres. This would result in a cumulative benefit to restoring fire resilient forested communities within the analysis area. Alternative A would result in no cumulative benefits associated with prescribed fire.	X	X	X
Wildfire	Wildfire occurrence coupled with the associated treatments in Alternative B would result in less severe fire behavior within the treatment units, over 31% of the landscape. This would enable improved suppression efforts when deemed the appropriate action. In addition, reduced potential fire behavior as a result of the treatments may also result in less active suppression and allow some natural fire to occur. Alternative C would result in the same cumulative benefit within the Woods Gulch–Marshall area, but only limited improvement in the main Rattlesnake Trail corridor; 24% of the landscape would result in a marked improved over the current condition. Alternative D would result in less severe fire behavior on 20% of the landscape, but would not treat the most at-risk stands with the highest crown fire potential, potentially rendering the treatments across the landscape wholly ineffective in the event of a wildfire. Alternative A would not improve the ability to suppress fires within treatment units. No cumulative benefits would occur. It may also result in more active fire suppression due to concerns over heavy fuel loading levels and potential for more extreme fire behavior.			X
MPB Activity	Alternatives B and C would remove MPB-infested trees on approximately 740 and 515 acres, respectively. Some insects may be removed from the forest by removing material before they emerge from trees. In addition, opening up stands and reducing competition through BA reduction within stands would reduce the likelihood of MPB attack in remaining susceptible ponderosa pine and lodgepole pine trees within the treated stands. Under Alternative A or Alternative D no cumulative effect would occur.		X	X

FIRE AND FUELS

EXISTING CONDITION

Regulatory Framework

National Cohesive Wildland Fire Management Strategy (2010)

The National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) is a bold, new national approach to the increasingly complex reality of wildland fire, land management, and fire response. The Cohesive Strategy is being developed in response to a mandate under the Federal Land Assistance and Management and Enhancement Act (FLAME Act). The Cohesive Strategy was developed in response to growing concern over mounting annual costs of fighting wildfires, devastating wildland fire losses to communities, and concern about overall landscape health. The Cohesive Strategy recognizes that fire is a natural process, necessary for the survival of many ecosystems, and focuses on attempting to reduce the conflict between fire-prone landscapes and people. The Cohesive Strategy takes a holistic approach by simultaneously looking at the role of fire in the landscape, the ability of humans to actively manage these landscapes, plan for and adapt to living with fire, and the need to be prepared to respond to fire when it occurs.

The Cohesive Strategy brings together representatives of the many stakeholders – federal and state land management agencies, local governments, landowners, environmental groups, tribal groups, fire professionals, and non-governmental organizations and other entities, to discuss goals and work collaboratively to develop shared objectives. The top-down, bottom-up approach of the Cohesive Strategy brings local knowledge about landscapes and fire to the highest levels of decision-making. And it brings together natural and social scientists to employ a scientific model to inform the deliberations with the best available science, designed to help determine the best path forward in addressing the complex issues relating to wildland fire. Working through regional strategy committees representing the three distinct regions of the country – the Northeast, the Southeast, and the West - these groups are devising a shared strategy that will inform decision-making to best use our ecological, social, and economic resources in preparing for, responding to, and recovering after inevitable wildland fires.1

Three National goals have been identified for making a positive difference in addressing the wildland fire problems. The Cohesive Strategy builds on these goals in the three phases:

- Restoring and maintaining resilient landscapes. The strategy must recognize the current lack of ecosystem health and variability of this issue from geographic area to geographic area. Because landscape conditions and needs vary dependent on local climate and fuel conditions, among other elements, the strategy will address landscapes on a regional and sub-regional scale.
- Creating fire-adapted communities. The strategy will offer options and opportunities to engage communities and work with them to become more resistant to wildfire threats.
- Responding to wildfires. This element considers the full spectrum of fire management activities and recognizes the differences in missions among local, state, tribal and Federal agencies. The strategy offers collaboratively developed methodologies to move forward.

National Cohesive Wildland Fire Management Strategy Phase II National Report (2012)

In Phase II, diverse groups of stakeholders representing each of the three regions met independently, identifying regional challenges and opportunities as well as key priorities. They agreed upon regional goals, which for the most part are the same as the national goals. The regions focused on how the processes of wildland fire, or the absence of fire, affect their values-at-risk. In Phase II, the Western region articulated its broad objectives and actions required to achieve those objectives. The size, scope, amount of federal land, and diversity of the landscapes in the West were identified as key components that make the West unique. Immediate opportunities for success were identified. Phase II of this National effort established specific regional objectives tied to the national goals. The Western regional objectives and the National Cohesive Strategy goal they are tied to are outlined here.

Restoring and maintaining resilient landscapes

Sustaining landscape resiliency and the role of wildland fire is a critical ecological process in the Western Region and requires a mix of actions that are consistent with management objectives. All aspects of wildland fire should be used to restore and maintain resilient landscapes.

- Actively manage land to achieve healthy forest and rangeland conditions.
- Protect landscapes and multiple values from the effects of unwanted fire.
- Improve interagency and stakeholder coordination and planning of actions that contribute to achieving landscape resiliency.
- Develop and maintain professional and industrial capacity to implement cost-effective and sustainable landscape treatments and support local economies.
- Fully use existing policies and procedures to provide the management flexibility needed to implement a mix of landscape treatments.
- Increase public awareness, acceptance and active participation in achieving landscape objectives using all available tools.
- Identify and prepare for non-fire threats and disturbances may increase susceptibility to wildland fire and/or impair ecosystem function.

Fire-adapted Communities

- Prevent unwanted human-caused fire ignitions within or in close proximity to communities.
- Reduce hazardous fuels within the wildland-urban interface and nearby areas containing community values to be protected.
- Continue to develop, support, and maintain Community Wildfire Protection Plans (CWPP) as one of the primary tools to achieve the goals of the Cohesive Strategy.
- Build a culture of self-sufficiency to prepare for and protect life and property from wildland fire.
- Improve effectiveness and self-sufficiency of emergency response within each community.
- Improve post-fire recovery efforts that impact public health and safety, water sources, power transmission corridors, and other critical infrastructure.

Wildfire Response

- Provide for firefighter and public safety.
- Ensure that wildfire response reflects the broader wildland fire management strategy.
- Maintain the capacity to suppress unwanted fires.
- Improve organizational efficiencies and wildfire response effectiveness.

- Coordinate planning, training, detection, and response activities for efficiencies.
- Improve and maintain infrastructure (airports, roads, bridges, etc.) that affect wildfire response.
- Address capacity issues related to all-hazard response.
- Provide access and reporting standards to all wildfire response agencies and organizations.

National Cohesive Wildland Fire Management Strategy: Phase III Western Regional Science-Based Risk Analysis Report (2012)

Phase III serves as the conclusion of the planning period of the Cohesive Strategy, during which the scientific analysis and risk assessment are added to the goals and objectives. In this phase, alternatives for emphasis and action plans will be developed as we approach the implementation phase.

Phase III of the Cohesive Strategy represents the first time that datasets from the various land and fire management agencies, NGOs, and the private sector have been brought together to create one tool that can be employed to identify key factors, issues and risks that affect wildland fire management across the nation.

Based on this effort a numerous recommendations were identified. The ones directly related to the Marshall Woods Restoration Project are highlighted below:

> "Emphasize landscape treatments where existing collaborative groups have agreed in principle on management objectives and areas for treatment, and encourage and facilitate the establishment of collaborative groups."
>
> "Encourage U.S. Forest Service and Department of the Interior/Bureau of Land Management to use existing authorities under Healthy Forests Restoration Act, Healthy Forest Initiative, and other contracting authorities to expedite fuels treatments. Assess what is currently being spent on these tools and increase that amount. Project criteria to be worked out during action planning may include: project has to be 5,000 acres or larger; reduces risk to landscapes and/or communities by focusing on areas that have a high burn probability or departure; has to be initiated within 2 years; and is based on collaborative processes."
>
> "Develop and promote local collaborative capacities to implement fuels treatments and respond to fires."

National Cohesive Wildland Fire Management Strategy Phase III Western Regional Action Plan (2013)

The Western Regional Action Plan is a science-based roadmap to direct a truly western approach to wildland fire that holistically addresses the needs of the landscape, the communities, and the wildland fire responders. The National Cohesive Wildland Fire Management Strategy: Phase III Western Regional Science-Based Risk Analysis Report of 2012 set forth recommendations for reducing wildfire risk, improving forest and rangeland health, protecting communities from wildfire, and enhancing firefighting effectiveness and firefighter and public safety.

Missoula County Community Wildfire Protection Plan

The Marshall Woods Restoration Project is within the area assessed in the Missoula County Community Wildfire Protection Plan (CWPP). Missoula County Community Wildfire Protection Plan (2005) is a county level document emphasizing collaborative effort to reduce hazardous fuels.

The county level CWPP efforts are directly tied to the Healthy Forests Restoration Act of 2003(HFRA). The HFRA effort asked communities to assume a greater role in identifying lands for priority fuels reduction treatment and treatment recommendations.

The CWPP defines wildland-urban interface as a 1.5 mile zone around areas of population density. Population density data is provided by the US Census Bureau.

The CWPP has an overall rating for communities based on two subcomponents: wildfire risk and human safety factors. Wildfire risk is based on critical infrastructure, water supplies, transportation corridors, fuels, slope, and facilities. Human safety risk factors are based on population density, critical egress, and fire response capabilities. The combination of these two risk factors establishes the overall risk rating. The overall risk rating for the Rattlesnake portion of the Marshall Woods Project is second out of eight areas at high risk for wildfire impacts.

Effects Analysis Methodology

The effects analysis is based on the following measurement indicators:

Resilience - the ability of a forest community to avoid alteration of its present state by a disturbance. Resilience practices seek to improve forest defenses against the effects of rapid environmental changes. Resilience measures are directly related to stand mortality in the event of a disturbance.

High intensity wildfire potential - the measure of a stand's higher or lower potential for crown fire initiation during typical fire season weather patterns and fuels conditions. The post-fire stand condition is directly related to this indicator of fire intensity (Scott and Reinhardt, 2001).

Firefighter efficiency and safety - the ability to initial attack a fire with direct attack suppression tactics during typical fire season weather patterns and fuels conditions. Our success utilizing direct attack is generally higher with flame lengths less than four feet in height allowing firefighters a greater margin for safety since there are limited unburned fuels between them and the fire. The need for additional aviation or heavy equipment resources is likely lower in direct attack operations (Andrews and Rothermel, 1982).

Ecosystem Function - measured by functions and processes characteristic of healthy ecosystems, whether or not those systems are within the historical range of variation. Properly functioning systems can sustainably handle natural disturbance processes including fire, insects, disease, and climate change.

Forest Vegetation Simulator (FVS)

The Forest Vegetation Simulator (FVS), an individual-tree, distance-independent growth and yield model, was used in this analysis to summarize current stand conditions, model future conditions and stand dynamics, and model proposed treatments and their effects. In addition, FVS was used in conjunction with the Fire and Fuels Extension (FFE) to analyze the effects of taking no action (Alternative A) and the proposed treatments on fire behavior and fuel loading. The temporal scale used in this effects analysis was from present day to 2050. FVS output calculation and its use as measurement indicators is described below.

Crown Fire Index (Severe): Crown fires are typically faster moving than surface fires, more difficult to suppress, and result in more tree mortality and smoke production. FFE-FVS uses information about surface fuel and stand structure to predict whether a fire is likely to crown. Two crown fire hazard indices are calculated in the model: torching index and crowning index. Torching index is the 20-foot wind speed (in miles per hour) at which a surface fire is expected to ignite the crown layer, while crowning index is the 20-foot wind speed (in miles per hour) needed to support an active or running crown fire. Torching index depends on surface fuels, surface fuel moisture, canopy base height, slope steepness, and wind reduction by the canopy. As surface fire intensity increases (with increasing fuel loads, drier fuels, or steeper slopes), or canopy base height decreases, it takes less wind to cause a surface fire to become a crown fire. Crowning index depends on canopy bulk density, slope steepness, and surface fuel moisture content. As a stand becomes denser, active crowning occurs at lower wind speeds, and the stand is more vulnerable to crown fire. For both indices, lower index numbers indicate that crown fire can be expected to occur at lower wind speeds, so crown fire hazard is greater at lower index values. The complete algorithms for determining torching and crowning index are described in Scott and Reinhardt (2001). The crown fire index under severe conditions will be used as a measurement indicator high intensity wildfire potential and ecosystem function.

Potential Mortality: When a fire is simulated, FFE calculates several different effects from the fire: crown scorch, tree mortality, fuel consumption, mineral soil exposure, and smoke production. Potential tree mortality will be used as a measurement indicator for stand-level resistance from the impacts of wildfire. Fires can kill trees and can have a short-term effect on tree growth for some of the surviving trees. Probability of tree mortality is calculated based on scorch height, crown length, diameter, and species (Ryan and Reinhardt, 1988). The tree mortality equation presented below is for surface fires. When crown fires are simulated, additional mortality is predicted based on the percent crowning predicted.

Flame Length (Resistance to control): Surface fire intensity is calculated using Rothermel's 1972 fire behavior prediction model. Fire intensity depends on static variables such as slope, variables that depend on stand conditions such as fuel quantities (represented by fire behavior fuel models) and mid-flame wind speed, and environmental variables specified by the user, such as fuel moisture levels. Surface fire intensity is used to calculate flame length and scorch height, which affect tree mortality and growth. It is also used to determine the amount of crowning in the stand. Flame length will be a measurement indicator of firefighter efficiency and safety. In general a flame length over four feet requires an increased commitment of suppression resources and a more indirect attack tactic.

Fire Behavior Fuel Models

Fire Behavior Fuels Models (FBFM): Predicted and observed fuels models are important indicators of potential fire behavior and effects. Each fuel model is typically used to represent a range of fuel conditions in which fire behavior may be expected to respond similarly to changes in fuel moisture, wind and slope. Most fires ignite in and are carried by surface fuels, so mathematical fire behavior fuel models were developed for surface fuels to provide a quantitative basis for fire behavior predictions (Rothermel, 1972). The "Standard" fire behavior fuel models, which is a comprehensive set for use with Rothermel's surface fire spread model" developed by Scott and Burgan (2005), will be used to categorize surface fuels.

Table 17. Fire Behavior Characteristics and Fire Suppression Interpretation

Flame Length (ft.)	Fireline Intensity (Btu/ft./sec.)	Interpretations
Under 4	Under 100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4-8	100-500	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8-11	500-1000	Fires may present serious control problems – torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11	Over 1000	Crowning, spotting, and major fire runs are probable. Control efforts at the head of fire are ineffective.

Fuels models will be used as a measurement indicator to assess potential fire intensity at the stand level using these fire behavior characteristics.

The effects of the treatments proposed in the Marshall Woods project are analyzed and described in terms of shifts in expected fire behavior, fuel models and residual stand conditions (mortality). The effects of the no action alternative (Alternative A) will be analyzed in the context of a wildfire occurrence in the stands existing condition.

While the impacts of thinning and burning can be predicted and may have some environmental impacts, these impacts need to be evaluated against the option of ‘‘no action’’. ‘‘No action’’ is not a risk-free option, as dry climates regularly predispose forests to burn in a typical dry summer (Heyerdahl et al., 2001; Skinner, 2002; Swetnam and Baisan, 2003). The impacts of ‘‘no action’’ in dry forest ecosystems must incorporate the probability of stand-replacing, intense fire where stand density has increased and dead fuel accumulated in excess of historical levels (Agee and Skinner, 2005).

Burn probability is estimated using simulation and represents the likelihood of an area burning during large wildland fires. As shown in Figure 31 below, Missoula County is rated as moderate for mean burn probability. The Marshall Woods Project Area is entirely within Missoula County.

The No-HARM1, (National Hazard Risk Model) map (Figure 32) is based on models of fire behavior and probability, using information about fuels, weather, topography and historic fire occurrence, to show the areas of highest wildfire risk across the country. The largest areas of high risk are in the Western states. This map was created by identifying the levels of risk at the “fireshed” level of approximately 175-acre units. Communities located in moderate, high, very high and extreme fire risk areas need to become fire adapted. The analysis shows the existing condition for the general area of Missoula County high to very high hazard and risk regarding wildfire.

Figure 31. Mean Burn Probability Map

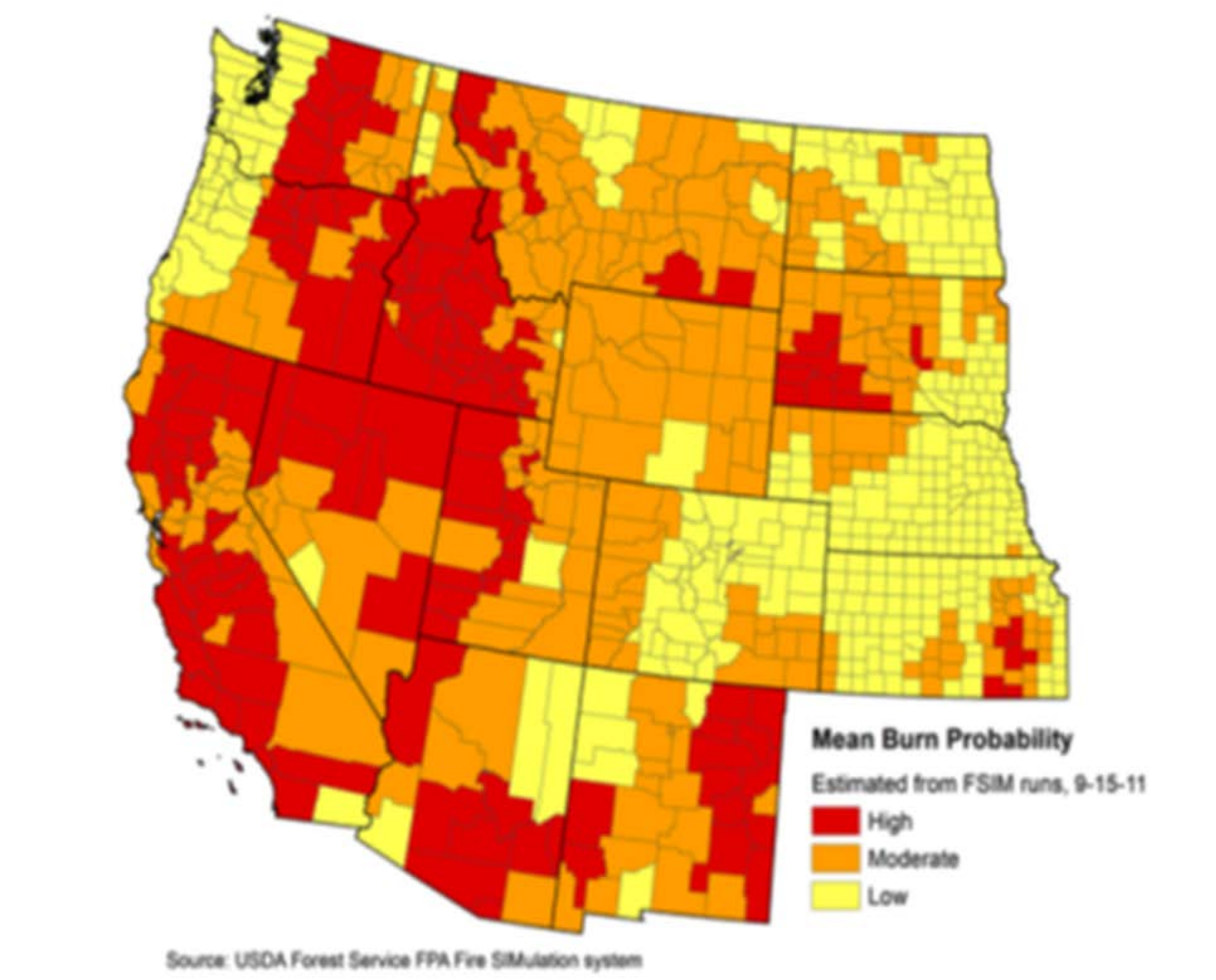
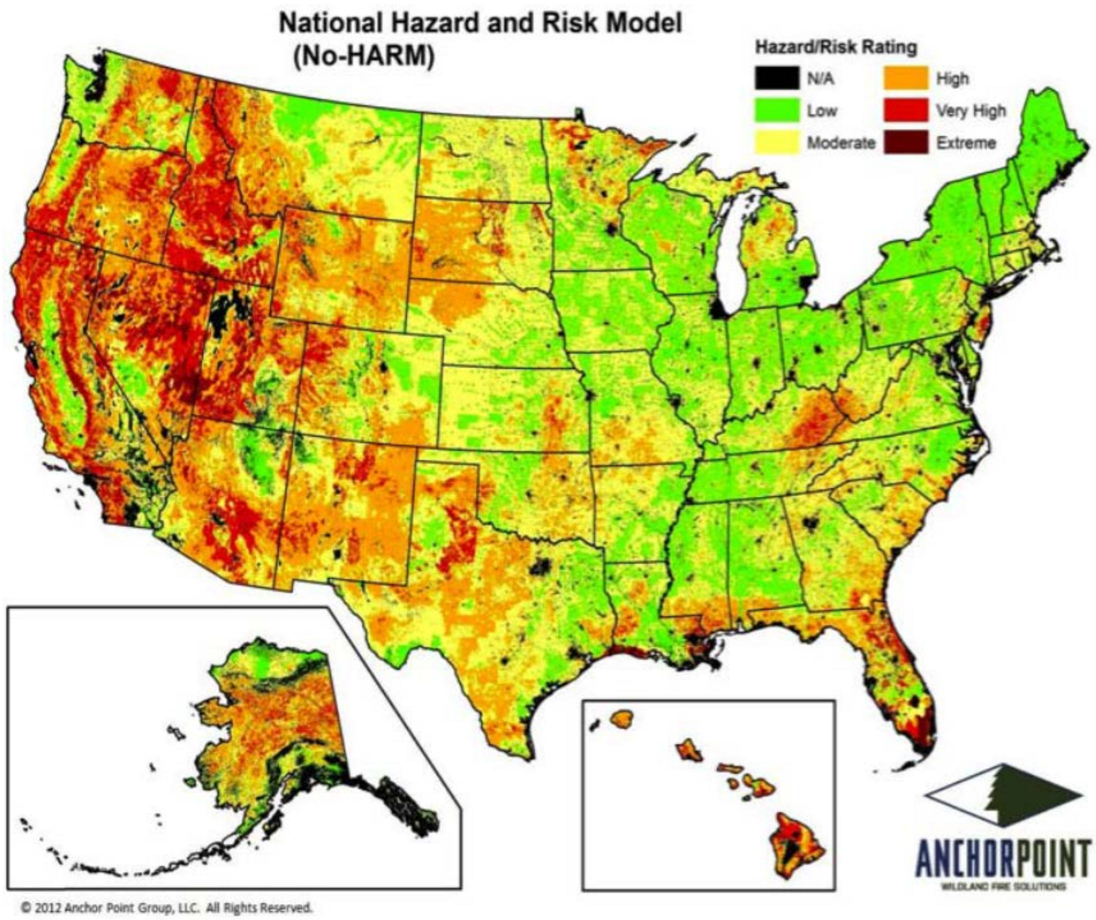


Figure 32. National Hazard and Risk Model

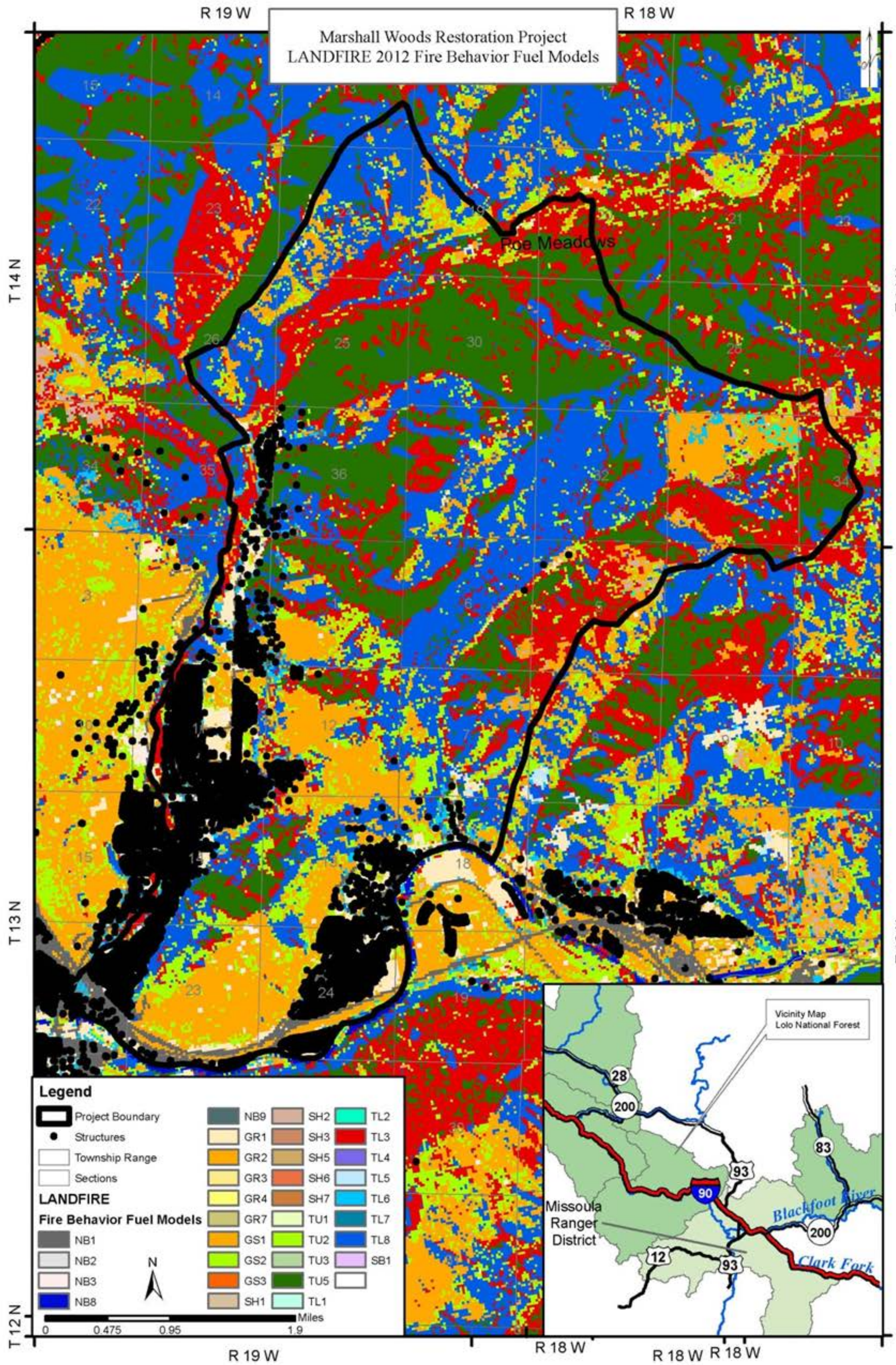


Fire Behavior Fuel Models for Marshall Woods Project Area

Current conditions within the Marshall Woods project are primarily at low elevations that transitions from grass to timbered fuel models along predominately southerly aspects. The following Fuel Model Codes and brief model descriptions characterize fuel conditions in Marshall Woods project area: GR2 - Low Load, Dry Climate Grass, TL8 - Long-Needle Litter, TL3 - Moderate Load Conifer Litter, TU5 - Very High Load, Dry Climate Timber-Shrub. (Landfire 2012, Scott and Burgan 2005).

The 2012 Landfire fire behavior fuel modeling depicts the spatial nature of fuel model locations (Figure 33). The fuel models with the most problematic fire behavior TU5, GR2, TL8 are green, gold and blue respectively. Interspersed throughout these fuel models islands of TL3 are present represented by red. Due to the juxtaposition of these islands to other fire behavior fuel models that burn with higher intensities (flame length) there would be no expected dampening effect of fire behavior in the event of a wildland fire. Proposed treatments are focused on areas with fire behavior fuel models representing high intensity fire behavior during typical fire season conditions for this area.

Figure 33. Marshall Woods Project Area Fire Behavior Fuel Model Map



Fire History (1985-2013)

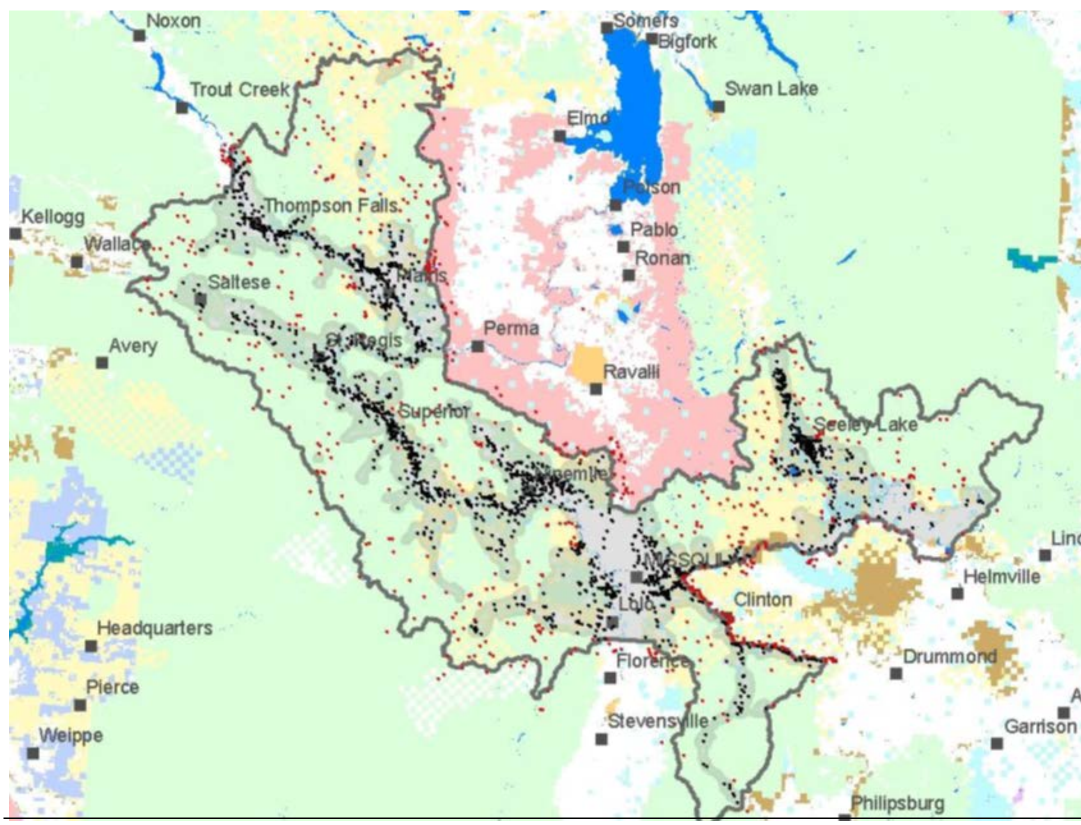
The Lolo NF encompasses five Ranger Districts (Missoula, Ninemile, Superior, Plains/Thompson Falls and Seeley Lake) covering a total of approximately 2,100,000 acres. Of that the Missoula Ranger District includes approximately 446,748 acres of NFS lands. The Lolo NF averages approximately 174 fires per year (1984-2013) and a 30-year average of over 14,000 acres burned annually by wildfire (Table 18). Historically 72% of the Forest's fires occur during the months of July and August. In general 60% of fires in a given year are lightning-caused and the remaining 40% are human-caused.

Table 18. Lolo National Forest 5-30 year Average Fire Occurrence and Acres Burned

Years	Year Span	Average # Fires	Average Annual Acres
5-year	2009-2013	148	4,381
10-year	2004-2013	149	18,681
20-year	1994-2013	178	18,330
30-year	1984-2013	174	14,958

Human-caused fires as well as wildland fire caused by lightning are both of concern within the wildland-urban interface. The map below (Figure 4) displays fires across the Forest between 1980 and 2008. There were 7,555 fires; 2,751 were human-caused (36%). Of those 2,751 human starts 73% were in the WUI as illustrated below. Black dots indicate human-caused fires that occurred in the WUI and the red dots indicate human-caused fires that were outside the WUI.

Figure 34. Locations of Fire by Type on the Lolo NF 1980-2008

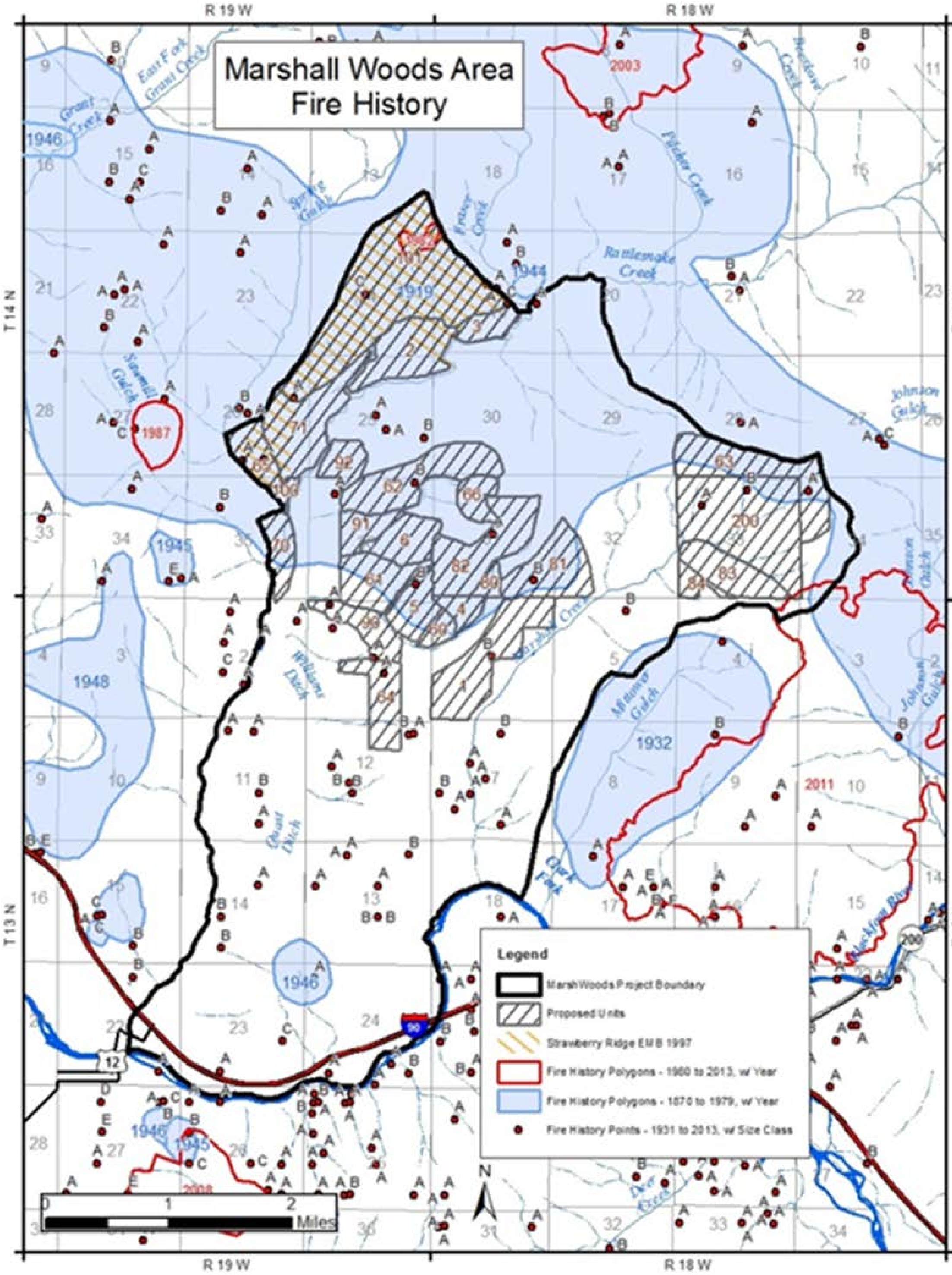


Fire History Points 1980-2013 and Large Fire Perimeters 1870-2013

The large fire perimeters (1870-2013) in light blue show the role fire has played over this landscape and where that interaction has occurred (Figure 35).

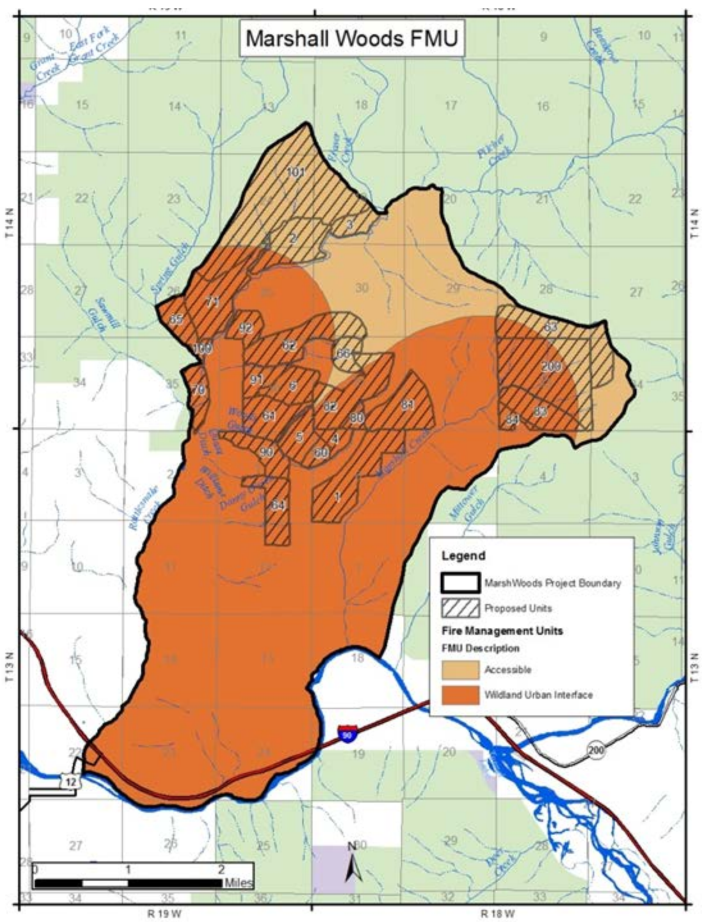
The largest historic fire perimeter depicted is the 1919 fire. In August 1919, Quast, a rancher in Grant Creek was burning hay piles when the fire escaped his control. The fire burned from Grant Creek eastward to Gold Creek affecting upwards of an estimated 20,000 acres (Poe 1992; Missoulian 1919 as cited in Comer, 2003). The fire burned through the analysis area roughly from the main Rattlesnake Trailhead and Woods Gulch northward and east to the western ridge that incises Marshall Canyon. The 1919 fire burnt over an area with an extensive history of human extractive use and habitation. The 1919 fire is the origin for most of the forested stands in the area. The map also displays fire occurrence points from 1931 to 2013 by size class; Class A fires (0.25 acre or less), Class B fires (0.25 to 10 acres), Class C fires (10 to100 acres), Class D fires (100 to 300 acres), and Class E, F and G fires (300+ acres). This clearly shows the level of potential fire interaction that could have occurred historically if not for some of the past management history.

Figure 35. Marshall Woods Area Fire History



Past Management History

Figure 36. Marshall Woods Fire Management Units



It is generally accepted that past management practices including the successful suppression of many wildland fires in some western United States ecosystems over the last 70 years have resulted in excessive accumulations of surface and canopy fuels which have, in turn, increased the potential for severe fires (Brown and Arno, 1991; Mutch et al., 1993; Kolb et al., 1998; Keane et al., 2002; Stephens and Ruth, 2005). Because productivity exceeds decomposition in most of the West, surface fuels tend to increase in the absence of disturbance. In most coniferous forests, canopy fuels also increase and become more available without disturbance as more shade-tolerant trees become established in the understory and overstory (Keane et al., 2002).

Past timber and site preparation for planting activities and NFS lands within the Marshall Woods project area are summarized in the EA Appendix D. With the exception of the Strawberry Ridge Ecosystem Maintenance Burn in the late 1990 s there has been little broadcast prescribed fire applied to the Marshall Woods project area within the past seventy years.

This Strawberry Ridge Ecosystem Maintenance Burning (EMB) was implemented under the Rattlesnake NRA Wildlife Habitat Improvement and EMB EA (1997). A post-burn wildlife habitat survey conducted by then Wildlife Biologist Mike Hillis concluded widespread improvements to available wildlife browse.

Wildland-Urban Interface and Fire Management Units

Interagency Federal fire policy and Forest Service Handbook 5109.19: Fire Management Analysis and Planning Handbook require that every area with burnable vegetation must have a Fire Management Plan (FMP). The Lolo fire Management Plan (2014) establishes Fire Management Units (FMU) on the Lolo NF landscape describing their characteristics and summarizes guidance available in the Lolo Land and Resource Management Plan. FMU1 is defined as wildland-urban interface, FMU2 is defined as developed/accessible, and FMU3 (not present in this project area) is considered limited access. The majority of the project area (90%) and proposed treatments are within FMU1, wildland-urban interface (Figure 36).

ENVIRONMENTAL CONSEQUENCES

Each alternative was analyzed for its ability to address the following measures of success to meet the purpose and need: resilience, high intensity wildfire potential, firefighter and public safety, and ecosystem function. Crown fire index under severe conditions provides a measure regarding high intensity wildfire potential and ecosystem function. Potential mortality paints a picture of the residual stand condition and stand resiliency. Flame length allows an assessment of firefighter effectiveness and firefighter and public safety. Project design employs treatments that affect these indicators across a range of fire behavior fuel models and a temporal range of effectiveness. The No Action alternative is assessed in terms of a wildfire event during typical fire season weather conditions and the resultant effects to the stand condition.

A key issue that emerged through the public scoping process was a request to exclude all machinery from the area proposed for treatment along the main Rattlesnake Trail corridor, except that necessary to accomplish road improvements. Limited public comments desired complete exclusion of machinery in vegetation project design. Two alternatives to the proposed action were developed in response to this public issue. Excluding mechanized treatments and product removal along the main Rattlesnake Trail corridor dramatically alters the effects of the treatments and their ability to meet the purpose and need. Therefore, the effects will be displayed, by alternative, in the main Rattlesnake Trail corridor and in the Woods Gulch- Marshall portion of the project. The Rattlesnake portion of the project includes all units north or west of Rattlesnake Creek and Unit 70 (i.e., Units 2, 3, 65, 70, 71, 100a, 100b, 101). The Woods Gulch- Marshall portion of the project lies east of Rattlesnake Creek in the Marshall Creek and Woods Gulch areas (i.e., Units 1, 4, 5, 6, 60, 61, 62, 63, 64, 66, 80, 81, 82, 84, 90, 91, 92, 200). This effects analysis will also compare each of the action alternatives proposed treatments and Alternative A no action.

Direct and Indirect Effects

To summarize Alternative B provides the most effective treatments that increase ecosystem function and resilience by maximizing the retention of large fire-tolerant tree species (ponderosa pine, western larch), re-introducing fire to reduce surface fuel loads, and decreasing the probability of crown fire initiation within the treated stands. Alternative B would reduce horizontal fuels (ladder fuels) by stand thinning; and treating surface fuels with prescribed fire. These types of treatments have been accomplished across the Lolo NF on 7,000 acres annually and have proven to meet the objectives for the longest period of time. Alternative B accomplishes this in both the main Rattlesnake corridor and Woods Gulch-Marshall areas. Alternative C attempts to meet these objectives, but does not treat the horizontal fuel continuity within the main Rattlesnake corridor leaving this area vulnerable to higher intensity fires when they occur. Alternative D fails to address the horizontal fuels across most treatment areas, and so does not increase resilience leaving an even larger portion of the area vulnerable to high intensity fire (Table 19. Measurement Indicators by Alternative). Alternative A meets none of these objectives and does not meet the purpose and need of the project. Under Alternative A, the potential for high intensity fire remains very probable within a landscape that has missed numerous fire return intervals and has accumulated atypical stand densities and fuel loads.

Alternative B is the alternative best designed to create fire resilient stands. The best science indicates a three part objective to creating fire resilient stands with fuel treatments; reducing surface fuels, reducing ladder fuels and reducing crown density (Agee and Skinner, 2005). By meeting these objectives on a greater scale within the wildland-urban interface and the high use recreation corridor the crown fire potential is reduced and resiliency and ecosystem function increase. This occurs in a key location with a high density of high value assets that are currently at risk to negative impacts from a wildfire event. Alternative B best meets the objectives for effective fuel treatment by:

- Reducing surface and ladder fuels; increasing crown base heights
- Reducing and maintaining lower tree densities for a longer period of time; decreasing canopy bulk density and potential crown fire initiation
- Retaining fire-tolerant species (ponderosa pine and western larch)
- Reintroducing fire to reduce fuel loads, stimulate understory species, and maintain desired fuel beds

Alternative C is consistent with these objectives, but does not effectively meet them along a heavily-used recreation area, the main Rattlesnake corridor. Alternative D fails to meet most of these objectives across the most at-risk areas, and is ineffective at increasing resilience at the landscape scale. Alternative A meets none of these objectives and does not meet the purpose and need of the project.

Treatments Affecting Potential Crown Fire and Tree Mortality

As has become commonplace, the term "thinning" is in reference to partial cutting to reduce the number of stems or density within a forest stand (Graham et al., 1999). All tree cutting treatments under Alternative B "thin" stands to different levels using a variety of silvicultural approaches. Tree removal can play an important role in treating fuels, especially removal of understory trees that can provide a ladder into the forest canopy, but it is subject to site-specific limitations. A common objective of thinning for fuel management is to reduce the chance of crown fire by reducing canopy fuels, especially in forest types that historically burned in low severity fires. However, thinning alone does not typically constitute an effective fuel treatment, but instead must be combined with treatment of surface fuels. In the absence of fire, many stands that historically burned frequently and had open structures have become dense with vertically continuous canopies. This makes them more prone to crown fire and is one of the prime causes of the wildland fuel problem. Thinning stands to reduce crown fire potential is a primary means of reducing fire hazard (Graham et al., 1999, 2004; Brown and Aplet, 2000). Agee and Skinner (2005) summarize guidelines for treating wildland fuels with thinning. They offer four principles for creating fire-resilient stands in dry forests: reduce surface fuels, increase the height to the canopy, decrease crown density, and retain big trees of fire-resistant species (Reinhardt, et al., 2008). Thinning for fire hazard reduction should concentrate in general on the smaller understory trees to reduce vertical continuity between surface fuels and the forest canopy. In some cases it may be desirable to reduce the horizontal continuity of the canopy as well by thinning some bigger trees (Reinhardt, et al., 2008). All action alternatives' proposed treatments include prescribed fire applications to reduce surface fuels.

The removal of trees focuses on removing smaller diameter trees and retaining the largest healthiest ponderosa pine and western larch in all age classes as well as thinning and prescribed fire applications to modify crown fire potential and fire behavior characteristics that influence tree mortality and stand resilience.

Alternative A would retain all trees across 3,959 acres, and would not increase resilience or resistance to wildfire. In the event of a wildfire, the resiliency of the stands would be low due to increasing vertical (ladder) and horizontal (surface) fuels resulting in high intensity surface fire with a high probability to initiate crown fire over large areas during typical fire season weather patterns.

Alternative B is designed to retain large, healthy trees consistent with the objective of maintaining or restoring healthy fire-resistent stands. Ponderosa pine and western larch are key fire-resilient species that would be featured by the treatments. The treatments would reduce the horizontal and vertical fuels with thinning and prescribed fire particularly in Units 1-6 (740 acres) protecting large diameter ponderosa pine and western larch from the risk of high intensity fire behavior.

Alternative C is designed to achieve these same objectives; however, would not accomplish this effectively across 539 acres along the main Rattlesnake Trail corridor (Units 70, 71, 2, 3).

Alternative D would not accomplish this effectively on 1,054 acres that would be treated under Alternative B.

Treatments Affecting Surface Fuels and Fire Behavior Characteristics

In all action alternatives prescribed fire is applied in a variety of ways; ecosystem maintenance burning, underburning, broadcast burning, pile burning (machine or hand), and jackpot burning. In most cases the prescribed fire application would be preceded by slashing or thinning small diameter trees. All of these prescribed fire applications reduce surface fuel which in turn affects fire behavior; however, some applications are more effective than others at re-introducing fire effects into fire-dependent landscapes while reducing surface fuels. Pile burning and jackpot burning are much less effective at mimicking the role of fire in a landscape.

The goal of fuel treatment regimes probably should not be a target stand structure or a target fire hazard rating, but rather, to save those important ecosystem components (e.g., large, old ponderosa pine trees) and processes that might be lost if an unplanned wildfire happens to visit the landscape (Apfelbaum and Chapman, 1997). This especially applies to the WUI where fuel treatment regimes should minimize those fires that could burn homes (Reinhardt, et al., 2008).

Alternative A (No Action alternative) would perpetuate surface fuel conditions that contribute to fire behavior intensities that result in flame lengths 4 feet or greater and potential mortality ranging from 80% to 100% of the stand. The No Action alternative is does not meet the purpose and need of the project on any of the 3,959 acres proposed for treatment in the other alternatives.

Alternative B would apply prescribed fire treatments on all acres proposed for treatment. In critical areas (e.g., the Rattlesnake corridor) the treatment calls for thinning the overstory and understory to a greater extent than the other action alternatives. This treatment coupled with underburning is the most effective manner to address modifying fire behavior over the longest period of time. The stand densities are lower and canopy bulk densities are lessened to a greater extent prior to the application of prescribed fire. This would result in conditions that are at less likely to experience adverse fire effects. The crown fire index is the highest, the flame lengths the lowest, and the percent mortality the lowest of any of the action alternatives.

Alternative C is designed to achieve these same objectives; however, would not accomplish this effectively across 539 acres along the main Rattlesnake Trail corridor (Units 70, 71, 2, 3).

Alternative D would not accomplish this effectively on 1,054 acres that would be treated under Alternative B including the main Rattlesnake corridor.

Effects Common to All Alternatives

In some cases prescribed fire alone may accomplish surface fuel reduction, thinning from below with fire-caused mortality, and lifting of the canopy base height due to scorched low branches (Reinhardt, et al., 2008). Areas proposed for ecosystem maintenance burning without slashing were historically occupied by very large to moderately open ponderosa pine or ponderosa pine and Douglas-fir forests that experienced fire frequency averaging 5-50 years. Fire Group Four represents 10,023 acres within the planning area.

Fuel treatments that involve prescribed fire carry risks of escape and of greater than intended fire effects including post-fire insect attacks of residual trees (Ganz et al., 2003), consumption of organic soils, and unwanted smoke production. However, in many cases, no action may carry greater risks from effects of abnormally severe fires (Agee and Skinner, 2005). Finney et al. (2005) observed reductions in wildfire severity in portions of the Rodeo and Chediski wildfires on the lee side of areas previously treated with prescribed fire. These positive effects can be expected to be more frequent as the portion of the landscape that has been treated increases (Reinhardt, et al., 2008).

Measurement Indicators by Alternative

Table 19 provides a quantitative comparison of the four alternatives and their effectiveness at meeting elements of the purpose and need within the landscape. It is important to clarify that the treatments were designed to meet the purpose and need of the project and are not based on these specific measures. These measures are used to provide a quantitative comparison between the alternatives. They are based of FVS modeling of treatments; they are not absolutes, but should be viewed as relative measures to allow for reasoned quantitative comparison of the current condition, the four alternatives, and the magnitude of change and trends over time.

Effects will be displayed, by alternative, in the main Rattlesnake Trail corridor and in the Woods Gulch- Marshall portion of the project. The Rattlesnake portion of the project includes all units north or west of Rattlesnake Creek and Unit 70 (i.e., Units 2, 3, 65, 70, 71,100a, 100b, 101). The Woods Gulch-Marshall portion of the project lies east of Rattlesnake Creek in the Marshall Creek and Woods Gulch areas (i.e., Units 1, 4, 5, 6, 60, 61, 62, 63, 64, 66, 80, 81, 82, 84, 90, 91, 92, 200).

The following measurement indicators are utilized for the quantitative comparison:

Crown fire potential = 20 foot wind speed that will propagate a surface fire into a crown fire. The higher the number the more resilient the stand is to high intensity fire.

Flame Length = in feet is an indicator of surface fire intensity. In general a flame length over 4 feet represent higher intensity fire behavior and an increased resistance to fire suppression efforts.

Percent Mortality = in percent, represents the percent of the basal area killed under severe fire conditions, a higher number indicates stand replacement fire effects.

Table 19. Measurement Indicators by Alternative

Treatment Effects Crown Fire Index (CFI), Flame Length (FL) and Potential Mortality (PM) (Units 1, 2, 3, 4, 5, 6)*	Year 2018						Year 2040					
	Main Rattlesnake			Woods Gulch – Marshall			Main Rattlesnake			Woods Gulch - Marshall		
	CFI (mph)	FL (ft)	PM (%)	CFI (mph)	FL (ft)	PM (%)	CFI (mph)	FL (ft)	PM (%)	CFI (mph)	FL (ft)	PM (%)
Alternative A (No Action)	20	3.8	100	20	3.8	100	21	3.9	100	21	3.9	100
Alternative B (Proposed Action)	41	3.1	9	41	3.1	9	39	1.6	8	39	1.6	8
Alternative C	24	2.4	100	41	3.1	9	23	3.2	100	39	1.6	8
Alternative D	24	2.4	100	24	2.4	100	23	3.2	100	23	3.2	100

*Unit 3 FVS modeled effects (PF, Item M5-32)

Mechanized treatments as proposed under Alternative B in Units 70 and 71 along the main Rattlesnake corridor would result in a CFI of 41, FL of 2, and PM under severe conditions of 11%. While some localized improvement would occur in Units 70 and 71 under Alternatives C and D, the treatment would result in a CFI of 39, FL of 6, and PM of 97% under severe conditions. Under No Action the CFI would be 35, FL 4, and PM 81% under severe conditions.

In order to summarize the scale of the area affected by the action alternatives, the percent of the area treated, type, and location of treatments are compared (Table 20. Fuel Treatment Effectiveness By Alternative). Alternative A is not considered in this summary.

Each action alternative proposes treatment on 30.5% (3,959 acres) of the Marshall Woods project area landscape (13,000 acres) and these treatments affect 54.2% of the NFS land within the analysis area.

In Alternative B, which is designed to improve resiliency, ecosystem function and reduce the potential for high severity fire, the effectiveness of treatments would span 20-30 years across 3,701 acres or 28.5% of the landscape.

Alternative C would achieve these objectives on 3,162 acres or 24.3% of the landscape, with less effective improvements both in longevity and resiliency within the main Rattlesnake Trail corridor.

Alternative D aims to achieve these objectives on 2,647 acres or 20.4% of the landscape; however it does not effectively address reducing the potential for high intensity fire with flame lengths modeled to exceed the 4-foot threshold. Alternative D does not substantially address the canopy bulk density in the most at-risk stands (Unit 1-6) in the project area rendering it less effective at reducing the percent mortality to an acceptable level and meeting the purpose and need of the project.

Table 20. Fuel Treatment Effectiveness By Alternative

Unit	Alternative A Fuels Treatment & Acres	Alternative B Fuels Treatment & Acres	Alternative C Fuels Treatment & Acres	Alternative D Fuels Treatment & Acres
Units shaded darker gray are treatments considered to be most effective in immediately reducing fuels after all treatments and the greatest longevity of effectiveness.		Units shaded lighter gray are treatments considered to be effective in the long term and short term would see increased fuel loads. The longevity of the effectiveness is considered shorter.		Units without gray shading are treatments considered to be the less effective in fuel reduction with the most limited longevity.
1	No Treatment	IC/HPB/UB 266	IC/HPB/UB 266	STT/HPB/UB* 266
2	No Treatment	STS/UB 184	STT/HPB/UB* 184	STT/HPB/UB* 184
3	No Treatment	CT/UB 41	STT/HPB/UB* 41	SST/HPB/UB* 41
4	No Treatment	STS/UB 46	STS/UB 46	STT/HPB/UB* 46
5	No Treatment	STS/UB 94	STS/UB 94	STT/HPB/UB* 94
6	No Treatment	IC/UB 109	IC/UB 109	STT/HPB 109

60	No Treatment	YST/UB 38	STT/UB* 38	STT/UB* 38
61	No Treatment	STT/UB 144	STT/UB* 144	STT/UB* 144
62	No Treatment	STT/UB 234	STT/UB* 234	STT/UB* 234
63	No Treatment	Slash/UB 254	Slash/UB* 254	Slash/UB* 254
64	No Treatment	STT/UB 137	STT/UB* 137	STT/UB* 137
65	No Treatment	STT/UB 91	STT/UB* 91	STT/UB* 91
66	No Treatment	STT/UB 63	STT/UB* 63	STT/UB* 63
70	No Treatment	STT/HP/MP/UB 85	STT/HPB/UB* 85	STT/HPB/UB* 85
71	No Treatment	STT/MP/UB 229	STT/HPB/UB* 229	STT/HPB/UB* 229
80	No Treatment	YST/UB 27	YST/UB 27	YST/UB 27
81	No Treatment	YST/UB 185	YST/UB 185	YST/UB 185
82	No Treatment	YST/UB 230	YST/UB 230	YST/UB 230
84	No Treatment	YST/UB 35	YST/UB 35	YST/UB 35

90	No Treatment	STT/HPB 106	STT/HPB 106	STT/HPB 106
91	No Treatment	STT/HPB 73	STT/HPB 73	STT/HPB 73
92	No Treatment	STT/HPB 69	STT/HPB 69	STT/HPB 69
100A	No Treatment	Slash/JPB/HPB 19	Slash/JPB/HPB 19	Slash/JPB/HPB 19
100B	No Treatment	Slash/JPB/HPB 21	Slash/JPB/HPB 21	Slash/JPB/HPB 21
101	No Treatment	UB 729	UB 729	UB 729
200	No Treatment	UB/BB/JPB 450	UB/BB/JPB 450	UB/BB/JPB 450
Total Acres Treated	None	3,959	3,959	3,959

IC = Improvement Cut; CT = Commercial Thin; STS = Single Tree Selection; YST = Young Stand Thinning: STT= Small Tree Thinning; EMB = Ecosystem Maintenance Burn; JPB = Jackpot Burn; UB = Underburn; BB = Broadcast burn; MP = Machine Pile; PB = Pile Burn; HPB = Hand Pile and Burn; * Slashing diameter is less than 8” dbh.

Air Quality

Environmental Consequences

Alternatives A, B, C and D

Lightning and human-caused wildfires will continue to influence the Marshall Woods project area. The project area involves multiple fire protection jurisdictions including Missoula Rural Fire Department, Montana Department of Lands and Conservation and the Lolo NF. The Lolo NF Fire Management will continue to prioritize the NFS lands with an initial attack suppression strategy. A wildfire that escapes initial attack would have a full suppression strategy due to multiple fire protection jurisdictions and a high density of human values that would be at risk to adverse wildfire impacts. Although naturally occurring wildfire events could possibly produce positive beneficial fire effects over the landscape, the Agency’s current situation in the area represents an unacceptable level of exposure to the community.

The FOFEM model was used to analyze wildfire smoke emissions in a representative cover type under: 1) very dry summer conditions for current conditions; 2) anticipated conditions with no treatment: and 3) post-treatment conditions. This analysis assumes no treatment would be applied between the current and anticipated condition. This analysis also assumes annual wildfire suppression would succeed in limiting fires' spread until a significant wildfire event. The current condition reflects a Douglas-fir / ponderosa pine overstory with typical surface fuel loading. The anticipated condition reflects a Douglas-fir / ponderosa pine overstory with a high Douglas-fir understory component. Post-treatment conditions reflect a Douglas-fir / ponderosa pine overstory with the proposed treatments, including underburning, having been completed. Treatments would remove much of the understory Douglas-fir ladder fuel component. Post-prescribed fire underburn conditions would include light litter and surface fuel loading along with further understory Douglas-fir reductions.

FOFEM 5.21 output values are not absolute but do indicate potential wildfire smoke emission trends between Alternative A (No Action) and Alternatives B, C, and D (Table 21).

Under Alternative A, there would be an increasing potential for wildfire emissions as the current condition progresses toward higher fuels loads. In the case of a significant wildfire event, very high emissions would occur. With no treatment it is expected that future fuel conditions would trigger a noteworthy increase in wildfire smoke emission.

Alternatives B, C, and D each would reduce fuel continuity and arrangement over the area to various degrees.

Alternative B would reduce fuel continuity and arrangement to the largest extent followed by Alternative C with a slightly reduced scope. Alternative D would reduce fuel continuity and arrangement to the least extent of the three action alternatives. FOFEM 5.21 output values indicate a trend in reducing potential wildfire smoke emissions under post-treatment conditions for both PM 10 and PM 2.5 emissions. PM 10 emissions would be reduced approximately 95% and PM 2.5 emission would be reduced approximately 51-70% from current and anticipated conditions.

All action alternatives reduce emissions in the event of a wildfire.

Table 21. FOEFM Outputs Wildlife Emissions

FOFEM outputs potential wildfire emissions				Emissions Reduction Post-Treatment	
Emissions (Flaming and Smoldering)	Current Condition (lbs/acre)	Anticipated Condition (lbs/acre)	Post-Treatment Conditions (lbs/acre)	Current Condition (lbs/acre)	Anticipated Condition (lbs/acre)
PM 10	1,555	2,490	75	1,480	2,415
PM 2.5	1,318	2,109	640	678	1,469

However, all action alternatives would most likely increase nuisance smoke during the prescribed fire implementation timeframe. Problem or Nuisance Smoke is defined by the Environmental

Protection Agency (EPA) as the amount of smoke in the ambient air that interferes with a right or privilege common to members of the public, including the use or enjoyment of public or private resources. While there are no laws or regulations governing nuisance smoke, it can limit opportunities for land managers to use fire. Public concerns regarding nuisance smoke often occur long before smoke exposures reach levels that violate National Ambient Air Quality Standards (NAAQS). The most common air quality issues facing wildland fire managers are those related to public complaints about nuisance smoke...about the odor or soiling effects of smoke, poor visibility, and impaired ability to breathe or other health-related effects. Sometimes complaints come from the fact that some people don't like or are fearful of smoke intruding into their lives (Hardy et al. 2001). Prescribed fire treatments proposed in the action alternatives may result in an increase of Nuisance Smoke.

Cumulative Effects

Past, present and reasonably foreseeable actions within the Marshall Woods project area were considered to determine the potential for cumulative effects on forest conditions. The cumulative effects analysis summary is found in Table 22. Only past (P), present (C) and reasonably foreseeable future (F) activities within the Marshall Woods project area that are pertinent to the forest resource will be addressed in the cumulative effects. The Marshall Woods project area was used for the cumulative effects analysis area for fire and fuels.

Table 22. Cumulative Effects Summary for Fire and Fuels

Project/Activity	Cumulative Effect in Conjunction With Project	P	C	F
Fire Suppression	The effects of past fire suppression with respect to the project and fuels conditions was described in the existing condition section of this report. Alternatives B and C would increase resiliency with regard to high intensity fire on approximately 740 and 515 acres, respectively. Alternative B would increase resiliency across the project area, including the main Rattlesnake Trail corridor. Alternative C focuses these treatments to reduce high intensity fire only in the Woods Gulch-Marshall portion of the project. The treatments would provide for a greater margin of safety during fire suppression operations in areas due to changes in fire behavior attributable to reduced fuel loading which decreases the probability of a high intensity wildfire. Alternatives A and D would not address the stands resilience to high intensity wildfire which has decreased due to altered fire regimes and fuel accumulation. The fire management strategies in the area will continue to have a suppression emphasis where deemed appropriate due to values-at-risk. The primary cumulative effect for Alternatives B and C is an increased margin of safety for firefighters and the public during suppression actions due to reduced fire behavior. The cumulative effect for Alternatives A and D would include	X	X	X

Project/Activity	Cumulative Effect in Conjunction With Project	P	C	F
	an increase in the probability for stand-replacement fire behavior in the present and foreseeable future as well as a higher degree of risk associated with the suppression actions that would continue in the area due to values-at-risk.			
Prescribed Fire	Prescribed fire activities coupled with the fuel reduction and prescribed fire associated with Alternatives B, C, and D would cumulatively reintroduce fire to the landscape in controlled situations to restore it as an essential process of fire-dependent communities on up to 3,949 acres. This would result in a cumulative benefit to restoring fire resilient forested communities within the analysis area. Alternative A would result in no cumulative benefits associated with prescribed fire. Nuisance smoke levels over the implementation period would vary in severity and location but are likely to occur. The prescribed fire implementation would not exceed NAAQS thresholds.	X	X	X
Wildfire	Wildfire occurrence would continue unabated in the area. The cumulative effect would be the nature of the wildfire when it occurs. Alternative B would result in a beneficial reduction in the potential for severe fire behavior within the treatment units, over 31% of the landscape. This would enable improved suppression efforts when deemed the appropriate action. Alternative C would result in the same cumulative benefit within the Woods Gulch–Marshall area, but only limited improvement in the main Rattlesnake Trail corridor; 24% of the landscape would result in a marked improved over the current condition. Alternative D would result in less severe fire behavior on 20% of the landscape, but would not treat the most at-risk stands with the highest crown fire potential, potentially rendering the treatments across the landscape wholly ineffective in the event of a wildfire. Alternative A would not reduce the probability of high intensity wildfire, no cumulative benefits would occur. None of the alternatives affects the probability of wildfire occurrence only the potential impacts to the Forest and the Communities they surround. Smoke emissions from a wildfire may exceed NAAQS thresholds.			X

WILDLIFE

ANALYSIS AREA DESCRIPTION FOR WILDLIFE (INCLUDING PAST ACTIVITIES)

The wildlife analysis area for the Marshall Woods Project (hereafter "analysis area") encompasses 28,514 acres of land that provides a diversity of habitats for wildlife. This analysis area is used for all wildlife species throughout this assessment, with the exception of lynx (see details in lynx analysis section below). The boundaries for the analysis area follow hydrological divides, and include the entire middle Rattlesnake watershed (HUC6), and the Marshall Creek portion of the Middle Clark Fork watershed (HUC6). All proposed treatment areas are within the analysis area.

Roughly one-third of the analysis area is comprised of private lands (Figure 37). These lands consist of both residential areas, and undeveloped conservation lands, including the Mount Jumbo area that is popular with Missoula area hikers. These lower portions of the analysis area contain little to no NFS land, and the majority of habitat for wildlife occurs in the riparian areas along Rattlesnake Creek, or on the open hillsides on the larger tracts of open, grassland habitat, which support species such as western Meadowlarks and other grassland birds, as well as providing forage for wintering deer and elk.

The northern two-thirds of the analysis area is NFS land, much of which is designated National Recreation Area or Wilderness (Figure 37). Within these areas, a variety of habitat types exist (Table 23). Lower elevations along Rattlesnake and Marshall Creeks provide habitat for riparian-associated species. South-facing slopes generally provide open, dry grass/shrublands interspersed with open, dry forest types where ponderosa pine and Douglas-fir are dominant. In some areas, these warmer aspects provide scattered large diameter trees with grassy understories, providing habitat for species such as flammulated owls, pileated woodpecker, elk, mule deer, and others. Cooler aspects are also often dominated by Douglas-fir or ponderosa pine, with lodgepole pine intermixed, and shrub understories (ninebark, snowberry, huckleberry). These areas provide habitat for a number of birds and mammals, including grouse, black bear, and summer habitats for deer and elk. The high elevation areas at the heads of the Rattlesnake and Marshall Creek watersheds support subalpine fir, lodgepole, and Englemann spruce forests which provide summer habitat for big game and year-round habitat for multiple species including snowshoe and lynx.

In addition to providing a variety of vegetation types, the analysis area provides structural diversity, with approximately one-quarter of the area non-forested (i.e., grassland or shrubland), one-quarter in early successional forest (0-9.9" dbh), one-half in mid-to-late successional forest (10+ dbh Table 24). Canopy cover varies throughout the analysis area (Table 24). Nearly half of the analysis area is covered by relatively dense forest (>=40% canopy cover), which provides habitat for species that prefer more closed-canopy forests for portions of their life-cycles (i.e., goshawks). Over one-third of the analysis area consists of drier forest types (ponderosa pine/Douglas-fir), which under natural fire regimes would have moderate canopy cover. Given that many of these stands currently have dense canopies, they do not currently provide optimal habitat for wildlife species that evolved to live in these forest types (i.e., flammulated owls). The proposed action attempts to address this issue in a portion of the analysis area.

Figure 37. Analysis area (28,514 acres) used for description of existing conditions for wildlife and evaluation of effects to wildlife of the proposed management activities associated with the Marshall Woods Restoration Project. The area is comprised of the entire Middle Rattlesnake watershed (6th code HUC) and the Marshall Creek portion of the Clark Fork River—Marshall Creek watershed (6th Code HUC).

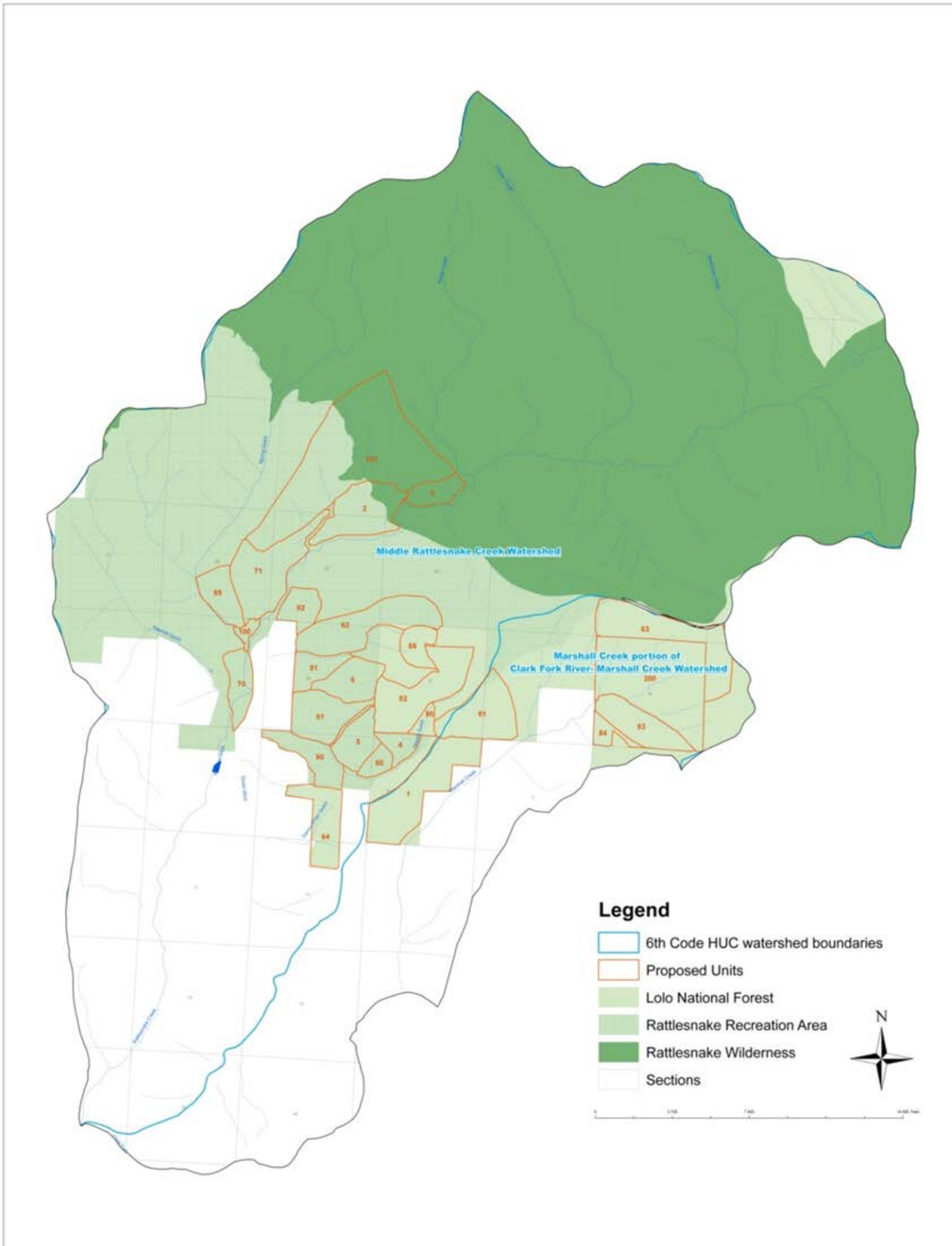


Table 23. Vegetation types in the wildlife analysis area for the Marshall Woods Restoration Project, including vegetation dominance-based habitat types and dominant tree size classes. Data are based on the R1VMap dataset (2009) and cover all lands in the analysis area.

Habitat Type Description	0-4.9" dbh	5-9.9" dbh	10+"dbh	Non-forested	Total
wet, cool sites at mid- to higher-elevations (subalpine fir/Englemann spruce-dominated stands)	79	379	806		1,264
lodgepole-dominated sites	130	1,375	1,593		3,097
larch-dominated sites	1	86	173		259
more shade-tolerant, wet or dry Douglas-fir sites	12	9	16		37
lower elevation, dry, warm sites (ponderosa pine/ dry Douglas-fir-dominated sites)	1,929	2,894	10,881		15,704
grasslands				3,499	3,499
shrublands				4,555	4,555
sparsely or non-vegetated sites (rock or water)				88	88
	2,151 (7.5%)	4,754 (16.7%)	13,468 (47.2%)	8,141 (28.6%)	28,514

Table 24. Structural diversity of forested areas in the wildlife analysis area for the Marshall Woods Restoration Project. Data are based on the R1VMap dataset (2009), and cover all lands in the analysis area.

Canopy Cover	10-24.9% Canopy	25-39.9% Canopy	40-59.9% Canopy	>= 60% Canopy	Non-forested (<10% Canopy)	Total
0-4.9" dbh	194	1,209	742	5	n/a	2,151
5-9.9" dbh	111	727	3,211	705	n/a	4,754
10+" dbh	873	4,475	6,552	1,569	n/a	13,468
Non-forested (grass, shrub, rock, water)	n/a	n/a	n/a	n/a	8,142	8,142
Total	1,178 (4.1%)	6,411 (22.5%)	10,504 (36.8%)	2,280 (8.0%)	8,142 (28.6%)	28,515

Past vegetation management activities in the analysis area have been minimal since the 1980s when most of the area came into the NFS (Table 25). Detailed information of treatment types and acres treated by individual project are available for review in the Project File and discussed in detail in the Forested Vegetation Specialist's Report. In the past 30 years, vegetation treatments have influenced less than 3% of the analysis area (783 acres harvested in 1980s and 201 acres in 2001), and wildfire has affected less than 3% (Table 26). Thus, in the past several decades, disturbance has been minimal in the analysis area, and many of the stands in the drier habitats that typically received non-lethal fires at 5-50 year intervals are grown in with dense seedling/sapling thickets that reduce the nesting and foraging potential for open forest associates, particularly flammulated owls. The project intends to address the lack of disturbance and to restore fire to the forest.

Much of the analysis area did receive major disturbance in the early 1900s, with a large wildfire that burned 12,834 acres in the middle and upper portions of the analysis area. In addition, historical harvesting occurred in much of the forest in the main Rattlesnake corridor, thus resulting in the second-growth forest that exists there today. As a result of these past activities, old growth in the analysis area is scarce to non-existent. No old growth stands (meeting the definition by Green et al. 1992) are proposed for treatment (see Forested Vegetation Specialist's Report), and the project is designed, in part, to promote the growth of many of the treated stands into stands that feature large diameter, older trees. Remnant old trees and snags (>21" dbh) are scattered throughout mature stands in the analysis area (see Forested Vegetation Specialist's Report).

All of the action alternatives (B, C, and D) would change the habitat diversity in the project area and thus in the analysis area to some extent. Details are presented in the Forested Vegetation Specialist's Report and discussed further in this report in regard to specific habitat needs for TES, Sensitive, and MIS species. None of the action alternatives are expected to have major negative impacts to habitat diversity for wildlife species. The no-action alternative (Alternative A) would likewise have no major impact to wildlife in the short-term. However, in the long term wildlife diversity could be decreased due to the lack of disturbance, resulting in decreased habitat and forest resilience to disturbance.

Table 25. Harvest history within the Marshall Woods project area and the wildlife analysis area since 1980.

Harvest by Decade	In project area (% of total project area)	In wildlife analysis area (% of total analysis area)
1980	**783**	**783**
Sanitation Harvest (salvage)	*751*	*751*
Shelterwood Establishment Cut (with or without leave trees) (EA/RH/NFH)	*32*	*32*
2000	**0**	**201**
Improvement Cut	*0*	*201*
Grand Total	783 (6%)	984 (3%)

Table 26. Acres of wildfire in the Marshall Woods analysis area in the past 3 decades (since 1980). The largest historical wildfire in the area occurred in 1919, burning roughly 12,000 acres.

Fire Name	Year	Acres (% of total analysis area)
Sawmill Gulch	1987	104
Strawberry	1982	28
Mineral-Primm	2003	566
West Riverside	2011	13
TOTAL		711 (2%)

Road densities are relatively high on the private lands in the southern part of the analysis area, and are non-existent in the Wilderness area in the northern part of the analysis area (Figure 40). Roads on NFS land in the middle to northern part of the analysis area occur at low densities. On NFS lands in the analysis area, there are currently 33.648 linear miles of roads, of which 33.387 miles have restricted access for motorized use (seasonal closures= 0.194 miles; year-round closures= 33.193 miles).

Human presence in the analysis area also diminishes along the south-north gradient. Suburban residential use and associated activities occur in the southern part of the analysis area, moderate to heavy recreational use by hikers, mountain bikers, and others occurs in the central analysis area (particularly in the project area), and limited non-motorized human use occurs in northern reaches of the analysis area that are within the Rattlesnake Wilderness Area (see Recreation Specialist's Report for more details).

THREATENED, ENDANGERED, PROPOSED SPECIES – EXISTING CONDITION

YELLOW-BILLED CUCKOO (THREATENED)

This species was listed as a Threatened species by the USFWS on Nov 3, 2014. On the Lolo NF, there was one older observation on the south side of Missoula County several years ago (MTFWP 2010, Montana Field Guide, http://fieldguide.mt.gov/default.aspx). The most current range distribution map for the species in Montana depicts summer habitat only located in riparian areas in prairie ecosystems east of the Continental Divide. No evidence of breeding has been noted on the Lolo NF. The western yellow-billed cuckoo currently nests almost exclusively in low to moderate elevation riparian woodlands that cover 50 acres or more within arid to semiarid landscapes (cited in the Listing Proposal, USFWS 2013). At the landscape level, the amount of cottonwood-willow-dominated vegetation cover and the width of riparian habitat influences western yellow-billed cuckoo distribution and abundance (ibid).

Within the Marshall Woods project area, there are no large patches of cottonwood and willow riparian vegetation that are 25 acres in size or larger. Therefore, the project would have "No Effect" on the yellow-billed cuckoo.

CANADA LYNX (THREATENED)

The Marshall Woods project was designed to primarily address restoration of drier forest stands that would not typically be considered habitat for lynx. The majority of the Project Area occurs outside of Lynx Analysis Units (LAU) and lynx Critical Habitat, and is at lower elevations than what lynx in western Montana are known to use (Squires et al. 2010). However, a small portion of the project area does occur within Lynx Critical Habitat and an LAU, and in these areas, the project was designed to avoid lynx habitat (Figure 38). Details regarding lynx habitat in the project area, and project effects to lynx, lynx habitat, and lynx Critical Habitat are detailed below.

Throughout the lynx analysis, multiple terms will be used in reference to lynx habitat. The following definitions are intended to clarify the terms:

"Lynx habitat" is used as defined in the NRLMD, and refers to mesic coniferous forests primarily dominated by subalpine fir, Engelmann spruce, and lodgepole pine. Types of lynx habitat (e.g., stand initiation, mature multi-story, etc.) are used as defined by the NRLMD and identified using methods described in the Lolo NF lynx habitat mapping effort (USDA FS 2010).

Lynx Critical Habitat, or Critical Habitat refers to the USFWS designated Critical Habitat for lynx, as defined and displayed in 50 CFR Part 17, Volume 74 (No. 36), Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; CHFR09. The designated Critical Habitat area in Montana is a broad-brush polygon that delineates the area considered Critical Habitat for lynx. Within Critical Habitat, there are two main types of habitat:

1. 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.

2. Boreal forest. The predominant vegetation of boreal forest is conifer trees, primarily species of spruce and fir (Ibid, page 8616). Boreal forest can occur in multiple structural stages.

Within the Marshall Woods project area, the portion of the project area that is within the Critical Habitat polygon is also within Lynx Analysis Units (LAUs). Therefore, "lynx habitat" is synonymous with "boreal forest," and all other areas within the Critical Habitat or LAU that are not boreal forest or lynx habitat are thus "matrix."

Lynx Status on The Lolo NF And Marshall Woods Project Area

Intensive winter snowtrack surveys conducted by the Rocky Mountain Research Station across western Montana, indicate that lynx are uncommon to absent in many parts of this region with the Yaak and Clearwater Valley near Seeley Lake being primary strongholds for lynx in northwest Montana (Squires et al. 2006).

In 2007, the FWS, classified the Lolo (along with numerous other Forests) as occupied/core lynx habitat because of strong recent and long-term evidence of lynx reproduction (USDA-FS 2007). In 2009, the FWS designated lynx critical habitat (74 FR 8616-8702, hereafter referenced as USFWS (2009), discussed below).

A portion of the Lolo (including the Seeley Lake Ranger District and the northern end of the Missoula Ranger District) is located in designated Critical Habitat Unit 3. About one-quarter of the Marshall Woods project area (3,106 acres) falls within the Gold Creek LAU, and also in Critical Habitat. The remainder of the Marshall Woods project area is outside of an LAU, outside of Critical Habitat, and has no mapped lynx habitat within it. The project area primarily occurs within the Gold LAU (41,331 acres in size; see Figure 38); because the project area also extends into the Rattlesnake LAU to a small extent, the two LAUs are used as the analysis area for lynx assessment. Using the two LAUs as the analysis area is appropriate because: 1) all of the proposed actions that could affect lynx habitat fall within the LAUs, 2) the LAU represents the size of a home range of a female lynx, 3) maintaining habitat at the scale of a home range allows for good distribution of lynx habitat components, and 4) expanding the analysis beyond the scale of an LAU could dilute the effects analysis.

Because the adjacent LAUs on the Missoula and Seeley Lake Ranger District have adequate lynx habitat, and other Forest Service projects that are occurring, or are planned to occur in adjacent LAUs meet the same stringent standards of the NRLMD, there is no reason to look beyond the boundaries of the Gold LAU and Rattlesnake LAUs when assessing the project's effects on lynx.

Forest-wide surveys for carnivores conducted on and by the Lolo NF from 2007 to present have documented lynx on only one of five Ranger Districts, that being Seeley Lake (data in Project File).

Lynx use of the project area is sporadic at most, with no evidence of persistent occupation by lynx. Use of the area was documented in the summer of 2006. During the summer of 2006, a juvenile male lynx, originally trapped a few miles NW of Seeley Lake and fitted with a GPS collar, traveled through the project area on what appeared to be an exploratory movement (John Squires, Rocky Mountain Research Station, personal communication). This is the only documented case of lynx use of the project area. No lynx tracks were observed while doing walk-through surveys of proposed units in February and March of 2011, nor when doing intensive vegetation examination during ideal snow tracking conditions in the most likely areas to provide lynx habitat. Systematic track surveys (following the Squires et al. 2004 protocol) were not conducted in this area.

Lynx Habitat in Project Area & in Lynx Analysis Units

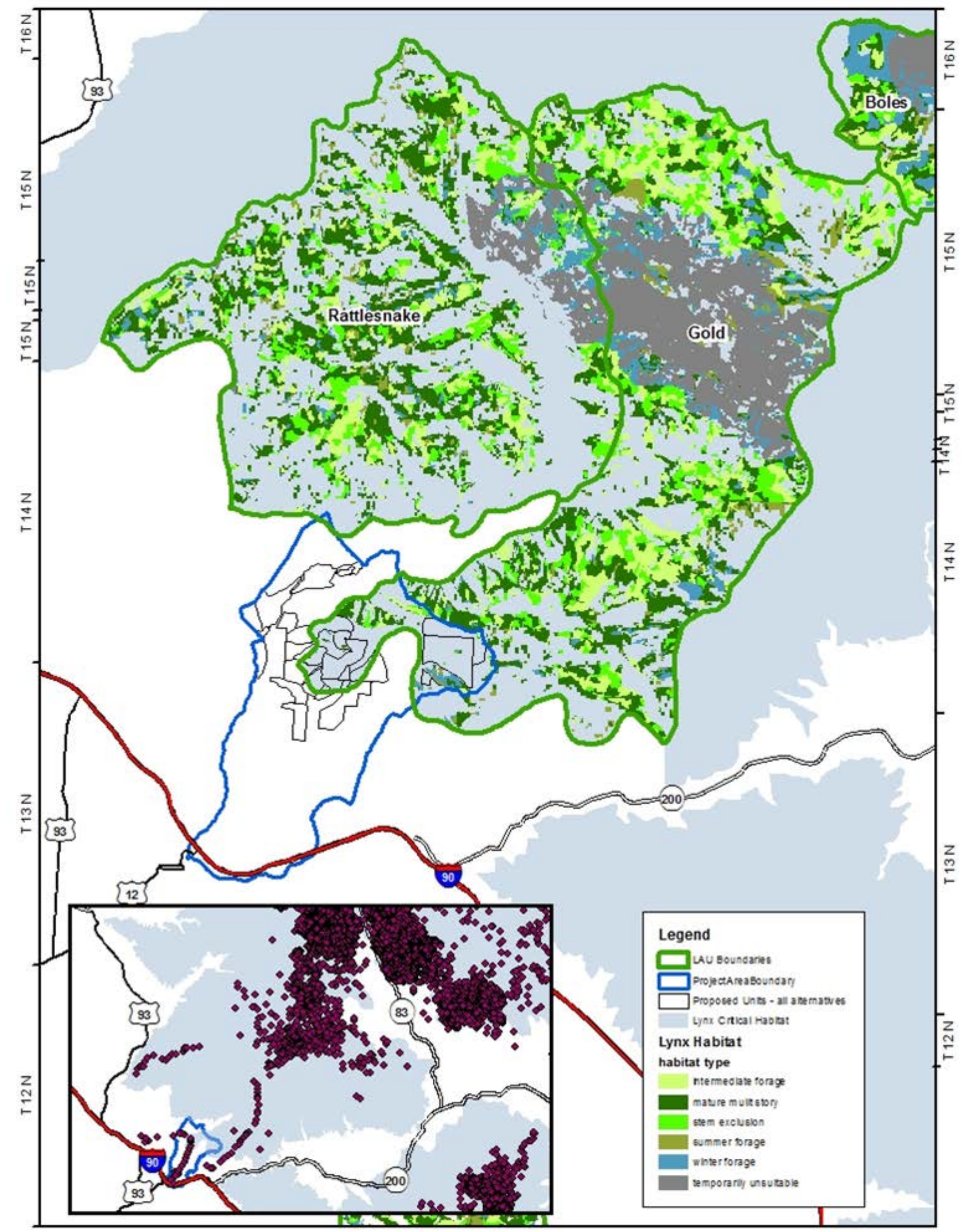
Much of the Marshall Woods project area falls outside of a Lynx Analysis Unit (LAU), is below the 4,100’ elevation range below which lynx are typically not found in western Montana (Squires et al. 2010), and is comprised of drier forest types (e.g., those that are dominated by ponderosa pine and fall into the low severity/high frequency fire regimes). These portions of the project area, which fall outside of the LAU and do not provide habitat for lynx, were not further considered in lynx effects analysis.

There is less than 613 acres of lynx habitat in the project area (Table 27). Reasons for habitat limitations are mostly due to the dry forest types that dominate the project area, as well as the low elevations and south-facing slopes. Table 27 below displays the acres of lynx habitat within the LAUs.

Table 27. Lynx habitat in the Gold Creek & Rattlesnake LAUs (both of which are fully within Lynx Critical Habitat), as well as lynx habitat within the Marshall Woods Project Area. Calculations include all ownerships.

Lynx Habitat Type	Gold LAU		Rattlesnake LAU		Marshall Woods Project Area	In Proposed Units	Boreal Forest	Lynx Denning	Lynx Travel Habitat
	Acres	%	Acres	%	Acres	Acres			
Temporarily Unsuitable-- has had recent (within 10 years) moderate or high intensity fire or stand regenerating treatment (e.g., clearcut, seed tree, shelterwood). Not currently habitat for lynx or hares.	6,808	16%	1,712	4%	0	0	yes	may provide denning	yes
Early Stand Initiation/Summer Forage-- 10-15 years post-fire or stand initiation treatment; limbs do not protrude above snow in winter. Provides foraging habitat for lynx in summer months	1,155	3%	824	2%	27	0	yes	may provide denning	yes
Late Stand Initiation/Winter Forage-- 15-45 years post-fire or stand initiation treatment; 1000s of stems per acre - high horizontal cover. Provides winter & summer habitat for hares; high quality forage for lynx, used more in summer.	1,985	5%	1,120	3%	93	0	yes	may provide denning	yes
Stem Exclusion-- single story, high canopy cover, limited understory and dead/down material limited. Not foraging habitat for lynx.	4,856	12%	3,044	8%	68	0	yes	generally non-denning	yes
Intermediate Forage-- young forest multistoried or understory re-initiation. May or may not provide lynx forage, depending on understory.	3,474	8%	2,816	7%	91	0	yes	may provide denning	yes
Mature Multi-Story-- overstory mature and understory dense from canopy layering; large woody debris component. Provides high quality foraging and denning habitat for lynx.	6,177	15%	7,771	20%	239	0	yes	high quality denning	yes
Total Boreal Forest in LAU	24,455	59%	17,287	45%	613	0	yes		
Matrix – no potential to grow into lynx foraging habitat – may include grass/forb/shrub openings; ponderosa-pine, Douglas-fir, mixed conifer on south aspects	16,834	41%	21,126	55%	2,516	1,527	no	non-denning	yes
Total Acres Inside LAU Boundary	41,289		38,413		3,129				

Figure 38. Lynx habitat in the Rattlesnake and Gold LAUs. Photo inset depicts GPS/VHF locations for lynx (from J. Squires, RMRS, 1998-2008).



Lynx habitat comprises 59% of the Gold Creek LAU and 45% of the Rattlesnake LAU, with non-lynx habitat (i.e., dry forest or non-forest) comprising the remainder. A wildfire in the Gold LAU in 2003 rendered 28% of the lynx habitat temporarily unsuitable. This area is beginning to regenerate, however, and turn into early stand initiation stage, which can provide habitat for snowshoe hares (and thus foraging habitat for lynx) in the summer when not covered in snow. In the Rattlesnake LAU, only 10% of lynx habitat is temporarily unsuitable. Mature multi-story habitat comprises 25%

and 45% of the Gold and Rattlesnake LAUs, respectively, and late stand initiation (which provides high quality forage for lynx) comprises 8% and 6%, respectively.

Past activities that have created temporarily unsuitable lynx habitat in the Gold Creek LAU include primarily; the Mineral-Primm fire that occurred in 2003, as well as timber harvesting on private timber lands in the LAU (Plum Creek lands currently comprise 9,566 acres or 23% of the LAU, and another 2,414 acres (6% of LAU) are former Plum Creek lands that are now NFS lands via the Montana Legacy Project). Vegetation management on NFS lands in the Gold LAU in the past several decades has consisted of a total of <400 acres of stand initiation harvests, all of which occurred between 1986 and 1997.

The Rattlesnake LAU is almost entirely NFS lands, with <1% private land. The majority of the LAU lies within the Rattlesnake Wilderness Area, and thus timber harvest has not been a factor influencing lynx habitat in this LAU in the past. Wildfires have been minimal, as have prescribed fires, rendering a mere 10% of the lynx habitat in the LAU as temporarily unsuitable. Montana Snowbowl ski area is within the Rattlesnake LAU, and has contributed to snow compaction on 1,228 acres of the LAU, with 451 of those acres in lynx habitat. An expansion to the Snowbowl ski area was recently approved (Montana Snowbowl Expansion ROD; USDA FS 2014), and will result in an additional 59 acres of lynx habitat (and 189 acres of non-lynx habitat/matrix habitat) being converted to unsuitable habitat. Thus the ski area expansion will impact roughly 6% of the total LAU, not all of which is lynx habitat.

Habitat connectivity is defined in the LCAS (Interagency Lynx Biology Team 2013) as cover (vegetation) in sufficient quantity and arrangement to facilitate lynx movements. Connectivity may also be affected by high-speed, high-volume highways (Interagency Lynx Biology Team 2013). Connectivity within and between the Gold and Rattlesnake LAUs is good, as the majority of these LAUs contain forested cover (Table 24), and neither include high-volume highways or developments (with the exception of the Montana Snowbowl ski area at the edge of the Rattlesnake LAU). Connectivity to other LAUs to the north and east is good, but connectivity to the south and southwest is hindered by naturally non-forested areas (e.g., open grassy hillsides of Mount Jumbo, and the town of Missoula), as well as the 4-lane Interstate (I-90). There are no identified linkage areas in or near the project area. However, the western portion of the Rattlesnake LAU provides linkage to the Ninemile area, and the eastern portion of the Gold LAU provides linkage to the Garnet Range (see Linkage map in Project File). None of the putative corridors identified by Squires et al. (2013) for connecting U.S. lynx populations to Canadian populations are impacted by the Marshall Woods project.

Environmental Consequences to Lynx & Lynx Habitat

*** Reminder: In this portion of the effects analysis, the term "lynx habitat" is used as defined in the NRLMD, and refers to mesic coniferous forests primarily dominated by subalpine fir, Engelmann spruce, and lodgepole pine. Types of lynx habitat (e.g., stand initiation, mature multi-story, etc.) are used as defined by the NRLMD and identified using methods described in the Lolo NF lynx habitat mapping effort (USDA FS 2010).*

This analysis addresses all of the project activities that could affect lynx or lynx habitat, as defined in the NRLMD. Direct and indirect effects were assessed in light of proposed activities that could affect lynx or lynx habitat including vegetation treatments (thinning, burning, reforestation), as well as transportation activities (temporary road building, road maintenance, timber hauling), and any recreational or human use that could result from activities directly related to this project that may result in snow compaction.

Cumulative effects to lynx and lynx habitat were assessed in regards to the existing condition (which results from past and present activities), as well as any reasonably foreseeable actions on both federal and non-federal lands in the Gold and Rattlesnake LAUs that could alter vegetation, habitat, connectivity, transportation, or snow compaction (in terms of standards and guidelines of the NRLMD).

See further analysis, in separate section below, on effects to Lynx Critical Habitat.

Alternative A - No Action Alternative

Direct & Indirect Effects to Lynx

The no action alternative is not expected to cause any measurable direct or indirect effects to lynx or lynx habitat; therefore, cumulative effects are not expected. As such, Alternative A would have No Effect on lynx or lynx habitat.

Currently 28% and 10% of the lynx habitat in the Gold and Ratttlesnake LAUs is in a temporarily unsuitable state, respectively. As such the LAUs currently meet Standard Veg S1 and S2 and are expected to continue to meet those standards unless a large fire occurs on the landscape. Other management activities will continue as described in the cumulative effects section for Alternatives B, C, and D below.

No additional road decommissioning or storage would occur with this alternative, and the no-action could result in a greater chance for stand-replacing fires to occur in the project area, as fuel loads and ladder fuels are currently very high in some of the drier forest stands. Such a wildfire could potentially spread into boreal forest types within the Project Area or the LAU and cause stand-replacing fires which would result in temporarily unsuitable lynx habitat conditions for a period or 10 or more years.

Cumulative Effects to Lynx

See cumulative effects discussion below for information on past, present, and reasonably foreseeable actions that could affect Canada lynx. Because the no action alternative would not affect lynx, there would be no additional cumulative effects under this alternative.

Alternatives B, C, And D

Direct & Indirect Effects to Lynx

VEGETATION MANAGEMENT

1. The Project is Not Directly Treating Any Lynx Habitat.

   a. Roughly two-thirds of the acres to be treated under any alternative are located outside of the LAU boundaries, and the remainder of the units that fall within the LAUs intentionally avoid stands that contain lynx habitat. Due to the warm, dry habitat types and predominately southerly exposures, the majority of the project area does not provide suitable lynx habitat, and does not have the potential to become suitable lynx habitat in the future. The warm, dry forest types do not support subalpine fir or Engelmann spruce trees that grow in thousands of stems per acre in the stand initiation stage, nor do subalpine fir and spruce trees dominate in the older, more mature age classes. These stands do not provide quality lynx habitat in any successional stage.

   b. Although many of the units that are proposed for thinning treatments (either commercial or non-commercial) currently have relatively dense understories or a multi-storied nature, these descriptions are relative for those dry forest types. None of the units provide mesic spruce/fir habitat types that would make them suitable lynx habitat now or in the future.

c. As such, the activities planned under any of the action alternatives do not run counter to objectives, standards, or guidelines found in the NRLMD. The action alternatives propose to mimic ecological process and to restore management-ignited fire to a landscape which has been affected by years of fire suppression. Implementation of any of the action alternatives would avoid thinning any lynx habitat within the Gold or Rattlesnake LAUs.

2. The Project meets all vegetation standards and guidelines within the NRLMD.

a. Since the project would not regenerate any lynx habitat, there would be no changes from the current condition in terms of Standards Veg S1 and Veg S2.

b. Standard Veg S5 addresses precommercial thinning projects that reduce winter snowshoe hare habitat in regenerating (or stand initiation) units. Units mapped as lynx habitat in the stand initiation phase within the Marshall Woods project area were not included for treatment under any of the alternatives, and thus the project meets Veg S5.

c. Standard Veg S6 would also be met, as no treatment is proposed in stands that provide winter snowshoe hare habitat in multi-story mature or late successional forests. As stated before, no treatments will occur in spruce-fir forests.

3. The vegetation treatments would ensure forested connectivity between LAUs and in linkage areas.

a. Treatments would decrease understory density in units that are not lynx habitat. This could slightly affect the utility of these areas as travel or matrix habitat for lynx moving in between areas of suitable habitat. However, all treatment units in the project, with the exception of Units 100A&B (which are currently meadows with conifer encroachment) would retain forested cover, and riparian areas would continue to provide corridors of dense vegetation, providing ample travel habitat for lynx.

ROAD TREATMENTS AND TRAILS

1. Project would not increase, and would slightly decrease, fragmentation due to roads.

a. No new permanent road construction is proposed under any alternative, and the approximately one mile of temporary new road associated with Alternatives B and C would be reclaimed upon project completion. In addition, unneeded roads, especially in newly acquired sections (former Plum Creek Timber Company lands) within the project area would be decommissioned, leading to a net decrease in miles of NFS roads within the project area. The decrease in roads would allow for the re-growth of forest on the decommissioned roadbeds, and thus increase connectivity of forested habitats and provide for slightly less fragmentation than under the existing condition.

2. Project would not create substantial disturbance or snow compaction due to motorized traffic or non-motorized recreational use of roads and trails.

a. No changes in motorized access, nor other activities that could cause snow compaction, are proposed under any of the alternatives. Non-motorized recreation will continue, including a moderate amount of hiking and cross-country skiing in the winter, which can compact snow. The only groomed ski trails in the project area are along the main Rattlesnake Trail, which is outside of the LAU.

3. The project meets all of the objectives and guidelines regarding roads, trails, and snow compaction in the NRLMD.

   a. Objectives HU 01 strives to maintain lynx's competitive advantage over other predators in deep snow by discouraging expansion of snow-compacting activities in lynx habitat. This project would decommission roads and reclaim user-created trails. The remainder of the Human Use objectives do not apply to this project.

      Guidelines HU G8 and HU G9 apply to this project. G8 addresses cutting brush along low-speed, low-traffic roads. None of the roads used for hauling or other project activities bisect quality lynx habitat. Even so, the Forest will use brushing to the minimum level necessary to provide for safe operations. G9 addresses new roads built for projects, and says that effective closures should be provided, and when the project is over, roads should be reclaimed or decommissioned if not needed. The short stretches of temporary road (about 1 mile total) that would be built for this project under Alternatives B and C (but not D) would not bisect lynx habitat, nor allow access into or near lynx habitat. Resource protection measures and project design would provide for their closure to the motorized public during project implementation, and their use by non-motorized public would be discouraged. The roads would be fully reclaimed once the project implementation is complete.

Cumulative Effects to Lynx

Cumulative effects to lynx were analyzed in regards to the potential direct and indirect effects of the project, following guidelines from the Council on Environmental Quality (see Project File) that direct the Forest Service to focus on the potential impacts of the proposed action and only review past actions to the extent that they are relevant and useful in analyzing whether they may have continuing, additive and significant relationship to the effects of the proposed action. To that end, cumulative effects to lynx considered past, present, and reasonably foreseeable vegetation alterations (natural or manmade) and roads/trails and access, and the effects these have and will have on lynx, combined with the proposed project actions.

The two LAUs (Gold and Rattlesnake) were used as the analysis area for lynx cumulative effects assessment. The LAUs are appropriate because: 1) all of the proposed actions that could affect lynx habitat fall within these LAUs, 2) the LAU represents the size of a home range of a female lynx, 3) maintaining habitat at the scale of a home range allows for good distribution of lynx habitat components, and 4) expanding the analysis beyond the scale of an LAU could dilute the effects analysis.

The current condition of the Gold and Rattlesnake LAU, described above, is a reflection of the past activities that have influenced lynx habitat. Vegetation types which are or could become lynx habitat (aka "Boreal Forest") comprise 59% and 45% of the Gold and Rattlesnake LAUs, respectively, with the remainder of those LAUs being dry forest types, rock, or other habitat types that do not constitute lynx habitat, regardless of successional/structural stage.

Activities that have occurred on NFS lands within the LAUs in the past 30 years that have changed the vegetation structure are detailed in Table 28. It should be noted that these activities have occurred on both the boreal and non-boreal habitats within the LAUs. The Forest Service does not have specific data on activities on non-NFS lands, particularly on Plum Creek Timber Company lands in the Gold LAU (9,565 acres or 23% of the LAU). However, the effects of any such activities on lynx habitat vegetation have been captured in the Lolo NF Lynx Habitat Model (USDA FS 2010), which assesses existing habitat on all ownerships. Thus the current lynx habitat assessment displayed in Table 27 above reflects past actions on all ownerships.

Table 28. Past vegetation management activities on NFS lands in the Gold and Rattlesnake LAUs that have affected the structural stage of forest stands in the past 30 years (1984-2014).

LAU	Year	Prescribed Fire	Wildfire	Insect Mortality	Regeneration Harvest	Total
Gold	1986				176	176
	1987				137	137
	1990	50				50
	1995	25				25
	1997			251	82	333
	2003		4,468			4,468
	2013		171			171
	All	**76**	**4,640**	**251**	**394**	**5,361**
Rattlesnake	1987				4	4
	1992				6	6
	1993				94	94
	1996	16				16
	1997	1,197				1,197
	1999				63	63
	2000				98	98
	2003		5,324			5,324
	2009				86	86
	All	**1,213**	**5,324**		**351**	**6,889**

In short, vegetation management on NFS lands within the Gold and Rattlesnake LAUs has been minimal over the past 30 years, with wildfires playing a larger role in changing vegetation structure than other activities. The lack of vegetation management is due in large part to the fact that the majority of the Rattlesnake LAU, and some of the Gold LAU, are in the Rattlesnake Wilderness or National Recreation Area.

Lynx habitat within the two LAUs is a mosaic of habitat types for lynx. Much of the lynx habitat on Plum Creek Timber Company lands in the LAU (roughly 1/3 of the LAU) has been regenerated in recent decades, and is currently providing "summer foraging" habitat for lynx. On the remaining 2/3s of the Gold LAU that are NFS lands, lynx habitat is a mix of mature multi-story and intermediate forage, primarily, with some winter and summer forage mixed in. Within the Rattlesnake LAU, the percentage of mature multi-story habitat (which is most important for lynx in winter; Squires et al. 2010), is more abundant, comprising nearly half of the LAU (Table 27). Denning habitat is abundant, especially in portions of the LAUs that lie within the Rattlesnake Wilderness and National Recreation Areas (approximately half of the LAU), as these areas have not experienced timber harvesting or other activities that would remove coarse woody debris.

Aside from the Marshall Woods restoration project, no additional vegetation management projects are proposed within the foreseeable future in the Gold LAU. The Rattlesnake LAU will be slightly affected by the Montana Snowbowl Ski Area expansion, which will permanently remove 49 acres of lynx habitat from the LAU (see Montana Snowbowl Expansion FEIS Wildlife section, Project File). The ski area in total affects 6% of the LAU, with the majority of the remainder in Wilderness. The <100 acres of ecosystem management burning in the Rattlesnake LAU that would occur is in non-lynx habitat. Likewise in the Gold LAU, the proposed treatments under any action alternative of the Marshall Woods project would have inconsequential impacts to lynx habitat in the LAUs, and no future vegetation management activities are projected to occur on NFS lands in either LAU.

Approximately 3/4 of the Rattlesnake LAU and 1/3 of the Gold LAU is unroaded, due to its inclusion in the Rattlesnake Wilderness and National Recreation Areas, and no new permanent roads are expected to be built within the LAUs in the foreseeable future. Thus the effects of the roughly one mile of temporary roads that would be constructed with Alternatives B or C would represent a negligible contribution to fragmentation due to roads in the LAUs.

The proposed project would not permanently increase snowmobile use or other snow compacting activities within the project area or the LAU, as no new trails or over-the-snow motorized routes would be constructed. Plowing of haul routes associated with Alternatives B or C could add to existing snow compaction within the Gold LAU. This would be additive to existing snow compacting activities in the LAUs, which in the Rattlesnake LAU primarily consists of the ski runs at Snowbowl, and in the Gold LAU consists of snowmobile routes in the Gold Creek drainage. Also within Gold LAU there is winter recreational use by hikers and skiers. This use is mostly concentrated within the first few miles of trailheads (which are outside of the LAU) although the main road/trail (Road 99/Trail 515) is groomed for cross-country skiing up to Pilcher Creek (roughly 5 miles up from the main Rattlesnake Trailhead, which does extend slightly into the Gold LAU; (see Challenge Cost Share agreement, Project File). It has been hypothesized that snow compaction from winter recreation may alter carnivore community structure (chapter 14 in Ruggiero et al. 1999), but recent science shows that this may have been overemphasized (Kolbe et al. 2007). Thus any snow compaction associated with the Marshall Woods project would be minimal, and would have minimal cumulative effects to the existing low amount of compaction in the LAUs. No additional snow compacting activities are foreseeable within the LAUs.

To summarize, the existing condition of the LAUs reflects the past activities that have affected lynx habitat in the LAUs. Because the proposed actions would not treat any lynx habitat within the LAUs, because snow compaction associated with the project would be minimal, and because no new permanent roads or developments would be constructed with the project, there would be minimal cumulative impacts to lynx within the LAUs.

Determination/Summary of Effects to Lynx

For any action alternative (B, C, or D), the Marshall Woods Project “**May Affect, but is Not Likely to Adversely Affect” (NLAA**) lynx or lynx habitat. This rationale is based on:

- The Marshall Woods project is designed within the NRLMD standards and guidelines providing habitat to support a viable population of lynx in the Northern Rockies by maintaining the current distribution of lynx habitat, and by maintaining the quality of the existing lynx habitat in the project area.

- The project provides for population viability[14] because it complies with the standards of the NRLMD.
- All Standards and Guidelines within the NRLMD would continue to be met both at the LAU scale and Forest-Wide (See Wildlife Specialist's Report Appendix A).
- The analyzed effects of the various management activities associated within the Marshall Woods Restoration Project are consistent with those anticipated in the programmatic biological consultation (Programmatic Biological Opinion for the effects of the NRLMD on the Canada Lynx 2007). All exemptions and exceptions within the NRLMD would be met (see discussion for Cumulative Effects, Standards VEG S1 and S2); no WUI exemptions would be used for this project.
- Connectivity between patches of lynx habitat within the LAUs would be maintained, as well as connectivity between the LAUs. The project is not within an identified linkage area for lynx.
- The project would not treat any forest stands that currently or potentially provide habitat for lynx; restoration treatments target drier ponderosa pine and larch-dominated stands that do not provide lynx habitat in any successional or structural stage.
- Snow compacting activities associated with this project would be minimal, mostly associated with potentially plowing roads if winter harvest is done (in Alt. B and C only), and occur only in non-lynx habitat.
- The project would not increase fragmentation by adding any permanent developments, roads, or treatments that would permanently convert current forested areas into non-forested areas. The project would involve decommissioning roughly 7 miles of road within a Lynx Analysis Unit.

Lynx Critical Habitat – Existing Condition

The following analysis displays effects of project alternatives on Canada lynx critical habitat. In the Marshall Woods project area, the Critical Habitat polygon follows the LAU polygons exactly (Figure 38, and see also larger Critical Habitat map in PF). Thus, Critical Habitat condition and effects were assessed using the same analysis area as for lynx and lynx habitat above, which is at the scale of the two LAUs affected by this project—the Gold and Rattlesnake LAUs. The portions of the project area that are within the Gold and Rattlesnake LAUs are thus also in designated Critical Habitat for lynx (3,129 acres of the total project area). The remainder of the project area is outside of Critical Habitat, and will not be discussed further in terms of effects to Critical Habitat.

Indicators and measures used to assess impacts to Canada lynx Critical Habitat are based on effects to the specific biological and physical features, otherwise known as the Primary Constituent Elements (PCE), which are essential to the conservation of the lynx. The PCE and its four sub-

[14] NLRMD p. 40 - A viable population is "one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well-distributed in the planning area." For the purpose of this decision, the planning area is the range of lynx encompassed by the National Forests subject to this decision. This is based on a biological delineation of the Northern Rockies made in the LCAS. The National Forests subject to this direction will provide habitat to maintain a viable population of lynx in the Northern Rockies by maintaining the current distribution of occupied lynx habitat, and maintaining or enhancing the quality of that habitat. Based on the best scientific information available, and for the specific reasons provided below, this management direction will provide habitat to support persistence of lynx in the Northern Rockies in the long-term. CHFR09, p. 8644.

elements are outlined in the CHFR09 [50 CFR Part 17, Volume 74 (No. 36), 2009, p. 8638] and are as follows:

Boreal [15] forest landscapes supporting a mosaic of differing successional forest stages and containing:

a) snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multistoried stands with conifer boughs touching the snow surface;

b) winter snow conditions that are generally deep and fluffy for extended periods of time;

c) sites for denning that have abundant coarse woody debris, such as downed trees and root wads; and

d) matrix habitat (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 majority of the Marshall Woods project area that is within Critical Habitat does not contain boreal forest types, as determined by the habitat type of forest stands. A few areas of boreal types exist, primarily on the north-facing slopes. The majority of the area consists of south-facing aspects, and vegetation types are not a boreal spruce-fir type, and thus are considered Matrix. These south-facing slopes do not often hold deep, fluffy snow for extended periods of time.

[15] Lynx and snowshoe hares are strongly associated with what is broadly described as boreal forest (Bittner and Rongstad 1982, p. 154; McCord and Cardoza 1982, p. 743; Quinn and Parker 1987, p. 684; Agee 2000, p. 39; Aubry et al. 2000, pp. 378–382; Hodges 2000a, pp. 136–140 and 2000b, pp. 183–191; McKelvey et al. 2000b, pp. 211–232).
The predominant vegetation of boreal forest is conifer trees, primarily species of spruce (Picea spp.) and fir (Abies spp.) (Elliot-Fisk 1988, pp. 34–35, 37–42). (Revised Designation of Critical Habitat, 50 CFR Part 17, Volume 74 (No. 36), p. 8616). All of the constituent elements of critical habitat for lynx are found within large landscapes in what is broadly described as the boreal forest or cold temperate forest (Frelich and Reich 1995, p. 325, Agee 2000, pp. 43–46). In the contiguous United States, the boreal forest is more transitional rather than true boreal forest of northern Canada and Alaska (Agee 2000, pp. 43–46). This difference is due to the fact that the boreal forest is at its southern limits in the contiguous United States, where it transitions to deciduous temperate forest in the Northeast and Great Lakes and subalpine forest in the west (Agee 2000, pp. 43–46). We use the term ‘‘boreal forest’’ because it generally encompasses most of the vegetative descriptions of the transitional forest types that comprise lynx habitat in the contiguous United States (Agee 2000, pp. 40–41; Revised Designation of Critical Habitat, 50 CFR Part 17, Volume 74 (No. 36), p. 8635).

Direct and Indirect Effects to Canada Lynx Critical Habitat [16]

Table 29 displays the acres of components of critical habitat by LAU. The acres include the effects to the PCE of past and current management actions and other effects to the PCE from past naturally occurring events within the LAU that are currently having ongoing effects to lynx habitat (see previous lynx cumulative effects section above for discussion of activities in the LAUs).

Table 29. Lynx Critical Habitat within affected LAUs associated with the Marshall Woods Restoration Project. Table shows acres of Boreal Forest, which includes multiple structural stages of importance to lynx, as well as Matrix. All numbers are acres (approximate).

LAU Name	LAU Total Acres	Boreal Forest Acres						Matrix[5] Acres (PCE 1d)
		Total Boreal Forest (all structural stages)	PCE1a- Boreal Forest: Stand Initiation currently hare habitat[1]	PCE1a - Multistory currently hare habitat [2]	PCE1a- Early Stand Initiation not currently, but progressing toward hare habitat [3]	Other[4]	Stem Exclusion[4]	
Gold	41,289	24,455	1,985	6,177	7,963	3,474	4,856	16,834
Rattlesnake	38,413	17,287	824	7,771	2,536	2,816	3,044	21,126

[1] Stand initiation structural stage with dense young trees, shrubs or overhanging boughs that protrude above the snow.

[2] Multistory 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.

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[16] In the CHFR09, p. 8618-8619 (2009):
"We also determined that occupied areas containing the features essential to the conservation of lynx support the majority of recent lynx records and evidence of breeding lynx populations since 1995. We relied on records since 1995 to ensure that the revised critical habitat designation is based on the best available data that most closely represents the current status of lynx in the contiguous United States and the geographic area occupied by the species".
"In mountainous areas, the boreal forests that lynx use are characterized by scattered moist forest types with high hare densities in a matrix of other habitats (e.g., hardwoods, dry forest, non-forest) with low hare densities. Lynx Habitat Requirements - Because of the patchiness and temporal nature of high-quality snowshoe hare habitat, lynx populations require large boreal forest landscapes to ensure that sufficient high quality snowshoe hare habitat is available and to ensure that lynx may move freely among patches of suitable habitat and among subpopulations of lynx" (CHFR09, p. 8617).
The CHFR09, p. 8617, recognized that "The boreal forest landscape is naturally dynamic. Forest stands within the landscape change as they undergo succession after natural or human caused disturbances such as fire, insect epidemics, wind, ice, disease, and forest management (Elliot-Fisk 1988, pp. 47– 48; Agee 2000, pp. 47–69). As a result, lynx habitat within the boreal forest landscape is typically patchy because the boreal forest contains stands of differing ages and conditions, some of which are suitable as lynx foraging or denning habitat (or will become suitable in the future due to forest succession) and some of which serve as travel routes for lynx moving between foraging and denning habitat (McKelvey et al. 2000a, pp. 427–434; Hoving et al. 2004, pp.290–292)."

[3] Stand initiation structural stage where the trees have not yet grown tall enough to protrude above the snow in winter (progressing towards stand initiation structural stage for hare habitat).

[4] Structural stages which do not currently provide hare habitat because they are lacking in dense understories of young trees or shrubs or lack conifer boughs touching the snow surface, but have the potential to provide hare habitat based upon habitat type. This category may provide denning habitat and may also be used for travel.

[5] Inclusions within critical habitat that the Forest has mapped as non-lynx habitat.

Primary Constituent Element 1a – hare habitat

PCE 1a evaluates the 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 in boreal forests.

Of the 3,153 acres within the Marshall Woods project area that fall within an LAU (3,129 in Gold LAU, 24 in Rattlesnake LAU), less than 600 acres is boreal forest, and none of that falls within the proposed treatment units (as discussed above in description of lynx habitat, which in this case is synonymous with hare habitat). Table 30 shows the amount of Boreal Forest and hare habitat (PCE 1a) in the project area.

None of the alternatives would affect the amount or quality of boreal forest within the Critical Habitat portions of the Marshall Woods project area. Alternative A would involve no vegetation management, whereas Alternatives B, C, and D would only be treating Matrix habitat. Thus, there would be No Effect to PCE 1a.

Table 30. Amount of Boreal Forest within portions of the Marshall Woods project area that fall within Lynx Critical Habitat. Habitat types in BOLD represent PCE 1a (boreal forest providing snowshoe hare habitat).

	Boreal Forest in Marshall Woods Project Area			Boreal Forest to be treated in Proposed Units for Marshall Woods Project		
Habitat Type	Acres	% of Project Area	% of LAU	Acres	% of Project Area	% of LAU
Early Stand *Initiation not currently, but progressing toward* hare habitat	27	0.2%	0.1%	0	0%	0%
Stand Initiation *currently* hare habitat	**188**	**1.4%**	**0.5%**	**0**	**0%**	**0%**
Multistory *currently* hare habitat	**239**	**1.8%**	**0.6%**	**0**	**0%**	**0%**
Stem Exclusion	68	0.5%	0.2%	0	0%	0%
Other	91	0.7%	0.2%	0	0%	0%
TOTAL	613	4.7%	1.5%	0	0%	0%

Primary Constituent Element 1b – deep, fluffy snow

Deep, fluffy snow occurs throughout much of the Gold and Rattlesnake LAUs. However, the portion of the project area that falls within the Critical Habitat polygon is not particularly prone to deep, fluffy snow, due in part to the low elevation, as well as to the south-facing aspects in much of the project area.

None of the proposed alternatives would substantially affect deep, fluffy snow conditions. Alternative A would result in no change from the existing condition. Under Alternatives B or C, commercial timber harvest could result in the need for plowed haul roads during the winter months to access Units 1, 4, 5, and 6 (Units 2 and 3 are not within the lynx analysis area). This plowing, along with any associated harvesting, could result in temporary snow compaction within units where machinery is operating. These roads and units would not be within or intersect boreal forest portions of the project area. Thus any effect to PCE 1B would only occur in matrix habitat.

Primary Constituent Element 1c – denning habitat

In Montana, Squires et al (2008) found that lynx located their dens in a variety of forest stand types, including multi-storied stands of spruce-fir forests with high horizontal cover and abundant coarse woody debris. Denning habitat is generally abundant across the coniferous forest landscape, especially in riparian habitats and in areas where insect or disease kills patches of trees. Given the large home ranges and low den site fidelity of lynx, den sites are not likely to be limiting (Squires, et al. 2008). Denning habitat is well distributed throughout the Gold and Rattlesnake LAUs, particularly in the Wilderness and less roaded areas where large coarse woody debris is abundant in mature forests.

Alternative A would have no effect on denning habitat. Alternatives B, C, and D would all involve some level of prescribed fire within treatment units in Critical Habitat. These treatment units are all within Matrix habitat, which is not considered habitat suitable for lynx denning. The prescribed fire could temporarily reduce the amounts of coarse woody debris, but would be designed to maintain some large pieces of material, and snag and coarse woody debris standards would be met under any alternatives. Thus any effects to PCE 1c would not affect lynx critical habitat in that they only occur in matrix habitat, and would not adversely affect adjacent denning habitat (see CHFR09, p. 8644 below for justification for how this then leads to no adverse effect to lynx critical habitat).

Primary Constituent Element 1d – matrix habitat

PCE 1d evaluates the areas used by lynx to travel through while accessing patches of boreal forest within a home range. These areas occur between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) and may include, for example, hardwood forest, dry forest, non-forest, or other habitat types that do not support snowshoe hares. In the Gold and Rattlesnake LAUs 41% and 55% of the LAU consists of these “travel” areas (Column 9, Table 29), as identified by the Lolo NF Lynx Habitat Model (USDA FS 2010).

Activities that occur in matrix habitat rarely affect lynx critical habitat, as stated in CHFR09, (p. 8644): “In matrix habitat, activities that change vegetation structure or condition would not be considered an adverse effect to lynx critical habitat unless those activities would create a barrier or impede lynx movement between patches of foraging habitat and between foraging and denning habitat within a potential home range, or if they would adversely affect adjacent foraging habitat or denning habitat”.

Alternative A would have no effect on Matrix habitat. Alternatives B, C, and D would each treat 1,527 acres of matrix habitat within the Gold LAU (although treatment types vary by alternative, as described above), and all action alternatives would treat 22 acres of Matrix in the Rattlesnake LAU with an ecosystem management burn (Table 31). None of these treatments would be regeneration treatments that would create large non-forested openings, and thus none would be expected to preclude lynx from using these areas for travel post-treatment. None of the alternatives include the addition of any travel barriers, such as major highways. Alternative A would retain all of the current forest roads (with the exception of the 1.2 miles of road decommissioning included in the Section 31 DM, 2008), whereas Alternatives B, C, and D all include the removal of roughly 7 miles of forest roads. Alternatives B and C would include approximately 1 mile of temporary road building. Squires et al. (2010) found that unpaved forest roads with low travel levels did not affect lynx. Thus it is unlikely that any of the alternatives would have a substantial effect on lynx travel or use of Matrix habitat within the LAUs.

Table 31. Vegetation treatments to occur within lynx Critical Habitat under the Marshall Woods Restoration Project. All of the vegetation treatments would occur within Matrix habitat; no boreal forest would be treated.

LAU	Treatment Type	Alt A	Alt B	Alt C	Alt D
Gold	Commercial thin	0	196	196	0
	Non-commercial thin & pile	0	0	0	72
	Small tree thinning & EMB	0	502	502	626
	Young stand thinning	0	357	357	357
	Site Prep & Plant	0	450	450	450
	EMB	0	0	0	0
	Subtotal	0	1,505	1,505	1,505
Rattlesnake	Commercial thin	0	0	0	0
	Non-commercial thin & pile	0	0	0	0
	Small tree thinning & EMB	0	0	0	0
	Small tree thinning & EMB	0	0	0	0
	Site Prep & Plant	0	0	0	0
	EMB	0	22	22	22
	Subtotal	0	22	22	22
	TOTAL	0	1,527	1,527	1,527

* EMB= Ecosystem Management Burn

Summary/Determination of Effects to Lynx Critical Habitat

A review of the NRLMD and the associated Biological Opinion reveals that Forest Plan direction addresses all the habitat types, habitat components, and habitat conditions detailed and described as the lynx Critical Habitat PCE. Since NRLMD standards and guidelines reduce or eliminate adverse effects to lynx habitat, the amendment also reduces or eliminates adverse effects on lynx Critical Habitat. Exceptions to this are those projects that occur within the WUI or precommercial thinning for resource benefits where exceptions to the standards are allowed and adverse effects can occur. The Marshall Woods Project is not such a project, and as such, does “not adversely modify or adversely affect lynx critical habitat.” Likewise, this project would not have any substantial cumulative impacts on lynx critical habitat.

Grizzly Bear (Threatened)

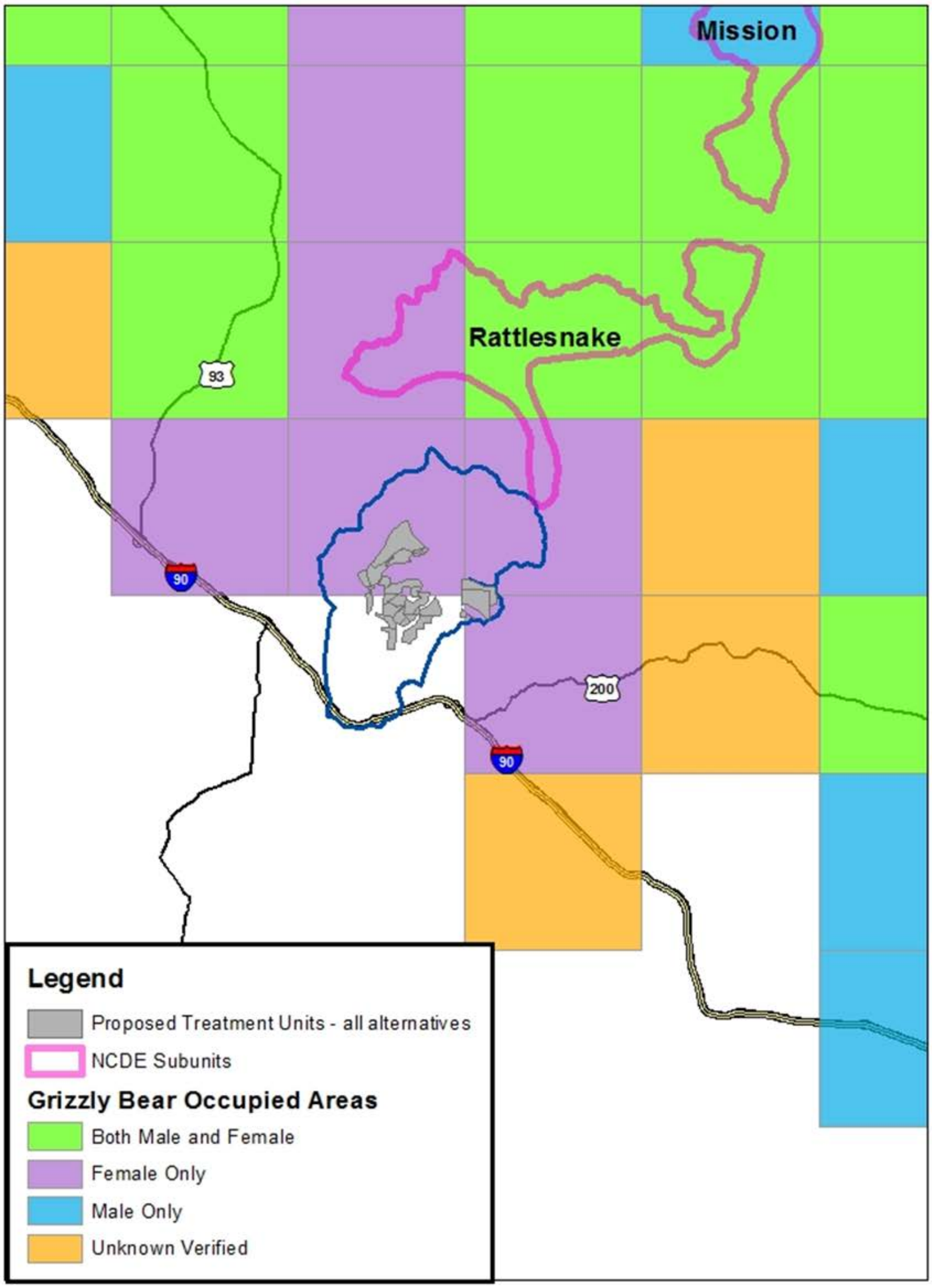
The Lolo NF encompasses portions of three grizzly bear recovery areas, the Northern Continental Divide, Cabinet-Yaak, and Bitterroot. The analysis area used for the Marshall Woods Restoration Project is described above, and includes the Rattlesnake Creek and Marshall Creek watersheds (Figure 39). The analysis area is appropriately large enough to consider the effects to grizzly bears, as it is large enough in scale (28,514 acres) to include the home range of a female grizzly (Waller and Mace 1997), as well as to evaluate landscape connectivity for wide-ranging species such as grizzly bears. It encompasses the entire project area as well as adjacent lands, and includes a combination of NFS and private lands.

The analysis area is located outside, but adjacent to, the Rattlesnake Bear Management Subunit of the Northern Continental Divide Ecosystem (NCDE) Recovery Zone (Figure 39), and thus is not subject to the Interagency Grizzly Bear Conservation (IGBC) road density and core standards that apply to the NCDE. However, the analysis area is considered to be occupied grizzly area outside of the Recovery Zone, according to Mace and Roberts (2012). Thus grizzly bears that occur in the analysis area are subject to Section 7(a)2 of the Endangered Species Act. A Biological Assessment will be prepared and submitted to USFWS for concurrence on the determination for grizzly bears associated with this project.

The proposed project is located within 10 miles of the NCDE Recovery Zone boundary; where mortality of grizzly bears is counted towards population recovery criteria outlined in the Recovery Plan (USFWS 1993 and recently detailed for the LNF in USFWS 2010a). The 10-mile zone was established to provide a conservative accounting for grizzly bears making their range primarily in the recovery zone, but it includes bears whose range overlaps the recovery zone line.

In 2012 the Lolo NF provided an updated baseline analysis for roads, grazing, and food storage that could affect grizzly bears on the Forest (Lolo NF 2012 , and subsequently received an updated Incidental Take Statement (ITS) from the US Fish and Wildlife Service (USFWS 2012)). The conclusion from USFWS is that the Forest has not exceeded the amount of “take” anticipated in the 2004 ITS, and that the Forest met the term and condition regarding permanent roads in the grizzly distribution area outside of the recovery zone (the Forest actually decreased permanent system roads by 5.14 miles since 2004; Ibid.) Thus the current Lolo Forest Plan has been thoroughly considered by USFWS and determined to be sufficient to protect grizzly bears in occupied areas outside the Recovery Zone, and that incidental take is accounted for in the updated ITS.

Figure 39. Analysis area (blue outline) used to assess effects to grizzly bears for the Marshall Woods Restoration Project, in relation to the Northern Continental Divide Ecosystem Recovery Zone subunits and currently occupied grizzly bear areas (per Mace and Roberts 2012).



Status in the Analysis Area

In areas of the Lolo NF that are outside of the Recovery Zone, grizzly bears are beginning to establish occupancy, expanding out from the Recovery Zone (Mace and Roberts 2012). Despite habitat fragmentation and higher disturbance due to roads and other activities, grizzly bears have continued to expand their range outside of the Recovery Zone onto the Lolo NF and surrounding Forests.

Historic and recent grizzly bear sightings have been documented in the analysis area (Mace and Roberts 2012). There is no known evidence of denning or reproduction in or near the existing or proposed Marshall Woods project area, although at least one den has been documented at higher elevations in the Rattlesnake Wilderness adjacent to the Marshall Woods analysis area (email correspondence from B. Wiesner, MTFWP, in Project File). In addition, point observation data downloaded from a female grizzly bear fitted with a tracking device, showed that in October 2011 a female grizzly bear travelled from tribal lands on the north through the analysis area. The bear walked through the Rattlesnake Wilderness west into lower Grant, Butler and La Valle Creeks before returning to the Jocko River area (J. Jonkel, email message 2013, Project File).

Given the proximity of the proposed expansion area to the known grizzly bear distribution area outside of the NCDE Recovery Zone (Mace and Roberts 2012), and to the Rattlesnake Subunit, grizzly bears have the potential to occur within the analysis area during the non-denning period (April thru November). However, at this time grizzlies in the analysis area are in relatively low densities, and use is likely concentrated in the upper reaches of the analysis area where human presence (recreational and/or residential) is lower.

Table 32. Marshall Woods Restoration Project in relation to grizzly bears.

Bear Management Unit	Sub-unit	Grizzly Use of Area	Den Sites	Mortality
N/A Analysis area within 1 mile of Rattlesnake subunit boundary of the NCDE and within the 10-mile area used to estimate mortality and trend. Closest proposed treatments within 3-4 miles of Rattlesnake subunit.	N/A Analysis area abuts Rattlesnake subunit	Mapped as occupied grizzly area by Mace and Roberts (2012). Verified sightings from collared female near analysis area.	None documented in analysis area. Known den in Rattlesnake Wilderness to north of analysis area.	No known mortalities in the analysis area.

Existing Condition for Grizzly Bears in the Analysis Area

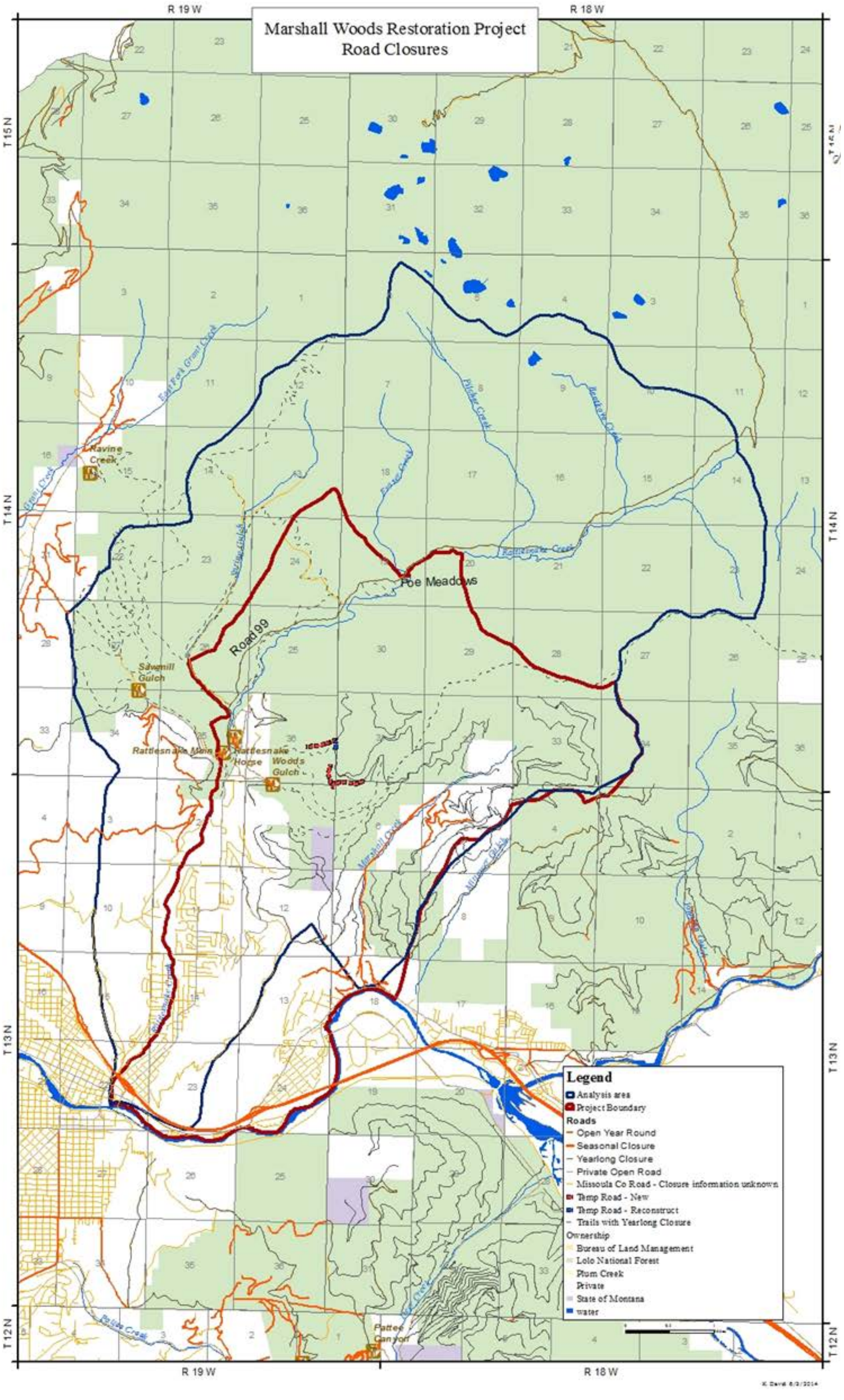
Grizzly bears are habitat generalists, relying on a diversity of habitat types to meet their needs. The analysis area consists of a diversity of upland forest, riparian forest, and non-forested areas (detailed in Table 32). Features of the existing environment that are most relevant to grizzly bears include security/motorized access, cover, habitat suitability, linkage, and food and garbage attractants.

Security/Motorized & High-use Non-Motorized Access -- Motorized access generally follows a gradient from south to north in the analysis area. Road densities are relatively high in the southern part of the analysis area, which consists primarily of private lands and residential developments. The northern part of the analysis area has fewer roads, and the majority of the NFS roads in the northern part of the analysis area have restricted motorized access (Figure 40 below). On NFS lands in the analysis area, there are currently 33.648 linear miles of roads, of which 33.387 miles have restricted access for motorized use (i.e., seasonal closures= 0.194 miles; year-round closures= 33.193 miles).

Road 99/Trail 515 runs along the main Rattlesnake corridor beyond the trailhead, and extends into the farthest reaches of the analysis area. This road is closed to motorized public access, but is used for administrative purposes by both the Forest Service and the local water utility company, and receives an average of roughly 70 vehicle trips per year during grizzly bear season (Apr-Nov; motorized grooming for cross-country skiing also occurs once a week in Jan-Feb). The remaining restricted roads in the analysis area receive less motorized use for administrative purposes. Thus, motorized access on NFS lands in the analysis area is fairly low, and causes little disturbance.

Non-motorized use of NFS lands in the analysis area is relatively high, due to the area being a National Recreation Area that is within about 10 miles of Missoula. The area is considered very high-use, with well over 20 parties per week using the main trails in Rattlesnake Creek, Woods Gulch, and Marshall Creek. In fact, a trail counter at the main Rattlesnake Trailhead recorded over 67,000 hits from March 14 to July 25, with some weekends receiving over 4,000 hits in a 3-day time period (see Recreation Specialist's Report for more details). Grizzly bears can be affected and displaced by both vehicular and foot traffic (Mace et al. 1996; Waller and Servheen 2005). Thus, much of the analysis area is currently minimally suitable for grizzly bears, because of the high residential densities in the southern part of the area, and the high amount of non-motorized recreational use of the Rattlesnake National Recreation Area (RNRA). The upper parts of the Rattlesnake watershed, however, are much more remote and undisturbed, and do provide more suitable areas for grizzly bears. From roughly Poe Meadows up to the headwaters of the watershed, human use decreases substantially, and use of the area is primarily concentrated on the main trail (Rd 99/Trail 515), leaving 15 sq. mi or more of undisturbed habitat for grizzlies in the northern portion of the analysis area.

Figure 40. Roads in the Marshall Woods analysis area.



Habitat - Habitat in the analysis area, including the proposed treatment units, consists of mixed conifer stands of predominantly Douglas-fir, ponderosa pine, and western larch (see Table 23**Error! Reference source not found.** above). These upland areas provide forested habitat for grizzly bears. Numerous riparian habitats occur in creek bottoms along Rattlesnake Creek and its tributaries, as well as a few high mountain lakes (plus many more lakes situated throughout the Rattlesnake Wilderness just to the north of the analysis area).

The best grizzly habitat in the vicinity of the project lies in the wetland and riparian areas associated with these riparian areas and meadows, which provide spring habitat for grizzly bears. Summer and fall habitats are generally at higher elevations to the north and east, although we know that grizzlies may use the lower elevations within and adjacent to the project area in the summer and fall as well.

Cover - Cover, especially along open roads, is important for grizzly bears. Although adult female bears are known to avoid roads, males and younger bears may not (Waller and Mace 1997). Mortality from poaching and mistaken identity hunting is a factor contributing to the bears' continued threatened status. Retention of cover along roads (especially open roads) helps reduce this mortality. Large blocks of cover provide security for bears using areas for feeding, breeding, resting, and other activities.

The areas proposed for vegetation treatment are all currently forested (with the exception of portions of Ecosystem Maintenance Burns). Cover is variable throughout the units as some microsite areas have dense brush and conifer regeneration while drier areas have a less dense understory (see Forested Vegetation Specialist's Report for details).

Disturbance/Displacement - The Lolo Guidelines state that major activity like timber sales will occur for no more than 3 consecutive years out of 10 years in a given Bear Management Analysis Area (BMAA). This area is not within a BMAA, so activity is not tracked in the same way. In general, there has been no major Forest Service activity in the analysis area in the past 10 years. There has been ongoing timber harvest activity in this area in recent years on State, Plum Creek Timber Company, The Nature Conservancy, and small private lands.

The majority of disturbance in the analysis area has come from human use, including the high recreational use of the trail systems, as well as suburban residential development on private lands in the lower portions of the analysis area. Much of the northern/upper portions of the analysis area (e.g., above Poe Meadows) however, receive little to no motorized use, lighter amounts of recreational use, and provide many areas of undisturbed habitat for grizzly bears.

Linkage – There are no identified grizzly bear linkage areas within the proposed project area boundary. Interstate 90 and residential development in the south of the analysis area presents a major deterrent to linkage for bears between the Rattlesnake and areas to the south of Missoula. However, linkage is much more connected from the analysis area to other areas to the north, particularly, and to the east and west, due to the mostly undeveloped, forested nature of those areas.

Attractants – The project area is covered by the food storage order, signed in 2011, that applies to the entire Lolo NF (Special Order F11-005-Lolo-Forest). Efforts have been ongoing in the Rattlesnake National Recreation Area (RNRA) as well as other parts of the analysis area and across the Forest to educate the public on food and attractant storage. Particular emphasis is placed during the early season elk hunt in the upper Rattlesnake in the Wilderness area.

On private lands in the analysis area, bear management specialists with MT Fish Wildlife and Parks and other organizations continue to try to educate the residents on proper food and attractant storage. However, several black bears are removed each year due to management actions (Jamie Jonkel, MTFWP, personal communication).

Environmental Consequences

The two primary challenges in grizzly bear conservation are the reduction of human-caused mortality and the conservation of remaining habitat (USDI-FWS 1993). Elements of the Marshall Woods Restoration Project that are relevant to grizzly bears were evaluated in terms of their effects on the risk of mortality from changes in habitat quality, motorized access, disturbance (e.g., due to low-flying helicopters, mechanized logging equipment, and increased human presence), and attractants (such as food, garbage, and carrion).

Alternative A – No Action – Direct, Indirect and Cumulative Effects

There would be no change in effects to grizzly bears as a result of the No Action alternative. Cumulative effects would continue as described in the Existing Condition above, as well as additional work associated with foreseeable actions as described in the Cumulative Effects for B, C, and D below. While the disturbance from vegetation management would be less under this alternative than any of the action alternatives, this alternative does not include the 7 miles of road decommissioning that would occur with Alternatives B, C, and D (although 1.2 miles of road decommissioning would occur in the project area), whereas all of the action alternatives do include that decommissioning and would thus do more to decrease human access in the area.

Alternative B, C, and D – Direct and Indirect Effects

Motorized Access and High Use Non-Motorized Access:

Motorized access has long been recognized as a major factor affecting grizzly bears. Grizzly bears normally avoid people, possibly as a result of many generations of bear sport hunting and human-caused mortality (USDI-FWS 2010b). Research has indicated that adult female grizzly bears underutilize habitat near roads or other human activities (Mace et al. 1996). Although males and younger bears can be displaced away from roads, they may not be displaced at the same high level as adult females (Waller and Mace 1997). Avoidance of roads can lead grizzly bears to either avoid essential habitat along roads, or put them at greater risk of exposure to human-caused mortality if they do not avoid roads.

Although roads can be problematic for grizzly bears, road use associated with the Marshall Woods project is not expected to have any substantial or long-lasting negative effects to grizzly bears, as explained below.

None of the action alternatives would involve the creation of any new permanent roads, and thus would not create new permanent access within the area (Table 33 below). Nor would any new trails be built. Alternatives B and C would both involve the building of roughly 1 mile of new temporary road that could be used for up to 2-3 years while the commercial harvesting of units 4, 5, and 6 is occurring. Resource protection measures in the project would require the roads to be closed to public use when not in use, and at no time would motorized public use of these roads be allowed. In addition, these temporary roads would not create access into areas that have previously been undisturbed, but rather would be placed in between areas where roads currently exist (see Alternative Maps - Figure 11, Figure 12, and Figure 13).

Table 33. Proposed Road and Trail Treatments

Road and Trail Treatments -- All Action Alternatives (B, C, & D)	
Proposed Treatment	Approx. Miles
Decommission unneeded roads	7.4
Add existing road to official road system (not stored)	1.1
Add existing road to official road system and Store until needed	4.8
Convert Road to Trail	1.4
Store system roads until needed	1.9
Re-align, add to official road system, and Store	0.1
Add existing trails to official trail system	0.4
Construct System trail to connect Road 53414 (to be converted to trail) to Road 2122	0.2
Road and Trail Treatments -- Alternatives B & C only	
Construct Temporary roads	1.0
Reconstruct non-system road for temporary road	0.1

Alternative B would result in the greatest amount of motorized road use, as it would involve the hauling of commercial timber and associated traffic from units in the main Rattlesnake corridor (Rd 99/Tr 515) as well as in the Marshall Canyon/Woods Gulch portion of the project area, including a total of 15.1 miles of haul roads in the project area (5.5 miles of which are currently open public roads – see PF). Alternative C would only include commercial timber haul in the Marshall Canyon/Woods Gulch area on a total of 7.2 miles of haul roads (1.3 miles of which are currently open public roads). Alternative D would not include any commercial timber haul. Under any of these alternatives, motorized road use would increase throughout the project area during implementation (a period of up to 10 years, although actual implementation would likely occur in spurts of 1-3 months at a time over the course of a few years), in order to facilitate the equipment and personnel needed for the activities. All of this use, would occur on roads that are currently used for administrative activities (albeit at a lower use than under the proposed actions), and these roads are also heavily used by the recreating public, and thus already have a relatively high level of disturbance in terms of grizzly bear perspective.

All of the action alternatives would include decommissioning unneeded roads (7.4 miles) within the project area, which would decrease any future motorized use of the project area where those roads currently exist. These are all roads that are currently only open for administrative use (for motorized access), but that are used for non-motorized access.

None of the alternatives would involve building any new non-motorized trails. The non-motorized component is not expected to change under any of the alternatives.

Attractants:

Grizzly bears are easily attracted to human food sources including gardens, grain, compost, bird seed, livestock, hunter gut piles, garbage, barbecue grills, etc. If bears are successful at receiving a food reward, they can lose their natural fear of humans and become conditioned, after just one occurrence, to return to the site of the food reward. Grizzly bears will defend food and have been known to charge when surprised. As a result, the presence of attractants is a public safety risk and it increases the chances of human-caused mortality because nuisance bears are often killed through management removals or defense of human life (real or perceived) and property. The majority of grizzly bear mortalities continue to be associated with conflicts arising from attractants on private lands (Mace and Roberts 2012).

Although attractants can be a major issue for grizzly bears, they are not expected to be a cause of concern for the Marshall Woods project. All activities associated with the project will be subject to the Food & Attractant Storage Order that went into effect across the entire Lolo National Forest in 2011 (see Project File for details). Contract provisions would require all contractors working in the project area to abide by these rules. Thus the project is not expected to have any effect on attractants.

Disturbance:

Grizzly bears can be disturbed and hence displaced by a variety of activities, including mechanical treatments and helicopter use. Bear responses may range from: 1) slight loss of habitat due to avoidance or displacement; 2) disturbance of bears during denning, causing abandonment of dens; and 3) physiological or behavioral stress (Level 1 Biologists Team, 2009).

Because there are no known den sites or suitable denning areas in the Marshall Woods project area, den disturbance to grizzly bears is not expected. However, any grizzly bears in the project area could be disturbed or displaced or stressed by proposed activities, although these effects are expected to be minor.

All three action alternatives would involve mechanical treatments (commercial or non-commercial) that would create noise and could potentially disturb grizzly bears. In addition to those units treated by large machinery, the units to be thinned by hand (e.g., chainsaws) could also create short-term disturbance to any grizzlies within the unit. Therefore all three action alternatives could provide some level of disturbance, but this disturbance would be limited spatially and as such, of low overall impact to grizzly bears. Under any of the alternatives, the total area to be treated would be the same and is roughly 10% the size of a female grizzly bear's home range (<4,000 acres total treatment). None of the treatments would occur in sensitive grizzly bear habitats such as avalanche chutes, riparian areas, or in spring habitats during the spring den-emergence season. The northern part of the analysis area and the Rattlesnake Wilderness to the north provide large areas of refugia for displacement, in the unlikely case that a grizzly bear was in the project area and was disturbed by the treatments.

Helicopters could be used for aerial ignition in a number of the units proposed for prescribed fire (e.g., Units 1, 2, 3, 4, 5, 6, 60, 63, 90, 91, 92, 101, and 200). The total number of days/trips are difficult to predict, given that burning would be subject to windows of opportunity when environmental conditions are right (see Fire and Fuels Specialist's Report). The season following prescribed burning, helicopter use would occur again for 1-2 days to spray weeds. At the most, helicopter use could occur for as many as 10 days in a season, although it is more likely that use would occur 1-3 days per season for 2-4 seasons over the course of the project (i.e., within a 10-year period). The Helicopter Use Guide (Level 1 Biologists 2009) reports that low-height use can disturb grizzly bears. However, as stated before, grizzly use of the project area is low density and rare in occurrence, grizzlies in the area would be accustomed to an existing amount of human disturbance due to the high level of recreational use, and displacement areas to the north, east, and west of the project area are available. Thus, it is unlikely that any grizzly bears would be substantially affected by the use of helicopters for prescribed burning or weed spraying under any of the alternatives.

Habitat Suitability/Linkage:

There would be a decrease in the existing levels of canopy and bole density in the proposed treatment units, however, forest cover would be retained in all units (except the meadow restoration unit) under all action alternatives. Depending on the alternative selected, the extent of the thinning would vary in terms of density of trees retained, with Alternative B resulting in the most removal of vegetation and Alternative D resulting in the least removal of vegetation, due to that alternative's non-commercial nature which would leave more of the large trees and thus have greater density. The understory across approximately 20 percent of all units would be left untreated in a patchy arrangement to provide for cover and habitat diversity. Resource protection measures designed to reduce human use of treatment units would also benefit grizzly bears in that they would leave thicker vegetation near trails and road junctions, which would provide some screening.

Overall, these prescriptions would provide limited sight distances and ample forest cover for grizzly bear security – especially given that limited motorized public access exists within the NFS lands in the project area. This fact is strengthened by the untreated riparian buffers within units which would further break up sight distances. Overall, the proposed treatments would result in a patchy, heterogeneous arrangement of tree density within the units.

The effects of vegetation removal treatments would not result in any disturbances to linkage for grizzly bears within the project area. The forested nature would remain intact, and allow for linkage between areas to the west, north, and east. Linkage to areas south of the project area are somewhat more restricted due to residential development and the I-90 highway corridor.

Alternatives B, C, and D – Cumulative Effects

Cumulative effects to grizzly bears were assessed within the analysis area (Figure 39) and considered past, present, and reasonably foreseeable activities on federal and non-federal lands relevant to grizzly bears under the Marshall Woods project, including changes in habitat quality from vegetation management and motorized access and associated disturbance.

The analysis area is not within the NCDE recovery area. It is not high quality grizzly bear habitat – it is generally dry forest types on south-facing aspects at lower elevations. Motorized public access is limited on NFS lands and would continue to be post-project. Road mileage on NFS lands would decrease post-project. However, motorized access in private lands in the analysis area is mostly tied to the residential development in the Rattlesnake neighborhoods, and would remain relatively high. This high motorized use and residential development would continue to preclude grizzly bear use of the lower parts of the analysis area as habitat or linkage. Areas to the north in the Rattlesnake Wilderness would remain highly suitable for grizzly bears, as would areas to the east and west of the analysis area.

The project does not propose actions that would increase human use in the long term. Considering the direct and indirect impacts of the project with past, present and reasonably foreseeable future impacts related to grizzly bears, the cumulative effects do not result in a substantial impact on grizzly bears within the analysis area.

Vegetation management in the analysis area has been minimal on NFS lands in the past, due to the majority of the area being in the RNRA or Wilderness (Table 25). The results of these actions as well as fires and other natural disturbances (Table 26) have led to limited changes in vegetative cover as far as grizzly bears are concerned in the past 30 years. Past logging on Plum Creek Timber Company lands in the analysis area, particularly in portions of Section 33 in the Marshall Creek area, has removed the majority of forested vegetation and cover for grizzly bears. Most of these areas are now under NFS management, via the Montana Legacy Project, with only 6 acres of Plum Creek land remaining in the project area. Reforestation efforts proposed for Unit 200 would begin to restore a more favorable condition for grizzly bears in that area. Other thinning and burning treatments associated with any of the action alternatives for this project would retain the forested nature of the units, as discussed above. Thus vegetation conditions in the analysis area are expected to improve over time for grizzly bears.

Activities that could cause disturbance to grizzly bears within the analysis area have been ongoing, and include such things as high recreational use of the area by hikers, bikers, and others, as well as the Marshall Mountain ski area, and disturbance associated with land management activities, such as the aforementioned logging on former Plum Creek lands. In general, the southern end of the analysis area has historically seen high disturbance, with the disturbance becoming less and less towards the middle of the analysis area, to very minimal in the northern portions of the analysis area where the Rattlesnake Wilderness is located. The Marshall Mountain ski area permit has been revoked, although the area is still used periodically for biking and hiking. The short-term disturbance/displacement associated with vegetation treatments that would be anticipated with any of the action alternatives would be additive to the existing disturbance, although the effects are not anticipated to have substantial effects on grizzly bears. The Rattlesnake Wilderness and other areas without trails in the analysis area (e.g., areas north and east of Poe Meadows) would continue to provide undisturbed refugia for grizzly bears. No other activities that would cause disturbance beyond the existing routine maintenance and use of the area are expected in the foreseeable future.

Unroaded habitats in the Rattlesnake Wilderness, north and east of the Marshall Woods project area, receive dispersed recreational use by hikers and others. The highest risk to grizzly in the Rattlesnake Wilderness occurs during the big game hunting season. Mortality of bears during the big game hunting season has occurred in other areas of the NCDE, as well as in the occupied distribution area, from illegal shooting (mistaken identity) or defense of life from a charging bear (summarized in USFWS 2010b).

Probably the most important management activity influencing grizzly bear habitat use has been road construction on federal and non-federal lands. Roads on federal lands have facilitated human access into grizzly bear habitat, which is directly associated with bear mortality. Existing open-road densities on federal lands outside of the recovery area are managed to provide secure areas for big game, which tend to benefit grizzly bears. Residences in the Rattlesnake neighborhoods would continue to attract bears to the area and act as a source of human-bear conflict. The Marshall Woods Project would not contribute to increased development in areas potentially visited by grizzly bears.

Interstate 90 and the city of Missoula provide a mortality source for bears moving from the NCDE to adjacent ecosystems. The long-term effects of over 7 miles of road decommissioning would lessen disturbance in some areas. Administrative use of Road 99/Trail 515 and other closed roads in the analysis area would continue to be the only motorized disturbance along roads within the analysis area post-implementation. The project is not expected to preclude the continued use of the Rattlesnake Wilderness as linkage habitat between Evaro Hill on the west, Bureau of Indian Affairs land on the north, or the Mission Mountains on the north east.

A food/wildlife attractant storage order has been in place since 2011 on all Lolo NF lands. The Forest has committed to strict enforcement of the order in and adjacent to the Rattlesnake Wilderness and Recreation Area. In addition, the Forest has reduced road densities during the last decade (Lolo NF 2012). Efforts have also been ongoing to reduce attractants on private land in the WUI in Missoula County (including by MTFWP, Defenders of Wildlife, the Montana Wildlife Federation, Be Bear Aware Program, and the Lolo NF). The Marshall Woods project is not expected to affect attractants to grizzly bears, and no other actions that would increase attractants are in the foreseeable future.

Grizzly Bear Conservation Strategy

A multi-agency effort has been underway to develop a Grizzly Bear Conservation Strategy (GBCS) for the North Continental Divide Ecosystem (NCDE). A draft of the GBCS was published in April 2013, with the primary goal of setting forth the management and monitoring direction to maintain a recovered grizzly bear population in the NCDE. The strategy has not yet been finalized and adopted, and thus it does not provide mandatory direction that would guide the Marshall Woods project. However, project development did consider the GBCS direction, and the project is consistent with the intent of the GBCS.

The Marshall Woods project area occurs within Management Zone 1 under the GBCS. Zone 1 is similar in concept to the 10-mile buffer around the Recovery Zone within which population data are recorded while listed under the ESA. Because current levels of open road densities have not precluded an increasing grizzly bear population, the intent is to maintain open motorized routes at levels known to be compatible with a stable to increasing grizzly population. The Marshall Woods project would not increase open road densities, and would decrease total roads, and thus is in line with the intent of the GBCS.

Determination/Summary of Effects to Grizzly Bears

Alternatives B, C, and D all result in the same determination, which is that the project "**May Affect, but Is Not Likely to Adversely Affect" (NLAA)** grizzly bears or grizzly bear habitat for the following reasons:

- The project is not within the NCDE Grizzly Bear Recovery area and is not within Management Situation 1 habitat. A programmatic biological assessment is in place that covers the effects of existing roads, grazing and sanitation/attractants on grizzly bears (Lolo NF 2012), and the Lolo NF has an Incidental Take Statement that covers forest management activities and their effects to grizzly bears (USDI FWS 2012).
- The project area lies almost entirely behind roads closed to motorized public use year-round (except for snowmobiles which operate in a small portion of the project area, and almost entirely during the denning period), although high non-motorized use occurs on the roads and trails. No new permanent roads would be constructed. The road improvements would be done on existing roads, all of which are closed to the public year-round. Post project there would be more obliterated and decommissioned roads in the immediate project area which translates to enhanced wildlife security.
- A Forest-wide bear attractant order is in place which requires safe storage of all bear attractants.
- No grizzly bear linkage zones or corridors would be impacted.
- Under any of the alternatives, the total area to be treated would be the same and is roughly 10% the size of a female grizzly bear's home range (<4,000 acres total treatment) None of the treatments would occur in sensitive grizzly bear habitats such as avalanche chutes, riparian areas, or in spring habitats during the spring den-emergence season.
- Based on elevation, slope and aspect, the project area is not quality denning habitat – probability of disturbing a denning grizzly bear is low.
- Cover in the form of tree boles would be reduced; however, the forested nature of the treated stands would be retained. In addition, many patches of non-treated cover would remain within the project area post project.

- Helicopter use to support prescribed burning operations would occur in areas that already receive a moderate level of human disturbance due to the recreation use of the area, and displacement areas to the north, east, and west of the project area are available. It is most likely that helicopter use would occur for 1-3 days per season for 2-4 seasons across the course of the project.

Sensitive Species

North American Wolverine

Wolverine Status in the Analysis Area

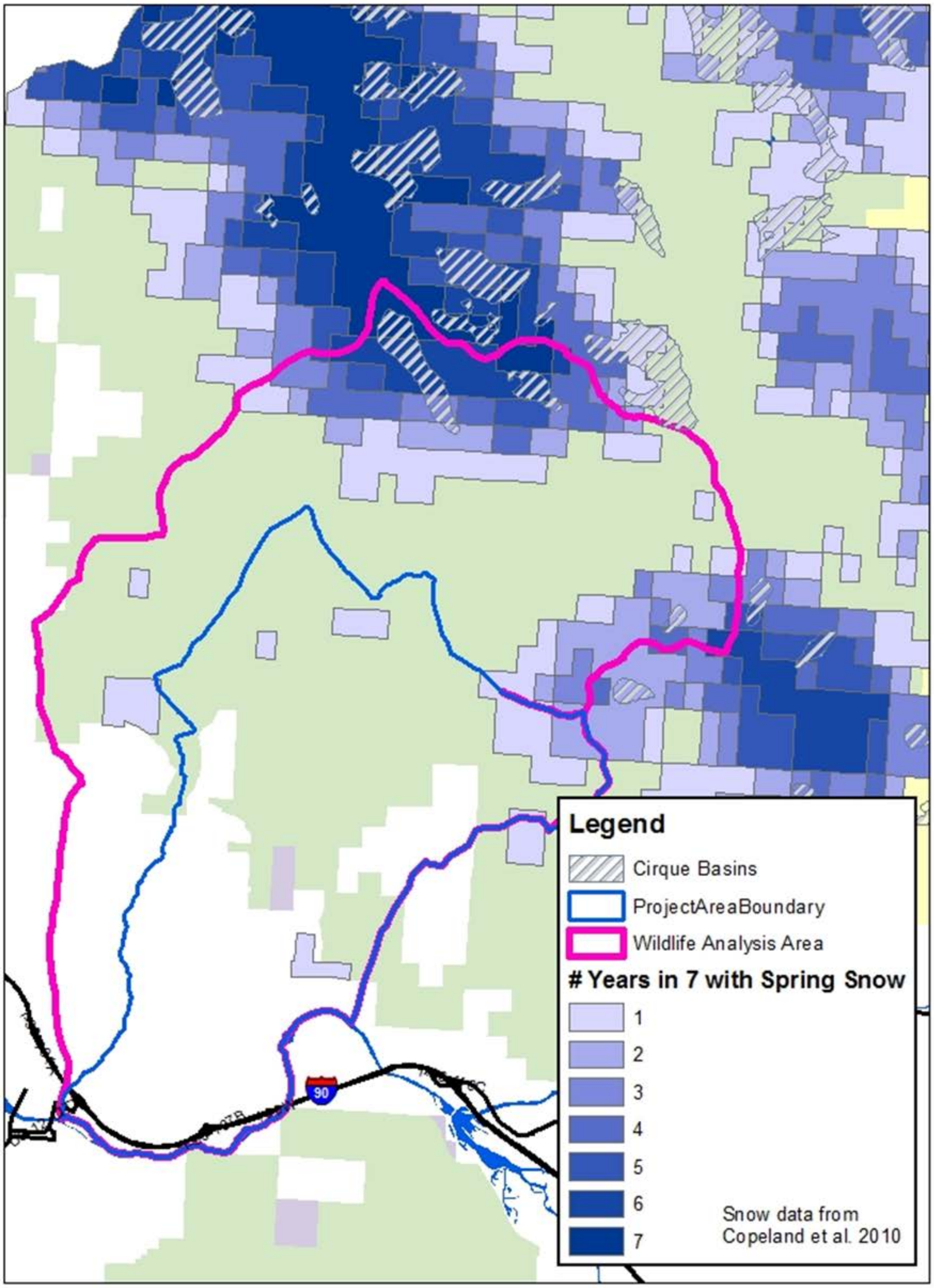
Wolverines occur on the Lolo NF and may occur in the Marshall Woods analysis area in low densities, based on survey, observation and trapping records (Project File). Wolverines have been documented in the Rattlesnake Wilderness and are known to use the hydrologic divide between tribal lands and the Rattlesnake Wilderness and have been documented near Evaro Hill (R. Yates, pers. comm. 2013) and in the Grant Creek area (Scott Tomson, pers. comm. 2014).

Wolverine Habitat in the Analysis Area

Based on the Land Systems Inventory (LSI) database (USDA-FS 2003, see Project File) and local knowledge, the Rattlesnake Wilderness provides cirque basin or similar landforms with denning habitat potential on 5,915 acres in patches that range in size from 23 to 566 acres (Figure 41, with data in Project File). The project area does not provide denning habitat, but would provide a portion of a wolverine home range. The analysis area is also considered linkage habitat between tribal lands on the north, the Mission Mountain wilderness on the northeast, the Evaro Hill area on the west, and the Clark Fork River on the south. The analysis area supports a diverse array of prey.

Snowmobiling is not allowed in the National Recreation Area (NRA) or in the Rattlesnake Wilderness, and use of the wilderness in winter by the public is limited because of deep snows, rugged terrain and lack of a distinct trail system. Big game hunting does occur in the wilderness in the fall and early winter, and furbearer and wolf trapping is an allowable use. Habitat security in the Rattlesnake NRA and is high, whereas, security in the lower elevations of the analysis area is lower because of the existing roads, and private lands where residential development occurs.

Figure 41. Wolverine denning habitat in the Marshall Woods analysis area.



Environmental Consequences

Alternative A - Direct, Indirect, and Cumulative Effects

Taking no action would have no direct or indirect effects on wolverine; therefore, added cumulative effects to the existing environment would not occur.

Cumulative effects from past, ongoing, and foreseeable future actions would continue as described in below.

Alternative B, C, and D – Direct and Indirect Effects

Based on information provided above, wolverine may utilize habitat in the analysis area as part of a much larger home range. Wolverine home ranges in Montana and Idaho vary from 38 to 350+ square miles (or 24,320 to 122,500 acres); therefore they naturally occur at low densities (Copeland and Harris 1994 and well summarized in 78 FR 7864-7890). Denning habitat does not occur in any of the proposed treatment units associated with any of the alternatives.

The proposed treatments, including any road or trail changes, would not affect denning habitat or increase the potential for human disturbance or wolverine mortality, or increase the potential for dispersed recreational activities near den sites

Climate change is no longer considered an immediate threat to the wolverine at the population level (FR 79 47522). It was also determined that the action alternatives won't affect the presence, absence, or abundance of snow remaining late into the spring at either the project level or the wolverine home range level. Although the goods and services provided by NFS programs and activities have been, and will undoubtedly continue to be affected by climate change (U.S. Department of Agriculture Forest Service 2012), the activities described in the proposed action are not the cause of climate change (USDA FS 2014).

The disturbance associated with vegetation treatments could have minor direct and indirect effects to individual wolverine in the form of disturbance and displacement to any wolverines that may be traveling through or foraging in the project area at the time of harvesting or road work. However, these disturbances would be over a relatively small portion of a wolverine's potential range, and would not occur in close proximity to denning habitat. The proposed treatments under any alternatives should not have a substantial impact on food sources for wolverine, including availability of big game (see Elk analysis below). These changes are not expected to measurably impact the wolverine prey base or the availability of carrion or the ability of wolverine to move through the area. Given the extensive amount of potential foraging habitat, hiding cover, and denning habitat at higher elevations in the adjacent Rattlesnake Wilderness and beyond, wolverines may avoid disturbance from project activities and find adequate refugia.

Trapping/harvesting of wolverine is currently prohibited under a Court injunction; however trapping for other species can occur within the analysis area, and incidental wolverine mortality is a possibility. Even if trapping is reinstated, it is no longer considered a secondary threat to the wolverine at the population level (FR 79 47522). The proposed and connected actions would not increase open or total road densities and would not measurably increase access to remote areas or increase trapping pressure in the area. As such, mortality rates of wolverine through illegal or accidental harvest would not measurably change as a result of the proposed activities. In fact, the action alternatives would all include a decrease in roads within the project area, which would slightly reduce trapping access.

Alternative B, C, and D – Cumulative Effects

Cumulative effects relevant to wolverine include loss of habitat from climate change; changes in the quality of denning habitat from recreation; legal, illegal and accidental mortality from trapping which is facilitated by road access; and changes to wolverine movement through linkage zones from human development. Within the analysis area, few to no activities have occurred in the past several decades that would influence wolverines, aside from potential habitat changes due to climate change.

The FWS recently completed an analysis of the impacts of climate change on wolverine using the best scientific data and projections available (78 FR 7874-7890) which concludes, "Wolverine habitat is projected to decrease in area and become more fragmented within the foreseeable future as a result of climate changes. These impacts are expected to have direct and indirect effects to wolverine populations in the contiguous United States including reducing the number of wolverines that can be supported by available habitat and reducing the ability of wolverines to travel between patches of suitable habitat." Impacts to wolverine from climate change in the analysis area are uncertain. The Marshall Woods Restoration Project is not expected to add additional impacts to those that would occur from climate change (see Project File). Higher elevation habitats in the Rattlesnake Wilderness may continue to hold snow for wolverine denning and survival late into the spring for an unknown amount of time.

The proposed treatments would have no impact on wolverine denning habitat because none occurs in the proposed units. Denning habitat is concentrated in the Rattlesnake Wilderness where snowmobiling is prohibited and dispersed recreation in winter is low due to steep terrain, deep snow, and high forest cover. Skiers and backcountry recreationists can access the upper Rattlesnake Wilderness area from the Snowbowl Ski Area, which is adjacent to the analysis area. As described in the Snowbowl Expansion EIS (see Project File), however, substantial effects to wolverines are not expected based on the expansion of that ski area. Therefore, no changes in quality of denning habitat are expected as a result of the effects of this project, or considered with other activities that occur adjacent to the analysis area and affect wolverines in the analysis area.

No new motorized access would be afforded under the action alternatives, and thus the project would not increase access into remote areas; therefore illegal or accidental trapping mortality of wolverine that can be facilitated by access would not increase. In addition, roads will not create any barriers to movement, aside from what currently exists. Road access at lower elevations on private lands, including the Interstate 90 and Highway 93 and Highway 200 corridors are outside of Forest Service control and will continue to provide a partial barrier to wolverine movement to adjacent mountain ranges south, west, and east of the analysis area.

Determination/Summary of Effects

All action alternatives for the Marshall Woods project "**May Impact Individuals or Habitat (MIIH)**", but are not likely to lead to a trend towards federal listing or loss of viability for the wolverine for the following reasons:

- Climate change is no longer considered an immediate threat to the wolverine at the population level (FR 79 47522), and the project is not expected to have substantial effects on climate change. The level of access via roads would not likely facilitate enough of a change in trapping pressure (if regulations change again in the future to allow wolverine trapping again) to affect wolverines at the population level, and road decommissioning would decrease the number of roads in the project area.

- No denning habitat would be affected by the project. Any foraging habitat impacted would not be rendered unsuitable for wolverines post-project and would continue to contribute toward maintaining wolverine viability.
- No changes would occur in the amount of highway transportation corridors or human infrastructure that would affect connectivity for wolverines.
- Land management activities occurring as part of the Marshall Woods project are actions that do not pose a threat to wolverines at a population level (FR 79 47539). Additionally these activities, though they may affect individuals are of little consequence due to the flexibility of habitat use shown by wolverines and their large home range size. Any effects to individual wolverines caused by this project would not be elevated directly, indirectly, or cumulatively to a level that would represent a loss of viability.

GRAY WOLF

Wolf Status in the Analysis Area

The U.S. Fish and Wildlife Service consider wolves potentially present on all Lolo NF lands. The Montana Department of Fish, Wildlife and Parks publishes progress reports on the wolf recovery program and also sends out weekly reports on the general locations of radio-collared wolves. These reports indicate that there is no established pack in the project area or in the Rattlesnake/Marshall Creek drainages. The nearest confirmed wolf packs are the Belmont Pack to the northeast, the Welcome Creek Pack to the south, and the Blue Mountain pack to the southwest. For the past several years, wolves have been using the Rattlesnake Creek watershed and surrounding areas, although the use seems to be occasional, without an established pack in the Rattlesnake area (Liz Bradley, MTFWP wolf specialist, personal communication August 2014). No known rendezvous or den sites are known to exist in the analysis area.

Wolf Habitat in the Analysis Area

Wolves are considered habitat generalists that use a diversity of forested and grassland habitats, but tend to avoid areas with heavy human use. Vegetative cover affects wolf survival by providing shelter for prey species such as deer and elk. In general, healthy wolves need little cover.

Key components of gray wolf habitat are: sufficient year-round prey base of deer, elk, moose, and alternative prey; suitable and somewhat secluded denning and rendezvous sites; and sufficient space with minimum exposure to humans. Wolves are social animals that form packs organized around a breeding pair. Depending on the prey base, packs maintain exclusive territories from 40 to 1,000 square miles (Ibid.). Wolves usually den in underground burrows dug in steep slopes. The wolf pack moves from dens to rendezvous sites pups reach 6 to 10 weeks old. Rendezvous sites are gathering areas where pups stay while the pack hunts.

The project area provides marginal wolf denning habitat due to human presence and proximity to roads and high use trails. The area supports a seasonal prey base of both deer and elk which would allow wolves to successfully forage. Livestock use does occur on private lands within the project area. To date, there have been no known depredations on this livestock by wolves. The upper portions of the analysis area, including the portion that is within the Rattlesnake Wilderness, provides more undisturbed habitat for wolves.

Environmental Consequences

To ensure conservation of wolf populations, the Forest Service uses the three limiting factors identified in the Gray Wolf Recovery Plan (USDI-FWS 1987) to evaluate impacts from forest management: 1) potential for wolf/human interaction; 2) effects on the wolf prey base; and 3) impacts to the integrity of key wolf habitat (rendezvous and den sites).

Alternatives A, B, C, and D

Direct & Indirect Effects to Gray Wolves

The no action and action alternatives would all be benign in regard to impacts on wolves. Although the action alternative would result in some increase in human presence (workers), human recreational use of the area would not likely increase. Likewise, the action alternatives would not have a substantial negative impact on ungulates within the area (see Elk section later in this report). Over time, the action alternatives would likely result in increased ungulate presence in the watershed due to stimulation of shrub, forb and grass growth through underburning and some canopy opening. Finally, no key wolf habitat would be impacted according to the latest information received from Montana Fish Wildlife and Parks wolf biologists.

Cumulative Effects to Gray Wolves

Because the project would have no direct or indirect effect on gray wolf under the no action alternative or any of the action alternatives, cumulative effects will not be analyzed for this species.

Determination/Summary of Effects

Implementation of the proposed activities would have "**No Impact**" on the gray wolf under any alternative. This determination is based on the following rationale:

- Wolves are not tied to any key elements or areas of the project area, and use the area on an occasional basis. No den or rendezvous sites are known that would be disturbed by any project activities. Further, there would be no reduction in prey, no increase in livestock use, and little to no long term change in human use under any of the alternatives.

Northern Rocky Mountain Fisher

Fisher Habitat in the Analysis Area

Fisher habitat is very limited in the analysis Area, consisting mostly of the riparian areas surrounding Rattlesnake and Marshall Creeks, although this habitat is separated from core areas of suitable habitat for fishers that exist primarily on the westernmost portions of the Lolo NF along the MT/ID border, and in portions of central ID (Olson et al. 2014). The southern portion of the analysis area, which consists mostly of residential areas and grasslands, does not contain suitable fisher habitat. The more forested parts in the northern portions of the analysis area also are limited in the amount of suitable habitat they provide, due to the dry, open nature of the forest stands. As such, fishers are not expected to use the project area on a regular basis.

Research indicates that fisher avoid dry forests (ponderosa pine habitat; Schwartz et al. (2013). Olson et al. (2014) has indicated that semi-arid valley bottoms areas characterized by non-forested or sparsely forested stands lacking dense overhead cover and with areas of high levels of human development are not conducive to fisher habitat. Some areas of low or unsuited habitat may not function as barriers since they are surrounded by medium to high value habitat, and are within the dispersal capability of fisher.

Due to the lack of substantial habitat for fishers in the project area and analysis area, the area has not been a high priority for fisher detection surveys on the Lolo NF. One fisher was harvested by a fur trapper in the upper portion of the analysis area in 1991 (MT FWP data, see PF). Given the relative popularity of the Rattlesnake NRA for cross-country skiing and other winter activities, if fisher were consistently present in the analysis area, it is highly likely that observations would have been reported.

Existing habitat security on NFS lands, measured by road densities that in turn influence access within the analysis area, is low in the lower parts of the analysis area due to private lands, residential areas, and the high-use recreation area. Conversely, security is high in upper part of the analysis area that includes a portion of the Rattlesnake Wilderness Area (see Figure 40, which shows road access and security areas in the analysis area). Snowmobile use, which can facilitate access during the late big game rifle and furbearer trapping seasons, is limited in the analysis area.

Environmental Consequences

Effects to fishers were assessed in light of the amount and distribution of suitable habitat, as well as in the accessibility for fur trappers, including changes in the amount of open and total roads in the project area.

Alternative A- No Action Alternative

Direct, Indirect, and Cumulative Effects to Fisher

Taking no action would not change the existing vegetative condition and would not impact trapping pressure. In the absence of direct or indirect effects, cumulative effects are not expected and will not be analyzed in detail for this alternative. Alternative A would have "No Impact" on fisher or fisher habitat.

Alternatives B, C, and D

Direct and Indirect Effects to Fisher

Given the lack of large patches of suitable habitat for fisher in the project area and analysis area, it is highly unlikely that fishers use the project area, and thus it is unlikely that any of the proposed action alternatives would impact fisher or their habitat. Thinning treatments are targeted in predominately warmer, drier ponderosa pine/Douglas-fir stands that do not provide suitable habitat for fishers (Schwartz et al. 2013, Olson et al. 2014). Thus the proposed treatments under any alternatives would not affect the distribution of late succession mesic forest habitat in the project area. All riparian corridors—the areas that could provide fisher dispersal habitat in the project area--would be protected through no-harvest buffers (INFISH) developed to protect soil, water, and aquatic resources. Snags and downed woody debris, both elements important to fishers, would be maintained in commercial treatment units in accordance with Forest Plan standards (USDA-FS 1986) and with the "Lolo National Forest Down Woody Material Guide" (USDA-FS 2006). As such, the structural components in forest/riparian ecotones important to fisher would continue to be provided under any of the action alternatives.

Access in terms of roads and trails would not increase within the analysis area, and in fact would decrease under any of the action alternatives by roughly 7 miles, representing a slight decrease in accessibility for fur trappers.

Determination/Summary of Effects

Alternatives B, C, and D "**May Impact Individuals or Habitat**", but would not contribute to a loss of viability at the population scale, and thus would not lead to a trend towards federal listing or loss of viability for the population or species because:

- Fisher use of the analysis area is infrequent to non-existent.

- Habitat for fishers is limited to non-existent in the analysis area. Riparian areas may provide limited linear habitat for fishers, mostly for dispersal. These areas would be protected through riparian buffers (INFISH), although some minor effects may occur to vegetation in these areas, thus potentially having very minor impacts to dispersal areas for fishers.
- Thinning treatments would be focused in dry forest types, which fishers select against.
- Trapper access would not increase, and total road miles would decrease in the project area, resulting in no changes to trapping pressure for fishers in the analysis area.

TOWNSEND'S BIG-EARED BAT

Habitat in and Use of the Analysis Area

An historic adit is known to exist in the analysis area, created by gold miners in the early part of the 1900s. No surveys have been done to determine if Townsend's Big-eared or other bat species use this mine. The best known, high quality habitat for this species on the Lolo NF occurs on the Superior Ranger District.

Riparian foraging habitat for bats is available in wet meadows and riparian areas distributed throughout the analysis area. Cave and abandoned mine roosting habitat has not been documented. Nearly half of the analysis area consists of mature forest (avg. tree size >= 10" dbh; Table 24) that may provide habitat for the bat.

Environmental Consequences

Alternatives A, B, C, and D

Direct, Indirect, and Cumulative Effects to Townsend's Big-eared Bat

Because of a lack of suitable cave roosting habitat, the presence of this species is highly unlikely within the analysis area. No activities associated with this project would occur directly around any open adit, cave, or mine that would provide suitable roosting habitat. Riparian or wet meadow foraging habitat would not be impacted. All activities associated with the project would occur during daylight hours, whereas bats forage at night, therefore the potential to disturb even one foraging individual is low. Vegetation treatments would impact a small portion of the analysis area, and all treatments would maintain the largest trees in the stands while maintaining large snags and allowing for future snag recruitment; therefore snag roosting habitat would be maintained across the landscape (see MIS section below). Given the above, this project would have "No Impact" on Townsend's big-eared bats under any of the alternatives, and no further effects analysis will be conducted.

Because the project would have no direct or indirect effect on Townsend's big eared bats, cumulative effects are not expected and will not be analyzed.

Determination/Summary of Effects

Implementation of the proposed activities would have "**No Impact**" on Townsend's big-eared bat. This determination is based on the following rationale:

- Low to no potential for disturbance
- Cave/mine roosting habitat is limited/non-existent within the analysis area - all foraging habitat (wet meadows, seeps, springs, bogs and riparian areas) would be adequately buffered through the use of INFISH and no treatment would occur within these buffers.

- The proposed treatments would retain ample forest cover to maintain landscape connectivity and habitat conditions for forest-dependent species.
- No removal of commercial trees would occur in old-growth, and protection of large diameter snags (> 21” dbh) is addressed in resource protection measures and prescriptions.

Peregrine Falcon

Habitat in and Use of the Analysis Area

There are no records of peregrines nesting near the project area; however, peregrines have been observed near the project area (on Mt. Jumbo; MT Natural Heritage Program Tracker database, accessed March 2011). An active nesting area (aerie) is known to exist a few miles east of the project area along the Blackfoot River, and others are located along the Clark Fork River west of Missoula. A few bands of cliffs exist along Rattlesnake Creek within the analysis area, but no peregrine nesting activity has been observed there in recent years. Because of limited nesting habitat and no known nests within the watershed, peregrine falcon management is not a significant wildlife concern in this analysis.

Environmental Consequences

Alternatives A, B, C, and D

Direct, Indirect, and Cumulative Effects to Peregrine Falcons

Information in the preceding section of this document indicates that the project area does not support nesting peregrine falcons, and there are no high quality nest sites, therefore the project would have “No Impact” on peregrine falcons under any alternative and no further effects analysis will be conducted.

Because the project would have no direct or indirect effect on peregrine falcons, cumulative effects will not be analyzed.

Determination/Summary of Effects

Implementation of the proposed activities would have “**No Impact**” on the peregrine falcon. This determination is based on the following rationale:

- There is no known nesting or nesting habitat within or immediately adjacent to project area.
- The proposed treatments are designed to retain ample forest cover to maintain landscape connectivity and habitat conditions for species associated with forests.

Bald Eagle

Habitat in and Use of the Analysis Area

A known bald eagle nest is located at the very southern portion of the project area/analysis area on the banks of the Clark Fork River (Table 34). Nesting habitat exists along the Clark Fork, as well as foraging habitat. Additional foraging habitat exists in the project area, where eagles may forage on carrion. The historic nest is located near a busy interstate, and along a section of river that receives a relatively high amount of recreational use in the summer, indicating a relatively high tolerance for disturbance by the eagles that nest there.

Table 34. Bald Eagle status relative to the Marshall Woods Restoration Project.

Bald Eagle Activity	Nest Site w/in ¼ mile of activities (Zone I)	Primary Use area w/in ½ mile of activities (Zone II)	Foraging Habitat w/in 2-1/2 miles of known nesting activity (Zone III)	Concentrated winter use area
Known	No	No	Yes	No

Environmental Consequences

The Forest Service assesses project and cumulative impacts on bald eagles by using the guidelines outlined in the Montana Bald Eagle Management Plan (1994). Management includes protecting nest sites and primary use areas from disturbance during the breeding season as well as sites where eagles concentrate to feed in winter. Typically, eagles are most sensitive to direct human disturbance during the nest building, egg-laying and incubation periods (February 1 to May 30). Human activities in close proximity to the nest may cause abandonment of the nest by the adults, thus causing egg failure due to exposure. Once young have hatched, a breeding pair is less likely to abandon the nest. However, eagles may leave the nest due to prolonged disturbances, exposing young to predation and adverse weather conditions. Human disturbance can temporarily displace bald eagles, causing long-term changes in habitat use, or appear to have no impact whatsoever (summarized in Hamann et al. 1999). Responses may vary by individual depending on a number of factors such as age, sex, breeding status, weather, or topography.

Alternative A

Direct, Indirect, and Cumulative Effects to Bald Eagles

No increases in disturbance, and no impacts to nesting or foraging habitat would occur under this alternative; therefore direct and indirect effects to nesting, primary use, or foraging habitat are not anticipated.

Because this alternative would have no direct or indirect effects on bald eagles, cumulative effects are not expected and will not be analyzed in detail.

Alternatives B, C, and D

Direct & Indirect Effects to Bald Eagles

Under any of the action alternatives, the nearest activities would occur over 2 miles away from the historic nest site or other possible nest sites along the Clark Fork River. It is highly unlikely that eagles would nest or primarily forage in any of the proposed treatment areas, given their forested nature and topographical distance from large water bodies. Snag and large tree retention under any of the alternatives would ensure adequate perching sites exist throughout the treatment areas. There are no known concentrated winter use areas in the project area. Any disturbance associated with treatments would be limited primarily to winter and periods during the late summer and fall (8/1 – 12/1). Thus, the proposed treatments under any of the action alternatives are expected to have “No Impact” on bald eagles.

Cumulative Effects to Bald Eagles

Because the project would have no direct or indirect effect on bald eagles, it would have no cumulative effects.

Determination/Summary of Effects

Implementing the proposed activities would have "**No Impact**" on bald eagles under any alternative (Montana Bald Eagle Management Plan 1994, Programmatic Biological Assessment for Activities that are Not Likely to Adversely Affect Listed Terrestrial Species, 2004). This determination is based on the fact that:

- There is no high quality nesting habitat in or within >2 miles of any of the proposed treatment areas.
- None of the action alternatives would increase disturbance in or near the historic nest site or other potential nesting areas in the project area.

BLACK-BACKED WOODPECKER

Habitat in and Use of the Analysis Area

There have been no black-backed woodpecker surveys conducted within the analysis area to date, and the species' use of the area is not known. There is no recently burned habitat within the analysis area and, as such, high quality black-backed woodpecker habitat is not present. Lower quality foraging habitat does exist in that there are bark beetle-infested ponderosa pine within the analysis area. In some areas of Montana, second-growth ponderosa pine stands have experienced between 46% and 56% average stand basal area mortality during the current outbreak (Sturdevant and Egan 2011); similar results could be expected in parts of the analysis area, particularly in proposed Units 2 and 3.

Recent research suggests that black-backed woodpeckers are highly dependent on burned forests and that unburned areas infested with beetles are not high quality habitat (Caton 1996, Powell 1999, Cilimburg et al. 2006). Ongoing monitoring on the Lolo NF supports this research and is providing further indication that black-backed woodpeckers prefer recent moderate-to high-intensity burns over beetle-killed stands (D. Hutto pers. com.).

Environmental Consequences

Studies on the impacts of vegetation treatments on black-backed woodpecker in unburned areas are limited. Activities that promote or create nesting/foraging trees or those that remove or suppress nesting/foraging trees can have positive or negative effects on black-backed woodpeckers (i.e., Dixon and Saab 2000). A clearcut with no reserve trees is assumed to remove all potential habitat. Other types of treatments that retain snags may reduce the available habitat and subsequently the number of nesting black-backed woodpeckers, but they would not eliminate them from the area (Hejl and McFadzen 2000 and Saab and Dudley 1998).

Pre-fire canopy cover (>40%) and tree diameter classes (> 5" foraging; > 9" nesting) can serve as an index to the availability of post-fire snag densities. Goggans et al. (1988) and Bonnot (2006) recommend maintaining untreated stands of mature and over-mature forest in bark beetle infested areas to provide nesting and foraging habitat.

Limited studies of black-backed woodpecker nest densities in burned areas that had been salvage logged compared with unlogged burned areas have shown a larger number of nests in unlogged sites (4 compared with 13 in unlogged; Saab and Dudley 1998; 16 compared with 41 in unlogged; Forristal et al. 2005). Conversely, in MPB infested stands, Bonnot (2006) found that greater than 50% of the nests observed were in areas where logging had occurred within the last 5 years. Productivity appears highest in burned areas.

Analysis of effects to black-backed woodpeckers took into account factors:

- Changes in the amount of burned area currently available to provide high quality habitat for black-backed woodpeckers
- Changes in the amount of beetle-killed area currently available to provide low quality habitat for black-backed woodpeckers;
- Changes in the amount of forest likely to provide good habitat if a fire or severe beetle infestation were to occur in the foreseeable future.

Alternative A - No Action Alternative

Direct & Indirect Effects to Black-backed Woodpeckers

Because this alternative would not change the existing vegetative condition on the project area, it would have “No Impact” on black-backed woodpeckers. Insect-infested trees would likely continue to provide limited foraging opportunities for this species. It is worth mention that the no action alternative would likely result in the continued aggressive suppression of fires within the project area. Further, taking no action would limit the Missoula Ranger District’s ability to use prescribed fire in this area. For these reasons, mature, fire-killed trees would not be recruited except in the event of an uncontrolled wildfire.

Cumulative Effects to Black-backed Woodpeckers

Because the No Action alternative would have no direct or indirect effect on Black-backed woodpeckers, cumulative effects will not be analyzed.

Alternatives B, C, and D

Direct & Indirect Effects to Black-backed Woodpeckers

The potential for direct effects to black-backed woodpeckers from proposed vegetation treatments is low, simply because black-backed woodpecker densities are expected to be low to non-existent in unburned forests. Removal of insect-infested trees of commercial size (>5” dbh) in thinning units could reduce some foraging opportunities, whereas ecosystem management burning would increase foraging opportunities by providing a few fire-killed trees. Alternatives B, C, and D would involve commercially harvesting 740, 515, and 0 acres, respectively. These commercial harvest units would reduce the density of beetle-infested trees that could currently provide foraging habitat. Given that the majority of the beetle activity to be harvested occurs in Units 2 and 3, only Alternative B would affect current foraging habitat.

In the long-term, fuels reduction treatments in the WUI are expected to reduce the risk of stand-replacing fires that would in turn reduce the potential for creating post-fire habitat in the treated stands. However, the proposed treatments under all alternatives are concentrated in areas that would typically receive frequent non-lethal fire events. A significant amount of untreated forest that evolved under stand-replacement fire regimes would remain in the analysis area (see Fire and Fuels and Forested Vegetation Specialists’ Reports) and recent post-burn habitat is abundant in nearby areas and across the Forest.

Proposed ecosystem management burning outside the WUI (Unit 101) and underburning post-thinning in other units could directly impact foraging individuals; however, the risks of impacts are low because woodpecker densities in these areas is expected to be low to non-existent. Conversely, burning in the same stands would create fire-killed trees that would increase the foraging potential for approximately 2 to 8 years post-fire (see above).

At the analysis area and Forest-wide scales, impacts from the project would be minor, given the amount of untreated forest that would remain, the increased foraging potential in EMB sites, and the abundant post-burn habitat available District- and Forest-wide.

It should be noted that the proposed treatments under Alternative B, particularly the commercial harvest in Units 2 and 3, would increase the opportunity to allow fires started in the upper portions of the analysis area to continue burning, as the thinning with this project would provide better opportunities for controlling fire from moving into the WUI.

Cumulative Effects to Black-backed Woodpeckers

Past, present, and reasonably foreseeable future actions were analyzed for cumulative effects to black-backed woodpeckers. As detailed in the introduction, past timber harvest has occurred within the analysis area using various prescriptions by project is detailed in the Forested Vegetation Specialist's Report and documented in the Project File.

A minimal amount of NFS lands in the analysis area have received vegetation treatments in the past (984 acres). These activities likely had some minimal impact on black-backed woodpecker habitat. Fires have burned 14,794 acres in the analysis area at different times since 1910, providing temporal post-burn habitat for black-backed woodpeckers, but then leaving those areas unsuitable after 5-8 years. Currently, these previously burned and harvested areas are in various stages of regrowth that range in age and will provide potential future habitat for the woodpecker once the stands reach maturity.

For many forest types in the Northern Rockies, stand-replacement fires were the common fire regime. Historic accounts suggest that black-backed woodpeckers were relatively abundant in recently burned forests. In the period between 1940 through 2000, active fire suppression greatly reduced the number of acres that burned with stand-replacing fires. Forested areas that actually did burn during this period were often quickly salvaged to remove wood while it still had value. This combined effect of fire suppression and salvage harvest greatly reduced the acres of standing burned trees, the preferred black-backed woodpecker habitat. Following this reduction in habitat, black-backed woodpeckers appeared to have gone from being relatively abundant to relatively rare.

Currently approximately 60% of the analysis area (18,222 acres) could provide suitable foraging habitat for black-backed woodpeckers in the future, should those areas burn and produce high quality habitat, or become infested with bark beetles and provide low quality foraging habitat (calculated from Table 23 considering all stands with >5" dbh and >25% canopy). As much of the analysis area lies within the NRA and Wilderness, aggressive timber management is not likely to occur. Therefore, the most significant foreseeable effect to black-backed woodpeckers would be fire suppression, which is expected to continue, especially in and near the WUI.

The listing of black-backed woodpeckers as a sensitive species has highlighted the importance of post-burn habitat. Several studies (Caton 1996, Hutto 1995, and Saab and Dudley 1998) have shown the close tie between these woodpeckers and burned forest. Salvage of burned forest on NFS lands has been limited to a small percentage of total area burned. No salvage has occurred in post-burn habitat in Wilderness including the Scapegoat which burned in 2003 and 2007 and Welcome Creek which burned in 2007. Continued treatment of fuels in WUI will improve the Forest's ability to employ wildland-fire use as a management tool for sustaining black-backed woodpecker habitat in the long-term.

Determination/Summary of Effects

The removal of insect-infested trees of commercial size (> 5" dbh) could result in the loss of some foraging opportunities in habitats that are not considered high quality for the species. Given this species' strong association with recently-burned stands and the abundance of these conditions Forest-and Region-wide, impacts from removal of a few beetle-killed trees are discountable (Samson 2006a). On the Lolo NF alone, 248,254 acres of post-fire habitat has been created in the past 5 years, more than 5 times the amount of habitat needed to maintain a minimum viable population across the entire Region One (Samson 2006b).

Implementation of Alternatives B, C, or D "**May Impact Individuals or Habitat (MIIH)**" but would not contribute to a loss of viability at the population scale. The impacts would be primarily in the form of displacement during vegetation treatment activities and would not likely result in any individual mortality, given the low probability of woodpecker presence. As such, the project would not increase the potential for population declines or lead toward federal listing.

This determination is based on the following rationale:

- This project would not result in the removal of fire-killed trees and would create some fire-killed forest patches, and foraging and nesting opportunities would be increased in EMB units
- Black-backed woodpeckers have been shown to be strongly associated with recent burns in western Montana and were detected at very low rates in insect-infested stands during surveys conducted in the summer of 2003 (Avian Science Center data).
- No even-aged harvest would be conducted (although the commercial thinning treatments would result in creating small openings in some instances) and the overall forested nature of all treated stands would be retained.
- Large live trees and snags greater than 21" would be retained except in rare exceptions. Post-burn habitat is abundant well-distributed near the in the analysis area, Forest-wide, and Region-wide, such that population viability is not an issue.

Flammulated Owl

Habitat in and Use of the Analysis Area

Mature ponderosa pine or dry Douglas-fir stands that could provide flammulated owl habitat are abundant in the analysis area, comprising roughly 10,000 acres of the analysis area (Table 23 above). Flammulated owl surveys were conducted by Lolo NF technicians in 2011, 2012, 2013, and 2014, focusing on proposed treatment units with potentially suitable habitat (see Project File and Figure 42 below). No flammulated owls were detected in the main Rattlesnake corridor. In Units 2 and 3, very few large snags exist, due to the prior harvesting of the forest in the early 1900s. Thus the general forest type is appropriate for flammulated owls, but the microsite features (i.e., snags) are not available. However, in the Woods Gulch/Marshall Canyon portions of the project area, habitat is more suitable for flammulated owls in the areas with mature trees, such as in Units 1, 4, 5, and 6.

Flammulated owls currently occupy parts of the analysis area, including several of the areas proposed for treatment under this project. Historic records in the Montana Natural Heritage Database show evidence of flammulated owls occupying the Woods Gulch area for at least the past few decades, and one flammulated owl was detected during surveys along Sawmill Gulch in 2006.

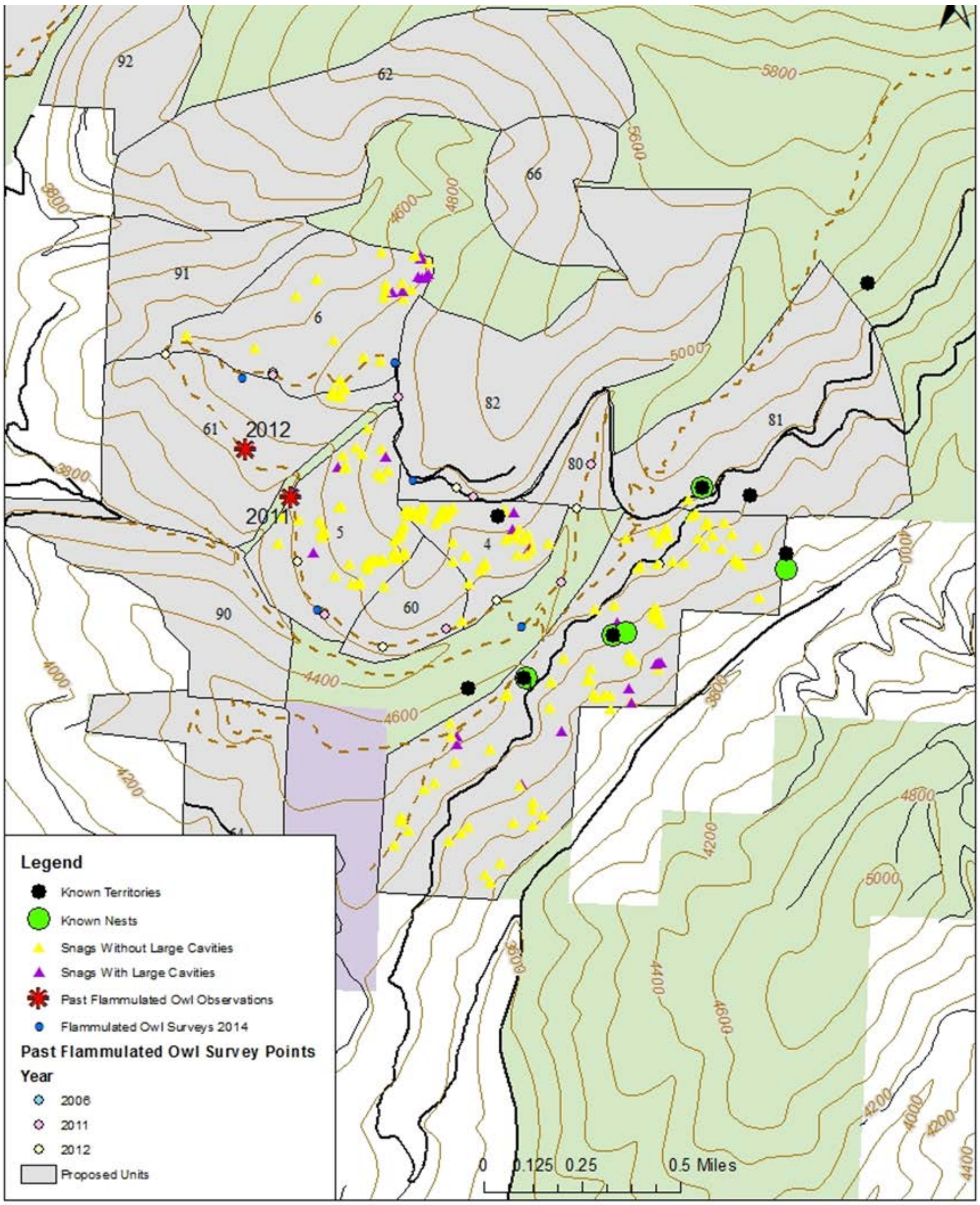
Flammulated owl surveys were conducted by Forest Service technicians in Units 4, 5, and 6, and units in between, in the June of 2011-2014. Flammulated owls were detected in Units 61 and 5.

Additionally, since 2008 researchers with the Owl Research Institute (ORI) have been studying flammulated owls in the Marshall Canyon and Woods Gulch areas (Seidensticker 2011; Matt Larson, ORI, personal communication Sept 2014). They have identified multiple territories in and around Unit 1, and have located nests in a few of the snags within the unit. Although owls have been detected in other proposed units (e.g., Units 4 and 5), no nests have been found there.

Two of the nests that were found were in large-diameter ponderosa pine snags, while a third was in a 10” Douglas-fir snag, and another was in a large live ponderosa tree that has a broken top with a cavity. In addition, in summer 2014 Forest Service technicians inventoried (measured, assessed use, and took GPS coordinates) all snags 18” and larger in the proposed harvest units, and identified those that could be potential nest trees (i.e., those with 3” or larger cavities).

Units in the project area numbered in the 80s and 90s do not have large enough trees and snags to provide suitable flammulated owl habitat at this time. The earliest that flammulated owls have been detected in the project area has been mid-May, and chicks have fledged and left the area, even in late nests, by early August (M. Larson, ORI, personal communication, Sept 2014).

Figure 42. Flammulated owl survey effort, observations (including detections, known territories, and known nests) within the Marshall Woods project area, as well as results from snag surveys in proposed Units 1, 4, 5, and 6 (snags >16" dbh were recorded). Snags with large cavities represent the most likely snags to be used for nesting by flammulated owls. Data represent those collected by both the Lolo NF wildlife technicians and by researchers with the Owl Research Institute.



Environmental Consequences

Conclusive studies on the direct impacts of forest management on flammulated owls are lacking. Human-related disturbances that occur during the breeding season in owl territories may disrupt courtship, thus affecting productivity (Linkhart et al. 2001). In a number of studies of other raptor species, disturbances near occupied nests have caused adults to abandon resulting in mortality of eggs or newly-hatched young (i.e., Squires and Kennedy 2006). Flammulated owls may (or may not) be vulnerable to disturbance and displacement effects from human-related activities during the breeding and chick-rearing season (early May thru early August).

The effects of forest fragmentation on the owl from vegetation management are also unknown. Owls occur in association with managed and unmanaged stands throughout their range (see Wright 1996). It is reasonable to assume that treatments that remove suitable nesting and foraging trees resulting in stand densities and dominant tree size classes below the ranges where owls typically occurs, reduce habitat quality for the species (discussed above).

The effects of fire suppression or wildfire on flammulated owl are also unstudied. Given owl productivity is higher in open forest conditions, it's reasonable to assume that an uncharacteristic increase in stand densities could also impact habitat quality (Linkhart et al. 2001).

Alternative A - No Action Alternative

Direct & Indirect Effects to Flammulated Owls

Because this alternative would not change the existing vegetative condition on the project area, it would have no direct impact on flammulated owls or its habitat. However, the persistence of dense understories and the continued exclusion of fires in flammulated owl habitat on NFS lands could reduce owl productivity over time (Linkhart et al. 2001). Wildfire occurrence in ponderosa pine/Douglas-fir areas with extensive sapling regeneration could spread rapidly to the canopy, resulting in a crown fire that would destroy flammulated owl nesting and foraging habitat (Graham et al. 2004, and Fire and Fuels and Forested Vegetation Specialists' Reports).

In the short-term, meaning for roughly the next few years to few decades, flammulated owl habitat would continue to exist in the project area, and owls would likely continue using the area. However, if a wildfire or insect outbreak were to affect any of the units at this point, the results would likely be more detrimental to owls and their habitat. For example, in Unit 1 the ladder fuels are dense enough that a crown fire would be likely. This high intensity fire would likely kill the majority of small and large trees, and potentially burn the existing snags in the unit. This would render the habitat unsuitable for flammulated owls, as the canopy cover would be greatly diminished, roosting sites would be non-existent, and large older snags with cavities may be much scarcer than they currently are.

Even in the absence of a wildfire, conditions in the proposed units would continue on their trend toward a denser, Douglas-fir dominated forest. Douglas-fir trees, which would be the dominant snag replacement trees (i.e., large trees that will eventually die and become the large-diameter snags that can then provide habitat for flammulated owls) are less likely to provide hard, long-lasting snags compared with larch or ponderosa pine snags, as Douglas-fir snags rot and crumble much more quickly than the larch and pine snags. In addition, the denser the understory becomes, the less suitable the habitat would become for flammulated owls, as they need open flight areas, and an abundance of grassy understories that produce moths and flying insects.

Thus the short-term effects to flammulated owls would be a continuance of the current conditions, but longer-term effects would be a degradation in habitat quality (as Douglas-fir encroachment continues) and/or quantity (if stand-replacement wildfire occurs) within the project area.

Cumulative Effects to Flammulated Owl - Alternative A

Past, present, and reasonably foreseeable actions were evaluated for cumulative effects to flammulated owl (summarized in the introduction, including Table 25 and Table 26 with specific acreages by individual project documented in the Project File and discussed in the Forested Vegetation Specialist's Report).

Past Forest Service timber harvest in the project area and in the greater analysis area has been minimal, affecting less than 1,000 acres, with most of the timber harvest being salvage or improvement cuts, which would not have substantially altered the amount or quality of flammulated owl habitat in the analysis area. Wildfires have been actively suppressed in the analysis area for many decades, excluding the wildfire that would have burned in the south-facing ponderosa pine stands, and deterred Douglas-fir encroachment. As such, the current condition of much of the analysis area consists of ponderosa pine stands with Douglas-fir encroachment.

Alternative A would continue these conditions, in which habitat for flammulated owls would continue to degrade over time, as forests become denser.

Alternative B

Direct & Indirect Effects to Flammulated Owl

Under this alternative, commercial harvest would occur in four units (515 acres) that are known or expected to provide flammulated owl habitat: Units 1 (known nest sites occur), 4, 5, and 6. Another 225 acres would be commercially harvested (Units 2 & 3), but flammulated owls are not known to occupy these areas. These treatments are designed to favor the retention of large, healthy ponderosa pine trees, reduce ladder fuels, and increase the regeneration of shade-intolerant species, such as ponderosa and larch. In the long-term, these treatments would move the units towards resilient stands that can endure the frequent low-intensity wildfire conditions under which flammulated owls have persisted. Commercial harvesting and subsequent hand-thinning and underburning would open the canopy to some extent, and allow more sunlight to the forest floor. Not only would this allow for pine and larch regeneration, but it would stimulate grass and shrub growth, providing habitat for moths and other flying insects that provide food for flammulated owls.

In less mature stands in the project area where ponderosa pine is present and thinning and burning is proposed, the treatments would provide long-term benefits to flammulated owl habitat, as they would ensure the stands are resilient to wildfire, and would favor the growth of small to mid-sized ponderosa pines into large pines that would eventually die and provide snags.

To minimize disturbance to flammulated owls during the mating, breeding, and early chick-rearing season, timing restrictions would prohibit ground-disturbing activities associated with commercial harvest and temporary road construction that would require the removal of trees in Units 1, 4, 5, and 6, where owls are known to occur (from May 1 thru Aug 15; see Resource Protection Measure #32). Burning may occur in any units in May, when flammulated owls are courting and beginning to nest, which may disturb or displace individuals, .However, because owls are nocturnal, and the burning would occur during the daytime when the owls are sleeping in their nest cavities, the disturbance due burning would be expected to be negligible (see Resource Protection Measure #32). If burning is conducted during the spring or early summer, there could be a temporary reduction in the availability of prey (moths & other insects). Unburned retention patches within the units would ensure not all habitat is burned.

Because flammulated owls are known to exhibit fidelity to nest trees, extra precautions would be taken to protect known nest trees. Trees or snags that currently or have historically contained flammulated owl nests (as identified by the Owl Research Institute biologists and/or Lolo NF wildlife biologists or technicians) would be protected from intentional or accidental felling during harvest (see Resource Protection Measure #33). This may mean that mechanical harvesting, and skyline corridors are excluded from the area surrounding known nest trees.

Reasonable efforts would also be made to protect potential nest trees (i.e., snags 18" or greater with large cavities that have been identified in the units) from accidental or intentional felling, although it is possible that these or other snags may be removed during harvesting operations for the safety of personnel working in the unit. Timing restrictions would ensure that any necessary removal would not occur while eggs or chicks may be in the nest, but this alternative could result in minor reductions in available nest trees and thus reduce potential nesting habitat. However, surveys by Forest Service wildlife technicians and the Owl Research Institute have both documented abundant large snags within Units 1, 4, 5 and 6. For example, there are at least 102 snags that are 18" or larger in Unit 1 (see PF); since part of the unit would likely get dropped during layout, and contract provisions would stress the importance of retaining large snags in the commercial units, ample snag habitat should remain post-treatment.

While opening the understory is an objective for the mature forest Units 1-6, it is also important to provide heterogeneity in the understory by retaining a clumpy or patchy distribution of smaller saplings and shrubs that can provide roosting habitat for flammulated owls (as well as hiding spots for fawns and other wildlife species). To that end, the project design will ensure that pockets or thickets of dense vegetation would remain throughout the units post-treatment (see Resource Protection Measure #36). Thus the thinning and burning may reduce some roosting habitat for flammulated owls, but some would be retained.

Compared with the other alternatives, Alternative B would provide the greatest long-term benefit for flammulated owls, as it would move the greatest number of acres of mature forest towards more resilient forest stands with large trees, abundant snags and/or snag replacements, and open understories that support prey for flammulated owls.

Table 35. Potential flammulated owl habitat affected by Marshall Woods Restoration Project.

Treatment Type and Effects	Alternative B	Alternative C	Alternative D
Commercial thin acres, where existing or future nest trees may be removed outside of the nesting season	740 acres (515 acres currently provide habitat for flammulated owls)	515 acres (currently all provide some habitat for flammulated owls)	0 acres
Thin (small tree and young stand thinning or slashing) and underburn acres, where foraging owls may be disturbed/displaced short-term during thinning and by fire when burning, but where habitat is expected to improve long-term. These are areas where nesting is not expected to currently occur, due to the lack of large trees.	1,722	1,947	2,352
Ecosystem maintenance burn acres, where foraging owls may be disturbed/displaced short-term by fire, but where habitat is expected to improve long-term. These are areas where nesting is not expected to currently occur, due to the lack of large trees.	729	729	729
Thin and pile acres, where foraging owls may be disturbed/displaced short-term, but where habitat is expected to improve long-term. These are areas where nesting is not expected to currently occur, due to the lack of large trees.	248	248	248

Alternative C

Direct & Indirect Effects to Flammulated Owl

Effects would be similar to those described in Alternative B, except fewer acres would receive commercial thinning (Table 35), and thus fewer acres would be moving towards open, mature ponderosa pine forests with grassy understory that flammulated owls prefer. Compared with Alternative B, the short-term risk of disturbance and displacement of individuals is the same, as flammulated owls are not known to inhabit Units 2 or 3.

Alternative D

Direct & Indirect Effects to Flammulated Owl

Effects would be similar to those described in Alternative B, except that all acres proposed for commercial harvest would instead be only hand thinned and burned. This alternative, therefore, would reduce the potential for nesting habitat removal that may occur with commercial logging (if snags are accidentally or intentionally felled for safety purposes), although some potential nest trees (snags) may still need to be removed for safety reasons while implementing the thinning and burning activities. All thinning and burning activities in Units 1, 4, 5, and 6 would still be restricted during June and July to minimize disturbance in these units where flammulated owl nesting currently does or possibly could occur. Therefore, the short-term risk of direct disturbance and displacement of individuals would apply to mating or foraging flammulated owls, but not to owls during the key nesting season. Conversely, compared with Alternatives C and D, fewer acres of dry habitats would be restored in this alternative; therefore, long-term maintenance of owl habitat would be reduced.

Cumulative Effects to Flammulated Owl

Past, present, and reasonably foreseeable actions were evaluated for cumulative effects to flammulated owl (summarized in the introduction, including Table 25 and Table 26 with specific acreages by individual project documented in the Project File and discussed in the Forested Vegetation Specialist's Report).

Past Forest Service timber harvest in the project area and in the larger analysis area has been minimal, affecting less than 1,000 acres, with most of the timber harvest being salvage or improvement cuts, which would not have substantially altered the amount or quality of flammulated owl habitat in the analysis area. Wildfires have been actively suppressed in the analysis area for many decades, excluding the wildfire that would have burned in the south-facing ponderosa pine stands, and deterred Douglas-fir encroachment. As such, the current condition of much of the analysis area consists of ponderosa pine stands with Douglas-fir encroachment that is excluding the recruitment of shade-intolerant pine, and is at an increased risk of stand-replacement fire due to the fuels. The lack of fire or harvesting in the analysis area over the past several decades has resulted in forest stands that will not be resilient to wildfire or insects or disease. Dense stands cover a large portion of the analysis area and may provide the owl with some roosting opportunities, but in the long-term may reduce nesting and foraging potential for the species (McCallum 1994, Linkhart et al. 2001). The south-facing forested slopes along the main Rattlesnake Corridor beyond Poe Meadows that are not proposed for treatment could also provide flammulated owl habitat. These stands are also becoming more and more dense due to lack of fire or thinning. Treatments in Alternatives B, C, and D would retain forested cover in all units (except for the meadow restoration and reforestation units), and provide long-term improvements to flammulated owl habitat.

Linkhart et al. (2001) concluded the association of flammulated owl productivity to open-grown forests with larger diameter trees suggests that the species is adapted to forests that were historically maintained by fire. In Region One, Groves et al. (1997), Wright et al. (1997), Linkhart et al. (2001) and others suggest habitat for the flammulated owl has and will decline due to fire suppression. Fire suppression permits young Douglas-fir trees to suppress the recruitment of shade-intolerant and large diameter trees important to the flammulated owl and to reduce the amount of open understory needed by the owl as foraging areas. This trend is obvious throughout the analysis area, as fires have mostly been suppressed due to proximity to residential areas, and thus many of the stands that historically likely received frequent non-lethal fires are now more dense and undergrown than would be expected with regular fires.

Recent studies have shown positive results in restoring the vigor of older trees in dry forest types often used by flammulated owl (Sala and Calaway 2004). In fact, monitoring in the northern Rockies has consistently documented flammulated owls in selectively-logged sites (Howle and Ritcey 1987, Wright 1996, and Lolo NF Monitoring Report). While the flammulated owl is a mature and old-growth forest associate (Reynolds and Linkhart 1992), the drier pine forest in which it occurs is naturally open with interior edges.

Projects that restore the open character of ponderosa pine and dry Douglas-fir stands will likely become more important if predictions for warmer springs and continued dry summers increase fire seasons with larger fires in the future (Running 2006, Westerling et al. 2006, Morgan et al 2008). The proposed thinning and ecosystem maintenance burning in Alternatives B, C, and D are consistent with this management approach.

A comparison of available ponderosa pine on the Lolo NF from 1938-42 to what exists today shows that ponderosa pine in all size classes has declined by about 2%, whereas Douglas-fir (a more shade-tolerant species) has increased by 12 to 14%, suggesting an overall decrease in habitat for the flammulated owl (Samson 2006a). Despite these changes, flammulated owl habitat on the Lolo NF is relatively abundant and well distributed (discussed above and see Samson 2006a), and flammulated owls are regularly detected across the Forest (Avian Science Center 2005 & 2008; Lolo NF 2001-2013 Monitoring Report in PF). Treatments are designed to favor ponderosa pine and would not preclude stands from developing into old growth in the future. Alternatives B and C, which take a more aggressive approach to suppressing Douglas-fir and favoring ponderosa pine via commercial harvest in the Woods Gulch/Marshall Canyon area, are expected to better promote stands of mature, open ponderosa pine than Alternative D, which only involves hand thinning and underburning. Any short-term disturbance or displacement to flammulated owls in the project area is not expected to affect species viability at the Forest or Regional scale (Samson 2006a).

Determination/Summary of Effects

Implementation of Alternatives B, C, or D "**May Impact Individuals or Habitat (MIIH)**" but is not likely to lead to a trend towards federal listing or loss of viability for the species. Short-term disturbance and displacement effects could occur during treatment-related activities in all units with thinning and burning, and habitat alteration in the way of reductions in snags in commercial harvest units. Timing restrictions that prohibit ground-disturbing activities in optimum/known occupied habitat in the Woods Gulch/Marshall Canyon area during the breeding season would reduce the potential for impacting breeding individuals. Population level impacts are not expected due to the abundance of undisturbed habitats that would remain in the analysis area, on the Lolo NF, and Region-wide.

This determination is based on the following rationale:

- This project would treat a modest amount of flammulated owl habitat in the analysis area (up to 7% commercially thinned) leaving 1000s of acres of flammulated owl habitat relatively undisturbed.
- The project would retain stand structures in treated areas that are consistent with where breeding owls occur on the Forest, including large diameter trees and snags.

- Ground-disturbing activities in flammulated owl habitat would not occur from May 1 through August 15 in Alternatives B or C, to reduce the potential for disturbance to breeding owls in the Marshall Canyon/Woods Gulch area in known occupied habitat.
- No even-aged regeneration harvest would occur and the overall forested nature of all treated stands would be retained.
- Flammulated owl habitat is abundant and widely distributed in the analysis area, Forest and Region, such that population viability is not an issue.

Harlequin Duck

Habitat in and Use of the Analysis Area

A search of the Montana Natural Heritage Program database revealed several historic reports of harlequin ducks on Rattlesnake Creek, dating as far back as 1948 to as recent as 2000. A few of these observations have indicated successful breeding has occurred. Field surveys for harlequin ducks in August 2011 and 2014 did not detect any harlequins in an 8 mile stretch of Rattlesnake Creek that runs thru the analysis area (from the main trailhead to Franklin Bridge). The portions of Rattlesnake Creek that lie within the NRA likely provide the most suitable habitat, as the lower portions of the stream run through residential neighborhoods where disturbance is more prevalent.

Environmental Consequences

Alternatives A, B, C, and D

Direct & Indirect Effects to Harlequin Ducks

Vegetation management proposed under any of the action alternatives would not directly or indirectly effect harlequin ducks, as no vegetation would be altered or removed along the banks of Rattlesnake Creek or any of its tributaries, or along Marshall Creek.

Slash may be piled along the banks of Rattlesnake Creek as sediment filters. The slight disturbance that may occur while slash is being piled is not expected to affect harlequin ducks, since the disturbance would occur only in small areas, only on one side of the creek, and only for a short period of time (a matter of minutes to an hour to pile the slash). As a result, no effects to harlequin ducks are expected.

Cumulative Effects to Harlequin Ducks

The proposed project would not contribute considerably to impacts on harlequin ducks. Effects to harlequins associated with past, present, and future activities include the development of streambanks and riparian areas associated with residences in the lower portions of Rattlesnake Creek, and with recreational use of the portions of the creek in the RNRA. Effects to harlequin ducks and their habitat would be minimal, and undisturbed habitat within the analysis area would remain intact.

Determination/Summary of Effects

The Marshall Woods Project is expected to have "**No Impact**" on harlequin ducks. Rationale for this decision is based on:

- Riparian areas would be protected by INFISH buffers, and no bankside harvest would occur that could affect harlequin duck habitat.

- Disturbance to streambanks would be limited to the placement of slash for sediment filters, which would be of short duration for disturbance, and would only occur on one side Rattlesnake Creek, thus creating no full-stream disturbance.

BOREAL (WESTERN) TOAD

Habitat in and Use of the Analysis Area

No year-round small lakes, ponds, or wetlands exist within the analysis area. Some riparian areas may provide suitable breeding areas for toads, such as those associated with beaver dams along Rattlesnake Creek, although these are accessible to fish, which makes them unlikely to be breeding sites for toads. No surveys have been conducted in the project area or analysis area for this species.

Environmental Consequences

Alternative A - No Action Alternative

Direct & Indirect Effects to Boreal Toads

This alternative would not change the existing vegetative condition in the analysis area or involve any ground-disturbing activities. However, it would include Best Management Practices (BMP) work along the main Rattlesnake road, and other activities that could crush individual toads. However, due to the existing high level of recreation use by hikers and mountain bikers along that road, it is unlikely the effects would be a substantial increase in effects to toads. And since there are no known breeding sites in the project area, it is very unlikely that toads will be affected. Therefore, this alternative may impact individuals, but would not lead towards a trend towards listing or loss of viability

Alternatives B, C, and D

Direct & Indirect Effects to Boreal Toads

Suitable breeding habitat in lakes or ponds or slow-moving streams with backwater areas do not exist in the analysis area. Treatment units near Rattlesnake and Marshall Creeks and their tributaries would be buffered from ground-disturbing activities through the use of INFISH standards and guidelines that would remove the potential for impacting breeding habitat.

Mechanical treatments and logging truck traffic on haul routes during dispersal periods could result in crushing individual toads. Activity fuels burning and ecosystem maintenance burning could result in mortality of dispersing individuals. This impact could occur under both any of the action alternatives, with equal amounts of area affected under all alternatives. However, since there are no known or seemingly suitable breeding sites within any of the treatment areas, or within the analysis area, it is unlikely that a substantial number of individual toads, if any, would be affected.

Cumulative Effects to Boreal Toads

Cumulative effects to boreal toads were assessed within the analysis area, which encompasses two watersheds large enough for multiple breeding sites for toads. However, no breeding sites are known to occur within the analysis area. Cumulative effects to toads can be broken down to those affecting reproduction and breeding and those affecting individuals during the non-breeding period (discussed above). Since there are no breeding sites that have been affected in the past and none that would be affected by this project, there would be no cumulative effects to breeding sites.

Effects on individuals using habitats not associated with water include past, present and future logging, road building and other ground-disturbing activities that can result in direct mortality of individual toads. Past Forest Service logging within the analysis area has been minimal in acreage, and has not occurred near any breeding sites. None of the roads within the analysis area bisect or travel within 200m of any breeding sites, and thus it is unlikely that toads have been directly killed in the analysis area in the past. Prescribed burning, heavy equipment use, or logging trucks (Alternatives B and C only) associated with treatment units in Alternatives B, C, and D could temporarily increase the risk of mortality to any dispersing individuals. Based on the spatial and temporal scale of the proposed treatments, the potential for impacts would occur over multiple seasons, but at a small scale in any given time period. After project implementation, road use would return to current conditions, with only occasional administrative use of NFS roads in the analysis area, none of which are near known breeding sites or areas where toads are known to disperse. Thus the overall cumulative effects would not create a substantial impact to boreal toads.

Determination/Summary of Effects

Because of the potential impacts to individual toads during dispersal (described above), the overall direct, indirect and cumulative effects during implementation (5 to 10 years out) "**May Impact Individuals or Habitat (MIIH)**" but is not likely to lead to a trend toward federal listing or loss of viability for the species. Population level impacts are not expected due to the protection of breeding habitat within the analysis area, breeding habitat protection on a broader scale, and the wide distribution of this species in the western U.S (Werner et al, 2004).

Bighorn Sheep

Habitat in and Use of the Analysis Area

There are currently seven herds of bighorn sheep that live within the bounds of the Lolo NF. Portions of the analysis area are inhabited by the Lower Blackfoot (Bonner) herd. FWP established this population by initially releasing 14 bighorns from Upper Rock Creek in 1987 on Woody Mountain. Another 30 sheep from the Sun River were released in 1990. The number of bighorn sheep counted during helicopter surveys in Hunting District 283 has ranged from 35 to as high as 128 sheep (in 2007; MTFWP 2010).

In addition to the core population that inhabits the area north of Bonner and the Blackfoot River, a subpopulation of approximately 30 (not surveyed) occupies a portion of the Rattlesnake Wilderness and NRA. Another subpopulation of approximately 30 (not surveyed and not hunted) occupies the area south of the Blackfoot River between Bonner and LaFrey Creek. Occasionally, bands of young rams and/or ewes are seen on Mount Jumbo and near Johnsrud Park in Missoula (MTFWP 2010). However, the project area is generally not used by bighorn sheep on a regular basis.

This herd suffered a major die-off in the early part of 2010, when an epizootic outbreak led to pneumonia that affected a majority of the herd. FWP took aggressive management action to try to control the spread of the disease both within the population and to other populations within the state. The natural deaths plus deaths due to management actions led to a nearly 70% decline in the herd (Edwards et al. 2010), bringing the total number of individuals in the herd back to approximately as many sheep existed when the herd was first being established.

Environmental Consequences

The following are actions that can affect bighorn sheep populations, and that were considered when evaluating the environmental consequences of the alternatives:

- Changes in hunter access within bighorn sheep range
- Grazing allotment that would allow domestic sheep on NFS lands

- Timber management in bighorn sheep area that could introduce weeds (negative) or discourage conifer encroachment/encourage grassland growth (positive)
- Weeds management using domestic sheep (negative) or other methods (positive)
- Prescribed fire that could increase weeds (negative) or deter forest encroachment on grassland and enhance palatability/nutrition of grasses (positive)
- Highway projects in sheep range that could fragment habitat or lead to increased sheep-vehicle collisions
- Residential or resort development that would fragment sheep range or connectivity between populations

Alternative A - No Action Alternative

Direct & Indirect Effects to Bighorn Sheep

Because this alternative would not change the existing vegetative condition in the analysis area, roads in the project area would be reduced by 1.2 miles, and because the BMP work and other actions that would occur under this alternative would not affect sheep habitat or security, this alternative would have "**No Impact**" on bighorn sheep. Weeds in the area would continue to be treated under the Lolo Weed EIS (USDA FS, 2007).

Because the project would have no direct or indirect effects, cumulative effects are not expected and will not be analyzed in detail.

Alternatives B, C, and D

Direct & Indirect Effects to Bighorn Sheep

Under any of the action alternatives, hunter access to the area would not substantially change, as motorized access would not change. In the short-term, temporary roads associated with Alternatives B and C would provide slightly more access into the Woods Gulch area. However, this area is already fairly accessible, given the number of existing system trails, and the area is not typically used by bighorns. In the long term, all of the action alternatives would remove a few roads in the project area. These roads are not currently open for motorized access. Overall, hunter access to bighorn sheep in the analysis area would not substantially change, and access to the Bonner herd would remain fairly limited.

Under any of the action alternatives, vegetative management activities and prescribed burning could risk the spread of weeds in treatment units and along travel routes. However, weed treatment resource protection measures associated with the project would seek to minimize the spread of weeds (see Weeds Specialist's Report).

The use of prescribed fire in the project area, particularly the underburns and ecosystem maintenance burns associated with all of the action alternatives, could positively affect habitat quality for bighorn sheep as it could enhance palatability/nutrition of grasses in the understory. These burns would not be likely to entice bighorn sheep into areas where they may come into contact with domestic sheep.

Cumulative Effects to Bighorn Sheep

Effects of the proposed actions were evaluated in light of past, present, and reasonably foreseeable future activities that could affect bighorn sheep in the analysis area. Likely the most significant threat to bighorn sheep in the analysis area is the potential to interact with domestic sheep that are used for weed control on Mt. Jumbo, and with domestic sheep on private lands in the town of

Bonner, east of the analysis area within the Bonner herd's range (MTFWP 2010). The proposed action alternatives would not significantly increase the potential for such interactions.

Given the currently low population numbers of the Bonner herd, the population is more susceptible to extirpation should another catastrophic event occur (such as another disease outbreak or major habitat reductions). None of the proposed actions, nor any management actions in the foreseeable future, would substantially affect bighorn sheep habitat in the analysis area, nor within the herd's range outside of the analysis area. In fact, the recent transfer of Plum Creek lands to the Forest Service via the Nature Conservancy (thru the Montana Legacy Project) has the potential to increase habitat security, improve weed management, and manage for more desirable habitat conditions than under the previous ownership.

Determination/Summary of Effects

Alternatives B, C, and D **"May Impact Individuals or Habitat**", but are not likely to lead to a trend towards federal listing or loss of viability for the population or species because:

- No areas of bighorn sheep winter range are proposed for any kind of treatment
- Hunter access would not substantially change
- The project would not increase the potential for disease spread via interactions with domestic sheep or goats
- Weed infestations would be managed, not leading to substantial losses of foraging habitat
- Conifer encroachments into grassland foraging areas will be discourage via the proposed treatments.

MANAGEMENT INDICATOR SPECIES

The Lolo NF Plan identifies the northern goshawk (mature and old growth forests), pileated woodpecker (snag/cavity habitats in mature and older forests), and elk (commonly hunted) as "Management Indicator Species" (MIS) (Forest Plan Standards #25 and 27, Lolo NF Plan, p. II-14 and Final EIS, pp. III-28 through III-29).

OLD GROWTH FOREST HABITAT

The Lolo NF Plan EIS established a strategy for defining and distributing old growth habitat Forest-wide (USDA-FS 1986 at II-61, IV-10). The Lolo NF was segregated into 71 drainages, and a minimum of 8% (all habitat groups combined) was allocated as old growth in most drainages where wilderness was not available. Old growth was distributed by habitat groups that range from warm dry types at lower elevations to moist types at higher elevations, recognizing the individual needs of various old growth dependent species. Management Area 21 (MA 21), representing about 2% of the Forest, was also designated in the Plan (III-104) to evenly distribute old age stands for associated wildlife, Forest-wide.

Using the definition of old growth in the Lolo NF Plan (1986 at pp. VII 24-25) conservative estimates derived from FIA data show at least 14.4% of the Forest is old growth or over mature timber (Bush et al. 2003). This estimate far exceeds the 8% standard in the Lolo NF Plan. Using the Region One definition of old growth (Green et al. 1992), conservative estimates from FIA data show the Lolo NF is comprised of 9.6% old growth (90% CI 7.7 to 11.5%), slightly above the 8% standard in the Plan and far above the 2% allocated in MA21 (Bush et al. 2007).

The Lolo NF monitoring program for old growth and old growth species is detailed in the May 2008 Monitoring Paper and accompanying appendices to the paper (USDA-FS 2008).

None of the action alternatives would treat a single acre of old growth habitat as defined by Green et al. (1992) or the Lolo NF Plan (1986 at pp. VII 24-25). The proposed commercial and non-commercial treatments would not preclude stands that currently do not meet Green et al. (1992) from developing into old growth in the future (Forested Vegetation Specialist's Report). Nesting and foraging habitat for the northern goshawk and pileated woodpecker (detailed below) would remain abundant and widespread in the analysis area, Forest- and Region-wide.

Northern Goshawk

Habitat in and Use of the Analysis Area

Goshawk surveys were conducted in and near proposed commercial and non-commercial thinning treatment units in the summer of 2011 using acoustical calling methods (Woodbridge and Hargis 2006) at calling stations placed on a grid with points approximately 200 m apart (data in Project File, Lolo Wildlife Field Season Report 2011). No goshawks were detected in these surveys, nor have any recreating members of the public or nor other wildlife researchers in the area reported seeing goshawks in the area.

Nesting habitat for goshawks was estimated using the goshawk habitat model developed by Lolo NF wildlife biologists (in the Project File). The model is based on vegetation attributes collected from nest sites observed in the Northern Rocky Mountain Ecoprovince that encompasses the analysis area (Samson 2006a), and then querying R1VMap data to identify areas that could provide nesting and foraging habitat. Reynolds et al. (1992) recommend 180 acres of nesting habitat per 5,000 acre home range. Given that goshawk home ranges can be between 1,400 and 8,650 acres, the analysis area could potentially host 3 to 20 goshawk home ranges (Table 37), if appropriate nesting habitat existed. According to Reynolds et al. (1992) recommendations, there should be 540 to 3,600 acres of nesting habitat in the analysis area. The existing amount of nesting habitat (approx. 1,100 acres) is towards the lower end of this spectrum. Even in the unmanaged wilderness and NRA portions of the analysis area, patches of goshawk nesting habitat are small and scattered. The amount of non-habitat in the analysis area is indicative of the open south-facing hillsides, residential development, and rocky high elevation habitats within the analysis area. Approximately 40% of the analysis area is "Potential" goshawk habitat, meaning the vegetation dominance types are those that goshawks have been associated with, but the size class and/or canopy is not great enough to support goshawk nesting. Again, this is less likely due to past management or fires, and more due to the south-facing nature of the majority of the analysis area, where tree canopies just do not grow that dense. Therefore, it is unlikely that much of the analysis area would be used for nesting, but could be used for foraging by goshawks in adjacent territories or by non-nesting individuals.

Table 36. Estimated goshawk nesting habitat in the Marshall Woods analysis area, calculated for both the whole analysis area (left columns) and for only the NFS lands within the analysis area (right columns)

Habitat Type	Acres in analysis area	% of analysis area	Acres in analysis area (NFS only)	% of analysis area (NFS only)
Existing Foraging Habitat	5,638	19.8%	4,910	25.0%
Existing Nesting (and Foraging) Habitat	1,106	3.9%	1,056	5.3%
Potential Future Habitat*	10,193	35.8%	7,591	38.7%
Non-Habitat	11,576	40.6%	6,048	30.8%

* Vegetation types are appropriate, but the size class and/or canopy does not meet goshawk habitat needs. Some of this could potentially grow into goshawk habitat in the future.

Table 37. Comparison of the amount of recommended nesting habitat for the analysis area versus the amount of existing nesting habitat for goshawks in the Marshall Woods analysis area, based on recommendations by Reynolds et al. (1992).

	Total acres	Estimated # of goshawk home ranges*	Nesting acres recommended**	Estimated acres of existing goshawk nesting habitat
Analysis area—all lands	28,514	3 to 20	540 to 3,600	1,106
Analysis area—NFS lands only	19,733	2 to 14	360 to 2,520	1,056

*Assumes no overlap between breeding pair. 1,400 to 8,650 acres per home range from Reynolds et al. 1992, Kennedy et al. 1994, Wisdom et al. 1999.

**30 acres, 3 suitable and 3 replacement totaling 180 acres per home range from Reynolds et al. 1992.

Goshawk foraging habitat in the analysis area is described by the tree dominance type and size class, plus grass/forb/shrub in Table 38 (rock/water was omitted from the table). Habitat was quantified using R1VMap methods detailed in Brewer et al. (2007) to produce a consistently derived habitat layer with an accuracy assessment (around 70%). Note total foraging habitat percentages in each tree size class category are nearly consistent with Reynolds et al. (1992) recommendations.

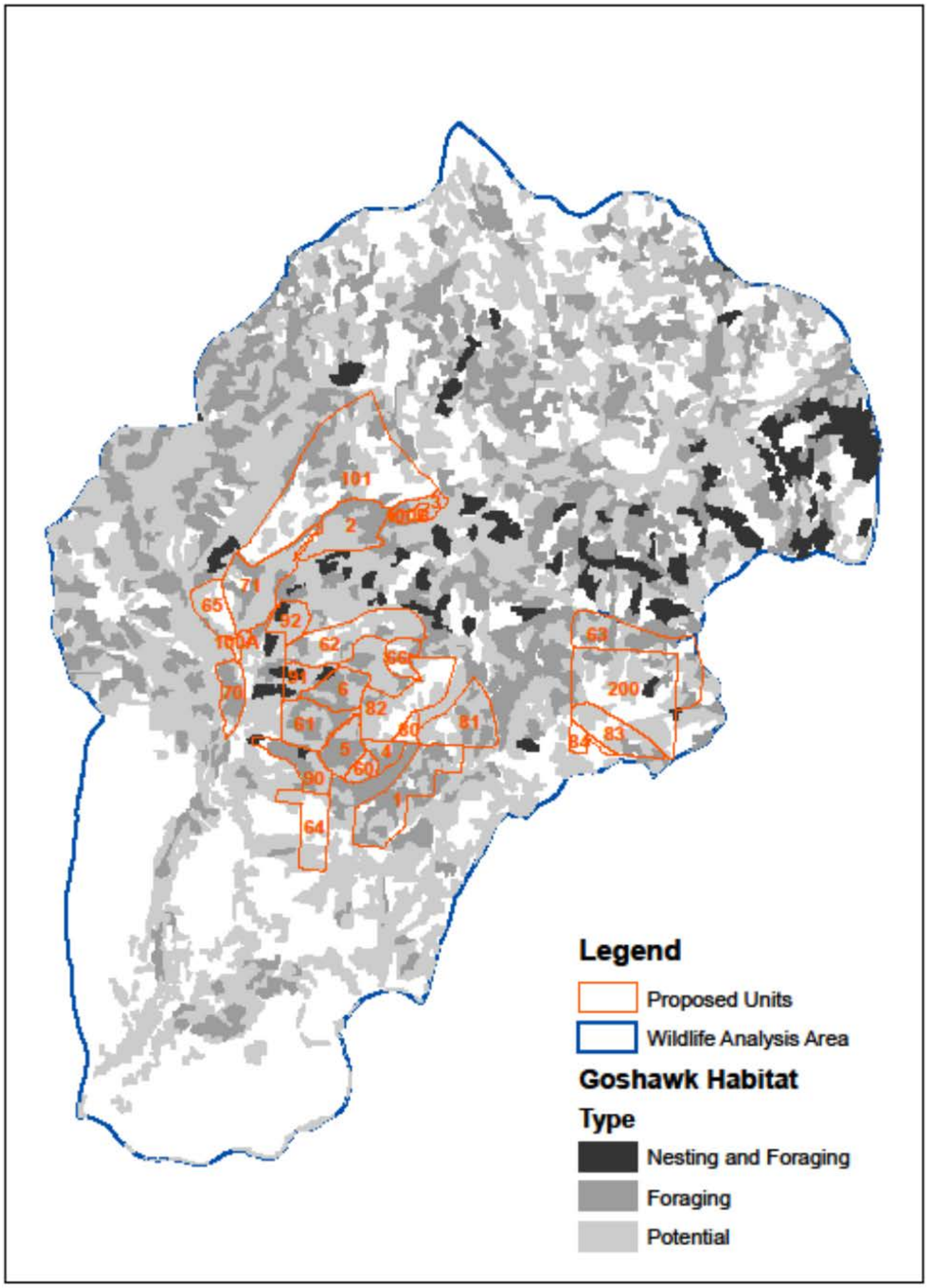
Table 38. Estimated foraging habitat in the Marshall Woods wildlife analysis area.

	Grass/ Forb/ Shrub	Seedling/ Saplings (< 5" dbh)	Small-Medium Trees (5 to 8.9" dbh)	Medium to Large Trees (9" dbh and greater)	Total Forested	Total Foraging
Existing in the Marshall Woods analysis area	8,054	2,151	4,754	13,468	20,373	28,427
	28.3%*	10.6%**	23.3%**	66.1%**		
Reynolds et al. 1992 recommendations	10% (VSS1)	10% (VSS2)	20% (VSS 3)	60% (VSS 4, 5, 6)		

*Grass/Forb/Shrub % is calculated by dividing acres by total foraging.

** Tree size class % is calculated by dividing acres by total forested.

Figure 43. Goshawk habitat within the analysis area for the Marshall Woods Restoration Project. Habitat model is based on R1VMap data, with categories described roughly by Samson (2006a), and modified by the Lolo NF (see PF for additional details).



Environmental Consequences

The effects of direct and indirect human disturbance near nest sites, inside or outside the breeding season, are not well documented. Human disturbance near nests, particularly during incubation, can cause nest failure (Boal and Mannan 1994). Heavy equipment operation within 330 feet of a nest has been shown to result in the adults abandoning the nest area, even with 20-day old nestlings present (Squires and Kennedy 2006). If adults abandon a nest with eggs or nestlings present, the eggs or nestlings will die from exposure, starvation, and/or predation.

Conversely, Zirrer (1947 in Squires and Kennedy 2006) noted repeated nesting attempts by goshawks despite extreme disturbance. On the Lolo NF, a goshawk in the Pattee Canyon Recreation Area east of Missoula has nested adjacent to a heavily used hiking/biking trail for the past several years, has attracted media attention for its repeated defensive behavior towards hikers during the nesting period, yet continues to return to the area to nest year after year.

In northern Idaho, Moser and Garton (2009) found timber harvest that occurred outside the breeding season in goshawk PFAs had no short-term effects (1 to 2 years after treatment) on breeding area occupancy, nest success, or productivity as long as adequate nesting habitat was available. However, because of a number of confounding factors (such as variation in weather) 1 to 2 years is not a long enough period of time to detect changes in occupancy rates relative to timber management (Reynolds et al. 2005; Woodbridge and Hargis 2006).

McGrath et al. (2003) found that goshawks in central Washington and northeastern Oregon (n = 82) occurred closer to human disturbances (i.e., forest roads) compared with random sites, with productivity levels well within the ranges reported for other studies throughout the western United States. McGrath stated that human disturbance does not appear to be a factor for the northern goshawk as long as 70% of the nest area structure is maintained and timber management operations are restricted to avoid activity during breeding and fledging time periods.

Given the above, impacts to goshawk will be measured based on the risk of disturbance to young and adults during the nesting period (discussed above); and changes in nesting and foraging habitat will be compared with management recommendations (Reynolds et al. 1992; and summarized in Brewer et al. 2007).

Alternative A - No Action Alternative

Direct & Indirect Effects to Northern Goshawk

Because this alternative would not change the existing vegetative condition in the project area, it would not directly or affect goshawks or their habitat. It is worth mentioning that the no action alternative would likely result in the continued aggressive suppression of fires within the project area, and taking no action would limit the Missoula Ranger District's ability to use prescribed fire in this area. For these reasons, shade-tolerant species such as Douglas-fir would continue to regenerate in the forest understory. Stands would develop denser understories and shade-intolerant species would decline. In the long term, these conditions would increase the likelihood of large-scale, stand-replacing fire which would have negative impacts on goshawk habitat.

Cumulative Effects to Northern Goshawk

See discussion in Cumulative Effects section below. Also recognize that taking no action on this project and in other situations where forests have missed one or more fire return intervals due to fire suppression could be detrimental to goshawks and other species over time.

Alternatives B, C, and D

Direct & Indirect Effects to Northern Goshawk

Direct effects to goshawks could occur under these alternatives through displacement of individuals during project implementation. The vegetation treatment, activity fuels treatment, ecosystem maintenance burning, and road work would occur over a period of at least 10 years so the impacts would be at a small scale over a relatively long duration. The overall project area is approximately 13,000 acres, which theoretically could contain several goshawk pair territories (the range of territory sizes is 1,409 to 8,649 acres).

Nesting Habitat — None of the alternatives include commercial harvest of goshawk nesting habitat. A few small patches of nesting habitat (less than 50 acres total) exist in Units 90, 91, and 92, which are proposed for non-commercial thinning, piling, and burning. The treatments would not remove potential nest trees, canopy would remain relatively intact, and the area is currently thought to be unoccupied by goshawks. Thus no short-term harvest-related disturbance to goshawks would be expected, and long-term improvements to habitat would be expected.

Brewer et al. 2009 recommends that one-to two-storied stands with 68-92 % canopy cover and basal area weighted dbh of >10" be retained as follows, "Maintain at least 240 acres of nesting habitat in patches (stands) of at least 40 acres per home range." To reiterate what was previously discussed, nesting habitat comprises only about 1,100 acres of the 28,000 acre analysis area (2-3% of total). Of this total, only 428 acres are in patches greater than 40 acres with a mean patch size of 85 acres. These estimates equate to enough habitat to support perhaps two breeding pairs (240 acres in patches > 40 acres per pair) within the analysis area.

No goshawk nests or indications of goshawk occupancy of the project area have been detected. Thus it is unlikely that any of the proposed treatment areas are occupied by goshawks. However, if an occupied nest area is located in a proposed treatment unit at any time, the project would be changed to eliminate any treatment within a 40-acre area centered around the nest. In addition, no ground-disturbing activities would occur within a 420-acre area (the size of the post-fledgling area) centered on the occupied nest from April 15 (courtship and egg laying) through August 15 (30 days post-fledging when juvenile feathers become hardened and are capable of sustained flight) (discussed in Brewer et al. 2007). After August 15, treatments could commence inside the PFA, but not inside the nest area.

Foraging Habitat — Approximately 1,500 acres of foraging habitat lies within the proposed treatment units and could be minimally affected by commercial and non-commercial thinning and ecosystem maintenance burning associated with the action alternatives. Commercial and non-commercial thinning and ecosystem maintenance burning would retain the large trees (>10" dbh), and therefore would not change the distribution of size classes in the analysis area (shown in Table 38). These activities would reduce down woody debris accumulations which may impact goshawk foraging habitat due to potential reductions in prey species. These treatments would occur over a period of at least 10 years so the impacts would be at a small scale over a relatively long duration. Post-treatment, foraging habitat composition would be consistent with the recommendations from Reynolds et al. (1992).

Cumulative Effects to Northern Goshawk

Past, present, and reasonably foreseeable actions were evaluated for cumulative effects to northern goshawk (see Table 25 and Table 26) with specific acreages by individual project documented in the PF and discussed in the Forested Vegetation Specialist's Report.

As discussed previously, past timber harvest has occurred within the project area using various prescriptions and logging systems. In total, about 984 acres were harvested in the analysis area with prescriptions ranging from sanitation harvests (about 750 acres) to improvement cuts (about 200 acres) and shelterwood harvest (32 acres) in the past 30 years. These activities potentially had some impact on goshawk habitat quality, especially those that significantly reduced canopy closure and large tree abundance. These treatment areas are regenerating and cover values are increasing. This equates to increased foraging habitat for goshawks but does not provide suitable nesting habitat. The same is true for past fires in the project area, which in the past 30 years have burned 711 acres in the analysis area. Cumulatively, less than 2,000 acres of the analysis area has been burned or harvested in the past 30 years or so, and thus the majority of goshawk habitat in the analysis area has not been affected in recent years. The amount of non-habitat in the analysis area is indicative of the open south-facing hillsides, residential development, and rocky high elevation habitats within the analysis area, as well as the second-growth forest conditions in the main Rattlesnake corridor that were a result of harvesting in the early 1900s.

Activities such as forest succession and fire suppression may allow for the development of more structurally complex stands that would benefit goshawks and goshawk prey. In other untreated areas, a continued increase in tree densities in the sub-canopy may reduce the suitability of nesting habitat and prey availability (Squires and Ruggiero 1996, Graham et al. 1997). Thinning treatments to restore conditions in dry forest types historically maintained by frequent, non-lethal fires have occurred on minimal acres of the analysis area in the past 30 years. Alternatives B, C, and D are expected to improve foraging conditions for goshawks by restoring some forested areas that were historically maintained by frequent, non-lethal fire events. Treatments would not preclude the stands from developing into old growth in the future, and are expected to reduce the risk of an uncharacteristic stand-replacing event that would remove habitat altogether.

Proposed treatments are designed to create areas with a more vigorous, healthy, heterogeneous vegetative component adding biodiversity to the analysis area for goshawks and goshawk prey. Collectively these treatments would effectively reintroducing fire into the landscape. As such the project is not expected to contribute negative cumulative impacts to goshawk, goshawk habitat, or goshawk prey. These impacts would not likely result in any individual mortality. As such, the project would not increase the potential for further population declines or lead toward federal listing. For a detailed discussion on goshawk population viability see the PF (Brewer et al. 2007, Samson 2006a, b).

Snag/Cavity Habitat

The Forest-wide estimated average number of snags per acre with diameter at breast height (dbh) 10” and larger is 10.33 with a 90% confidence interval of 8.67 to 12.09 snags per acre (Bollenbacher et al., 2009). Forest Plan standards call for leaving 3 to 4 snags (at least 10” dbh) per acre in treatment units, depending on habitat type (USDA FS 1986, Appendix N).

The average number of snags per acre on the Lolo NF with dbh 20” and larger is 1.00 snags per acre with a 90% confidence interval of 0.75 to 1.27 snags per acre. Table 39 provides an estimate of snags by habitat group (with 90% confident intervals) that range in ascending order from warmer drier groups that provide habitat for flammulated owl and pileated woodpecker to cool, to cool moist groups that provide habitat for such species as lynx and fisher. Of note Table 39 likely under-estimates snag availability given large-scale fires that have burned in the past decade on the Lolo NF.

Table 39. Estimates of snags per acre / diameter group and habitat type group and associated confidence intervals (CI) (Bush et al. 2003)

Habitat Group	Snags Per Acre > 10"			Snags Per Acre > 20"		
	90% CI Lower Bound	Estimation of Mean	90% CI Upper Bound	90% CI Lower Bound	Estimation of Mean	90% CI Upper Bound
1	0.000	3.232	8.551	0.000	0.810	2.665
2	3.539	5.932	8.597	0.229	0.617	1.076
3	3.360	5.688	8.344	0.465	0.979	1.575
4	9.385	12.346	15.578	0.693	1.120	1.594
5	7.982	12.555	17.816	0.226	0.654	1.179
6	12.127	19.915	28.347	0.831	2.218	3.782

Snag surveys were conducted in portions of the Marshall Woods project area, including in Units 1, 4, 5, and 6, to document the location, size, and condition of large snags (18" or larger) that could provide habitat for wildlife species, particularly flammulated owls (see Project File). Densities of these large snags ranged from 0.34-1.22 snags/acre, and spatial distribution was well-distributed (though not evenly distributed) throughout the units (see snag locations on Figure 42 above). As previously mentioned, snag densities in Units 2 and 3 are low due to the clearcut logging that occurred in those areas in the early 1900s that did not intentionally retain snags.

All action alternatives would maintain snags (and downed wood) in all commercial treatment units consistent with MA direction, Forest Plan standards, and management direction outlined in USDA-FS 2000; 2006. Snag retention beyond Forest Plan standards would likely occur in Units 1, 4, 5, and 6 (see Resource Protection Measure #44).

Pileated Woodpecker

Habitat in and Use of the Analysis Area

Habitat conditions for pileated woodpeckers are assessed for the project area, which is much larger than the reported home ranges for this species, making it an appropriate sized area for assessment.

Snag surveys were conducted in one representative commercial unit in the summer of 2011 to determine the relative abundance and distribution of snags as well as to document evidence of wildlife use of these important habitat features. Snags were less formally assessed in other units during walk-through examinations and/or searches for other wildlife species (e.g., flammulated owls and goshawks). Evidence of pileated woodpecker use (i.e., large cavities, and foraging holes at the base of trees) was observed on many of the large snags in the project area.

Call-back surveys were also conducted for pileated woodpeckers at 20 points along transects (points spaced 400 m apart). One pileated woodpecker responded vocally to the call on June 13, 2011 calling from NW of the main Rattlesnake Trail in Unit 2. Another pileated woodpecker was incidentally observed while conducting snag surveys in Unit 4 in July 2011, and another was heard while doing a walk-through in Unit 92 in February 2011. Owl researchers in the area also reported finding a pileated woodpecker nest in a snag in Unit 1 in 2010.

Environmental Consequences

Alternative A - No Action Alternative

Direct & Indirect Effects to Pileated Woodpecker

Because this alternative would not change the existing vegetative condition on the project area, it would not impact pileated woodpeckers. However, there would be some negative indirect effects for pileated woodpeckers under this alternative. These effects would be related to the persistence of dense understories and the continued exclusion of frequent, low intensity fires. Over time, these two factors would contribute to ever increasing chances of a stand-replacing fire in the area which could result in the loss of old-growth habitat conditions, live and dead large diameter trees, and creation of habitat unsuitable or of poor quality for pileated woodpecker nesting for a long duration of time. In addition, these conditions would not allow for the regeneration of shade-intolerant species such as western larch and ponderosa pine, species highly important to the pileated woodpecker.

Cumulative Effects to Pileated Woodpecker

See discussion in Cumulative Effects section below. Also recognize that taking no action on this project and in other situations where forests have missed one or more fire return intervals due to fire suppression could be detrimental to pileated woodpeckers and other species over time.

Alternatives B, C, and D

Direct & Indirect Effects to Pileated Woodpecker

Direct effects to pileated woodpeckers could occur under this alternative through displacement of individuals during project implementation. The vegetation treatment, activity fuels treatment, ecosystem maintenance burning, and road work would occur over a period of at least 10 years so the impacts would be at a small scale over a relatively long duration. Known nesting habitat in the form of large diameter snags occurs on the project area so there is potential for disturbance of this species during nesting. However, timing restrictions for commercial Units 1, 4, 5, and 6 (for flammulated owl nesting) would also minimize disturbance to nesting pileated woodpeckers in those areas.

Indirect effects to pileated woodpeckers could occur under this alternative in the form of snag loss during location of skid trails and landings. This would be most pronounced on commercial units (740 acres, 515 acres, or 0 acres, for Alternatives B, C, and D, respectively). Conversely, prescribed burning can provide additional feeding and nesting habitat by promoting large diameter, open stands and producing new snags. During project activities, the snag management guidelines in the Forest Plan would be followed. Further, Resource Protection Measures specify that "large, healthy ponderosa pine trees will be favored as leave trees. Any live trees >21" dbh (in Units 1, 4, 5, and 6) will be retained, regardless of species, to the extent practicable given project objectives and implementation logistics. Due to the importance of large diameter snags…with the exception of snags near roads, skylines, trails, or high use recreation sites, where public and operational safety and facility protection is necessary, all dead trees greater than or equal to 21" dbh will be retained within treatment units" (see Resource Protection Measure #35).

Removing commercial-sized trees that are infested with insects can also be considered an indirect impact to pileated woodpecker. However, this species is more of a generalist than other woodpeckers and does not depend heavily on bark beetles as a food source. Thus, the removal of trees infested with bark beetles should be viewed as a minor impact on pileated woodpeckers.

Cumulative Effects to Pileated Woodpecker

Removal of snags during harvesting, fire suppression, and extensive salvage programs have historically impacted pileated woodpecker habitat throughout Region One. Harvesting can remove snags, and fire suppression reduces the number of snags created across a landscape. Under current practices, habitat concerns related to pileated woodpeckers and other species are addressed. In most cases, large, high quality snags are now left in harvest and salvage units, and prescribed burning helps recruit new, fire-scarred snags.

Prior to 1900, underburns kept most of the ponderosa pine stands in and open, park-like condition dominated by large old trees (Arno, Scott and Hartwell 1995). Many of these stands were harvested during the early settlement because they were easily accessible at low elevations. Both harvesting and fire suppression allowed Douglas-fir to develop dense thickets in what were once open stands. These thickets made foraging difficult for flammulated owls and removal of older trees reduced nesting sites for the secondary cavity nesters.

Projects that protect and recruit large diameter ponderosa pine and western larch stands are beneficial for pileated woodpeckers. As discussed previously, past Forest Service timber harvest has occurred within the project area using various prescriptions and logging systems. In total, about 984 acres were harvested in the analysis area from 1950 to present with prescriptions ranging from sanitation harvests (about 750 acres) to improvement cuts (about 200 acres) and shelterwood harvest (32 acres). These activities potentially had some impact on pileated woodpecker habitat quality, especially those that significantly reduced large tree abundance or removed large snags. These activities have affected minimal amounts of pileated woodpecker habitat within the project area, and the proposed action alternatives would have minimal effects in addition to past actions. The proposed actions, especially Alternatives B and C, promote long-term recruitment of mature stands with large diameter trees and snags that would benefit pileated woodpeckers.

Therefore, implementation of any of the action alternatives may disturb or disrupt individual pileated woodpeckers, would not have significant impacts at the population scale. The impacts would be primarily in the form of displacement associated with timber removal activity and associated road work and would not likely result in any individual mortality. As such, the project would not increase the potential for further population declines or lead toward federal listing. For a detailed discussion on pileated woodpecker population viability see the PF (Samson 2006a).

ELK

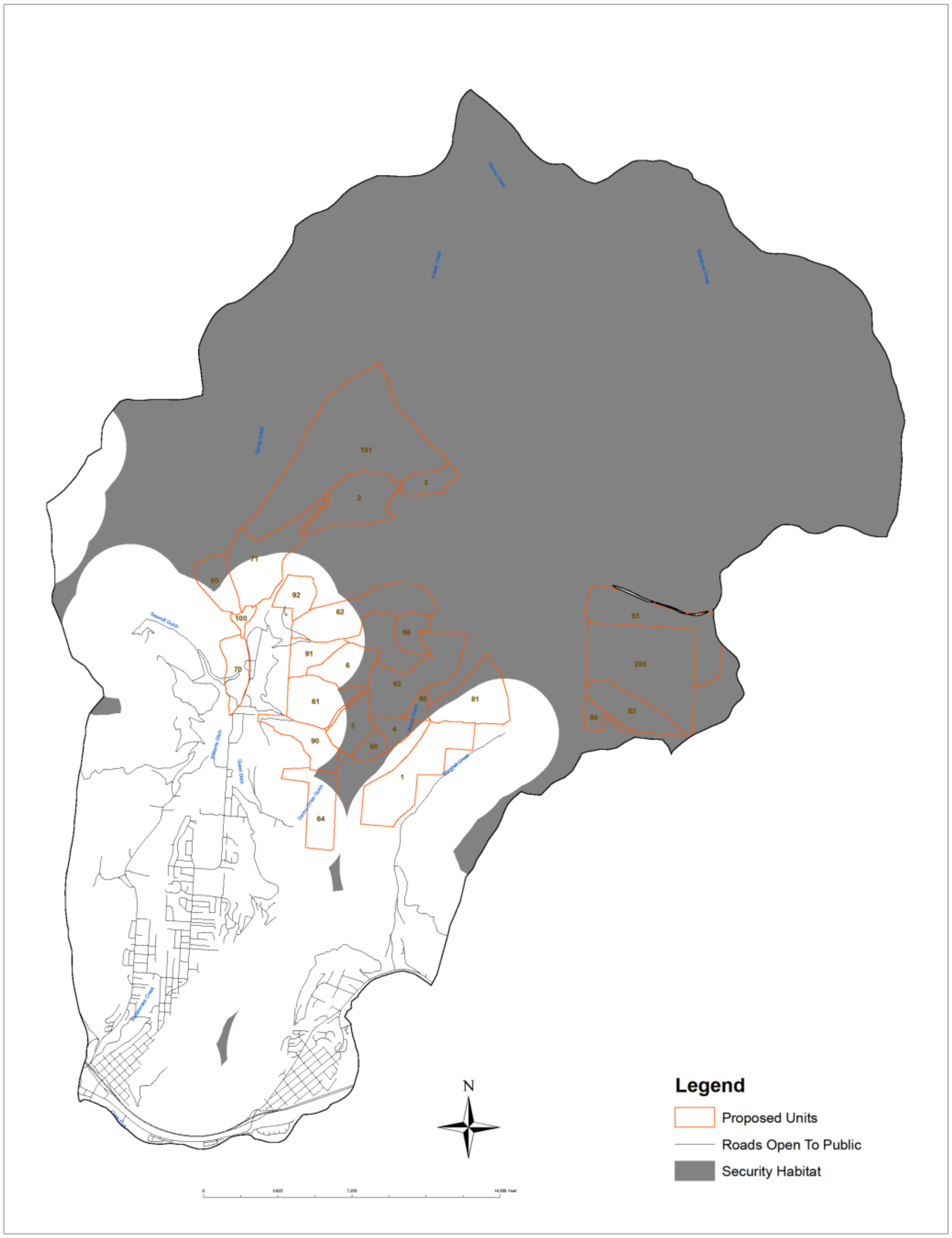
Habitat in and Use of the Analysis Area

The analysis area receives use by two elk herds—the North Hills/Evaro herd and the Mount Jumbo herd. Both of these herds utilize the upper parts of the analysis area (the Rattlesnake NRA and Wilderness) during the summer months, then head to their respective winter ranges in late fall. The project area lies directly within the range of the Mount. Jumbo herd. The Mount Jumbo elk herd consists of 90-100 elk. In the winter, the herd uses the open slopes and saddles of Mount. Jumbo when snowfall is greatest. When snowfall is not as deep, and later in the spring, the herd spends most of its time between Jumbo saddle and Woods Gulch area (particularly in sections 12, 1, 6, 31, and 36 of the project area). The variable terrain and existing forested cover provides better protection than the open slopes of Mount Jumbo, and is preferred habitat when snowfall allows.

Roads that are open to public vehicular traffic in the analysis area are concentrated in the southern portion, and are non-existent in the northern-most portions of the analysis area (RNRA and Wilderness; see Figure 44 – Security Habitat). Nearly two-thirds of the analysis area (17,854 acres) provide security habitat for elk, most of which is in areas that elk would be using in the hunting season (fall). This far exceeds the recommended 30% of a herd area recommended by Hillis et al. (1991).

In the project area there are 499 acres of lands designated MA 23. Table 40 displays the canopy cover on these MA 23 lands. Of these lands, approximately 316 acres 63% provide relatively dense cover (>40% canopy cover, according to R1VMap data). Another 144 acres (29%) provides forested cover with 25-40% canopy, and only 39 acres (7%) are in grass/shrub or forest with <25% canopy cover.

Figure 44. Security habitat within the Marshall Woods analysis area. Security habitat is areas that are larger than 250 acres and are located >1/2 mile from roads that are open to public motorized use.



Environmental Consequences

Alternative A - No Action Alternative

Direct & Indirect Effects to Elk

This alternative would not involve any timber harvest in elk winter range, and thus would not cause disturbance to wintering elk herds. However, the lack of thinning and fire in forested stands within the winter range areas would contribute to a continuing trend towards poorer quality habitat, in which understory shrubs and grasses become more and more stagnant and unpalatable. In addition, weed treatments would not occur, except along existing roads and trails. No change in security habitat would occur. Thus there would be no disturbance to elk in the short term, but potentially negative effects on habitat in the longer term.

Cumulative Effects to Elk

Aggressive fire suppression would continue and, if effective, could contribute to the downward trend in elk forage in some areas. Invasive plant treatments would continue to be pursued under the existing Forest weed management program (USDA-FS 2008).

Alternatives B, C, and D

Direct & Indirect Effects to Elk

Elk Security- Under all of the action alternatives, there would be no change in elk security, as no roads would change from open to closed or vice versa that would impact security habitat. However, the decommissioning of roughly 7 miles of road would limit walk-in hunter access minimally, creating perhaps a little more security for elk.

Elk Disturbance- Project design includes measures to minimize disturbance to wintering elk on and near Mount. Jumbo if harvesting occurs during winter months. It may not be feasible to completely avoid the commercial units within elk winter range (Units 1, 4, 5, and 6) during the winter, due to other resource concerns. Mechanical harvesting in these units needs to be done under dry or frozen ground conditions to protect soils (see Soils Specialist's Report). Because these units would be closed to harvesting during most of the summer to protect flammulated owl nesting habitat, it may be necessary to work in these units during the winter months when elk are wintering in the area. To minimize the disturbance under Alternatives B and C, the commercial units within the Mount. Jumbo elk herd's winter range would be harvested in phases, with Phase 1 (Unit 1) being completed before Phase 2 (Units 4, 5, and 6) or vice versa, to provide elk refugia from harvest-related disturbance (Resource Protection Measure #37). Even with these amends, however, there could be short-term, small-scale disturbance to the Mount. Jumbo elk herd, likely limited to one winter season for commercial harvesting, and potentially another winter season with very minimal disturbance associated with sale layout/marking.

Winter Range Habitat- Prescribed burns can improve browse and forage production by removing competing vegetation, returning nutrients to the soil, encouraging sprouting and bringing the shrubs down to browsing height. Prescribed burning on the Lolo NF has increased forage production from 59 pounds/acre to 1,189 pounds/acre or about twenty fold, and that was the average for the test stands, not the maximum (Hillis and Applegate 1998). In Alternatives B, C, and D, thinning treatments and ecosystem maintenance burning are expected to maintain or enhance forage quality and quantity for big game, especially on winter range (see Fire and Fuels and Forested Vegetation Specialists' Reports). Weed treatments would be expected to mitigate the potential spread of invasive weeds in harvested, thinned, and burned units (see Noxious Weeds Specialist's Report).

Forest Plan standards for MA 23 relate to elk winter range, and require a 50:50 cover:forage ratio. This MA applies to Units 1 and 81 in the project area, and also includes some areas not in proposed treatment units. According to the Forest Plan, the "majority of cover should be thermal cover, that is, trees greater than or equal to 40 feet tall with a crown density greater than or equal to 50 percent." This condition is usually met in forest stands that have an average canopy cover of 25% or greater, as long as the trees are mature enough to be 40 feet or taller.

There are 499 acres of MA23 in the project area, 369 of which are in two treatment units (Units 1 and 81). Unit 1 currently provides cover throughout most of the unit, as the majority has canopy cover >25% and consists of large trees. Unit 81 consists primarily of smaller trees that do not currently provide "cover," as they are less than 40 feet tall. The other areas within MA23 are considered to provide cover. Currently 75% of the project area in MA23 has canopy 25% or greater, meaning it provides "cover." Commercial harvest in Unit 1 under Alternatives B and C would reduce canopy cover, while retaining the largest, healthiest ponderosa and larch trees with dense crowns (the trees that provide the best cover for wintering ungulates). Opening up the canopy would allow more light to reach the forest floor, stimulating the growth of grasses and shrubs in the understory that provide forage. Under Alternative D the canopy cover would be retained to a greater extent, as only smaller trees would be cut. This would retain greater cover, but result in less light reaching the forest floor to stimulate the growth of forage. Under Alternatives B and C, the proportion of the MA23 that has canopy cover of 25% or more is estimated to be 50%, whereas it would be 62% under Alternative D. Thus under any of the action alternatives, the cover:forage ratio would meet the Forest Plan standard for this MA.

Table 40. Estimates of canopy cover that exist in the portions of the Marshall Woods project area that fall within MA 23 currently (Alt A= existing condition) and under the proposed alternatives. Acres of land with canopy cover 25% and higher (shaded in gray below) are considered to provide "cover" whereas acres <25% should be considered "forage."

	Canopy Class	Alt A	Alt B	Alt C	Alt D
	10-24.9%	7	128	128	67
	25-39.9%	99	151	151	125
	40-59.9%	272	99	99	185
	Herb/grass	7	7	7	7
Acres	Shrub/Small Trees	113	113	113	113
	10-24.9%	1%	26%	26%	14%
	25-39.9%	20%	30%	30%	25%
	40-59.9%	55%	20%	20%	37%
	Herb/grass	1%	1%	1%	1%
%	Shrub/Small Trees	23%	23%	23%	23%

Unit 64 is included in all alternatives. This unit is in MA 19, which is identified in the Forest Plan as being important winter range for big game. Goals for this MA are to optimize winter range, and to provide opportunities for dispersed recreation. The MA is classified as unsuitable for timber production. Under all alternatives, this unit would be non-commercially thinned to reduce small tree densities, then burned to stimulate grass and shrub growth and reduce fuels. The proposal meets Forest Plan Standards for MA 19, which allow for prescribed burning to "maintain or restore the composition and structure of plant communities, or for hazard reduction purposes."

Cumulative Effects to Elk

Past, present, and reasonably foreseeable activities in the analysis area have been considered in terms of their influences on elk security, winter range quality, and disturbance. Because of NRA and Wilderness area designations in the analysis area and the subsequent lack of road building on NFS lands in those areas, elk security in the analysis area has changed very little in the past several decades. The sale of several sections of former Plum Creek Timber Company lands to the Forest Service via the Montana Legacy Project helped to ensure these areas will not likely experience growth or opening of roads to vehicular traffic, which will ensure long-term security for elk.

Very little timber harvest has occurred in the analysis area, at least on NFS lands, in recent decades. Combined with aggressive fire suppression, this has led to conditions in which forest stands that historically experienced regular low-intensity fire that would have regenerated or stimulated growth of shrubs and grasses that would have provided forage for wintering elk, are currently over-grown and in need of disturbance. All of the action alternatives are expected to have long-term benefits to elk winter range. Restoring fire to several areas, especially the large EMB on Strawberry Ridge and in Section 33 (Unit 200) would be especially beneficial to stimulating forage growth for elk and other big game species. Under any of the alternatives, invasive plant treatments would continue to be pursued under the existing Forest weed management program (see Weeds Specialist's Report).

The analysis area has seen increased recreational use, and thus potential disturbance to wintering elk, with the increasing Missoula population and increasing popularity of hiking and mountain biking. However, efforts have been made to protect wintering elk from disturbance by limiting recreation in the heart of their winter range during critical times of the year. As stated above the Mount Jumbo Advisory Committee advises, and Missoula Park & Recreation enforces, a closure of the trails on the southern portion of Mount Jumbo (south of the saddle) from Dec 1- March 15. Trails from Jumbo saddle to Woods Gulch (roughly sections 12, 7, 1, and 6) are closed to recreational use from Dec 1 to May 1 to avoid disturbance to the herd. Timber harvest associated with Alternatives B and C could occur during the winter months when elk are on their winter range. Resource Protection Measures would allow project-related disturbance to only occur in small portions of the winter range at a time, thereby ensuring undisturbed refugia for elk in other portions of their range (see Resource Protection Measure #37). The effects of the disturbance that could occur could have short-term, small scale effects on the elk herd in terms of creating stress to individuals or displacing them from a portion of their range, but would not contribute to long-term disturbance of elk, and the reduction in non-system trails would further decrease disturbance to elk in the project area.

Summary of Effects/ Forest Plan Consistency

Any project-related impacts to elk would be primarily in the form of short-term displacement during timber removal activities and would not likely result in any individual mortality. In the long term (> 10 years), the activities proposed under these alternatives would likely be beneficial to elk in the area. This determination is based on the following rationale:

- Habitat suitable for elk is known to occur within the project area and thus, elk could be displaced by on-the-ground activity.
- No even-aged harvest would occur, and the overall forested nature of all treated stands would be retained.
- Treatment prescriptions included in the action alternatives create habitat conditions generally favorable to elk, including stimulation of browse and forage after prescribed fire.
- Elk security would remain high in the analysis area, and the proposed road decommissioning would result in enhanced elk protection.
- Timing restrictions which may concentrate most mechanical activities in winter when elk are likely to be using the project area, are designed to minimize large-scale displacement potential by working in phases.
- Under any of the action alternatives, cover:forage ratios for MA 23 lands in the project area would meet Forest Plan standards. Treatments in areas designated MA 19 would optimize winter range and continue to provide for dispersed recreation. Thus the action alternatives are consistent with Forest Plan Standards for elk.

Other Wildlife Species Of Concern For Project

Comments or concerns regarding a few other wildlife species were brought up during scoping for this project, and will be addressed here. These species are not federally listed, are not Sensitive, and are not Management Indicator Species for the Lolo NF.

Black Bear

Black bears inhabit the entire analysis area, utilizing a variety of habitat types. The project would continue to manage for a heterogeneous forest, which would benefit black bears. Black bears are known to den in the Woods Gulch area (per scoping comments submitted by MDFWP). Some commercial harvest could occur in Units 1, 4, 5, and 6 during the winter months, which could disturb denning black bears. Thinning using machinery in non-commercial units could also cause disturbance to black bears. Units proposed for hand thinning or EMB burning would likely not be treated before bears emerge from dens in late March or early April. Since black bear populations are healthy and robust across the state of Montana, any effects of disturbance to denning bears would not affect the population. Contractor provisions would require that any suspected bear dens be reported to the wildlife biologist, so site-specific mitigation can be determined at that time (Resource Protection Measure #43).

Mule Deer

Mule deer winter in the RNRA, particularly on the south-facing slopes above Rattlesnake Creek in sections 24, 19, and to some extent 26. While mule deer are somewhat less sensitive to disturbance than elk, long-term or repeated disturbances to wintering animals such as those associated with timber management, can cause stress during the most critical part of the year (December-April).

As a result of this comment, a Resource Protection Measure (RPM) was developed to minimize, to the extent feasible, the disturbance to mule deer around Units 101, 2, 3, and 71, during winter. Because of other resource concerns, including impacts to both recreation and soils, it was not feasible to completely restrict activities in those units to non-winter months. Therefore, the RPM is intended to provide undisturbed refugia for mule deer in portions of the project area if activities are to occur during winter months. Because Unit 101, which encompasses Strawberry Ridge, is proposed for an ecosystem maintenance burn, any prep work or burning activities in this unit would occur after the snow is melted and mule deer are able to disperse to other parts of their range. Otherwise Unit 101 would offer undisturbed refugia to mule deer during crucial winter months, even if activities were conducted in the other units.

Woody Draw

Comments during scoping pointed out the importance of woody draws in Unit 101 to contributing habitat for a variety of songbirds, as well as black bears and other mammals, and voiced concerns about measures that would be taken to control fire intensity to allow for dense vegetation to be maintained in seeps/springs/draws. Woody and ephemeral draws are addressed in project design, and resource protection measures for both soils and fisheries resources include measures that limit harvesting in these areas, and restrict ground ignition within 50 feet of perennial streams or scoured channels (see Resource Protection Measure #s 11 and 50). Incidental prescribed fire would be allowed to creep into these areas, and may cause some mixed-severity burning in a patchy, heterogeneous manner that would retain some vegetation while stimulating new growth of other vegetation. Vegetation in draws regenerates rapidly after a low or moderate intensity fire, and would continue to provide habitat for wildlife.

Table 41. Wildlife species considered in the Marshall Woods project area.

Species	Status on Forest	Preferred Habitats	Species and/or Habitat Present in Project Area?	Summary Determination Alternative A	Summary Determination Alternatives B, C, and D
Canada Lynx Lynx canadensis	Threatened, Critical Habitat	Subalpine fir/Engelmann spruce habitat types above 4,100 feet in elevation, vertical structural diversity in the understory (down logs, seedling/saplings, shrubs, forbs) for foraging and denning	Yes; part of project area within a Lynx Analysis Unit; occupied habitat, critical habitat	NE	NLAA lynx and lynx critical habitat
Grizzly Bear Ursus arctos	Threatened	Alpine/subalpine coniferous forest, lower elevation riparian areas in spring, lack of human disturbance.	Yes, project area is outside but adjacent to the NCDE Recovery Zone boundary, outside the occupied distribution area (USFWS 2004), within currently occupied range.	NE	NLAA
Yellow-billed Cuckoo Coccyzus americanus	Threatened	Deciduous forest stands of 25 acres or more with dense understories and in Montana these areas are generally found in large river bottoms	No, large willow or cottonwood stands of 25 acres or more do not exist within the project area	NE	NE
Wolverine Gulo gulo	Sensitive	Large areas of unroaded security habitat; secure denning habitat; persistent spring snowpack.	Yes, upper elevations of the project area include possible wolverine habitat, and big game abundance in area could provide food sources.	NI	MIIH

Bighorn Sheep Ovis canadensis	Sensitive	Steep slopes, open habitats that facilitate predator detection and provide ample graze and browse.	Yes, the Bonner herd of bighorn sheep utilizes parts of the project area	NI	MIIH
Gray Wolf Canis lupus	Sensitive	Habitat generalists. Lack of human disturbance, abundant prey (primarily elk) required.	Yes, individual wolf activity noted within the Rattlesnake Creek area	NI	NI
Fisher Pekanni pennanti	Sensitive	Moist mixed coniferous forested types (including mature and old-growth spruce/fir at low- to mid-elevations), riparian/forest ecotones, secure denning habitat.	Yes, minimal habitat exists in riparian areas	NI	MIIH
Northern Bog Lemming Synaptomys borealis	Sensitive	Wet riparian sedge meadows, bog fens.	N, nearest bog lemming habitat (occupied) is several miles west of Project area, dropped from further review	NI	NI
Townsend's Big-Eared Bat Plecotus townsendii	Sensitive	Roosts in caves, mines, rocks and buildings. Snag roosting habitat also important. Forages over tree canopy, wet meadows, riparian areas and open water.	Yes, abandoned mine adits within project area; abundant snag roosting, and riparian foraging available	NI	NI
American Peregrine Falcon Falco peregrinus	Sensitive	Cliff nesting (ledges); riparian foraging (small bird species prey).	Yes, riparian foraging lower along Clark Fork several miles south of project area	NI	NI
Bald Eagle Haliaeetus leucocephalus	Sensitive	Nesting platforms near a large open water body (> 80 acres) or major river system; available fish and water bird species prey, secure nesting habitat.	Yes, nesting documented on Clark Fork River, foraging habitat present	NI	NI

Black-backed Woodpecker Picoides arcticus	Sensitive	Burned forests or less typically, coniferous forests with high insect infestations (i.e. bark beetles)	Yes, some beetle infested trees present, although no recently burned forests in project area	NI	MIIH
Common loon Gavia immer	Sensitive	Lake habitat. Secure nesting and brood rearing areas.	No, lake habitat does not exist within project area, nearest suitable habitat is located on the Seeley Lake Ranger District, therefore the species was dropped from further review	NI	NI
Flammulated Owl Otus flammeolus	Sensitive	Mature (> 9 inches dbh) and old-growth ponderosa pine/Douglas-fir with abundant moth species prey. Secure nesting habitat (> 35% canopy cover).	Yes, nesting and summer foraging habitat within the project area, and known nest sites documented	NI; long-term MIIH	MIIH
Harlequin Duck Histrionicus histrionicus	Sensitive	During the breeding season, found near large, fast flowing mountain streams.	Yes, suitable habitat occurs in upper Rattlesnake Creek in the project area	NI	NI
Coeur d'Alene Salamander Plethodon vandykei. idahoensis	Sensitive	Talus rock near seeps, streams and waterfalls at elevations < 5,000’.	No, nearest habitat on Superior Ranger District near the Montana Idaho border, dropped from further review	NI	NI
Northern Leopard Frog Rana pipiens	Sensitive	Typically in or adjacent to permanent slow moving or standing water bodies with considerable vegetation	No, outside of range for this species, dropped from further review	NI	NI

Western Toad Bufo boreas	Sensitive	Variable including; wetlands, forests, woodlands, sagebrush, meadows and floodplains. Over winters in caverns or rodent burrows	Yes, breeding sites possible in wetlands, upland habitats in forests adjacent to wetlands	NI	MIIH
Northern Goshawk Accipiter gentilis	MIS	West of continental divide: Stands w/ mean diameter of > 10", crown closures of at least 40% and elevations below 6,200' Foraging habitat is variable but typically in mature stands with dense canopies fairly open understories	Yes, nesting/foraging habitat	Meets Forest Plan Direction	Meets Forest Plan Direction
Pileated Woodpecker Dryocopus pileatus	Old-growth/Snag MIS	Moderately warm, dry Douglas-fir/ponderosa; moderately cool, dry Douglas-fir; moist mid-elevation spruce/grand fir. Large, soft snags (> 21 "dbh).	Yes, year-round habitat	Meets Forest Plan Standards	Meets Forest Plan Standards
Elk Cervus elaphus	Commonly hunted MIS	Habitat generalists, secure habitat during the hunting season, secure winter range.	Yes, year-round habitat throughout project area, and winter range within project area	Meets Forest Plan Standards	Meets Forest Plan Standards

BOTANY

EXISTING CONDITIONS

Based on habitat and species distribution information, the analysis area is most likely to provide potential habitat for the following sensitive plant species: Ageratina occidentale (western snakeroot), Allium acuminatum (tapertip onion), Clarkia rhomboidea (diamond clarkia), Cypripedium fasciculatum (clustered lady's slipper), Dryopteris cristata (crested woodfern), and Heterocodon rariflorum (rareflower heterocodon).

Field surveys focused searching for Cypripedium fasciculatum, Allium acuminatum, Clarkia rhomboidea, and Heterocodon rariflorum in the highest quality habitat in the proposed vegetation treatment units. No Forest Sensitive plants were located in the project area.

ENVIRONMENTAL CONSEQUENCES

Effects Common to All Alternatives

Vectors such as vehicle traffic, wildlife, and recreationalists would continue to spread invasive plants in the project area. Potential habitat for Ageratina occidentale, Allium acuminatum, Clarkia rhomboidea, Cypripedium fasciculatum, and Heterocodon rariflorum would be degraded as invasive plants become more widespread, but the viability of these species would not be adversely affected. Potential habitat for Dryopteris cristata would be less likely to be impacted since this plant grows in wet habitats and most of our invasive plants tend to occupy heavily disturbed, open dry habitats.

Alternative A (No Action)

The rate of invasive plant spread in the project area would remain at current rates (see Weeds Specialist's Report) under Alternative A. While the action alternatives would create ground disturbance, herbicide treatment of haul routes, decommissioned roads, landings, and other areas where ground disturbance is proposed in the action alternatives would not occur. Potential habitat for Ageratina occidentale, Allium acuminatum, Clarkia rhomboidea, Cypripedium fasciculatum and Heterocodon rariflorum would remain widespread in the project area but perhaps of lower quality due to a greater presence of invasive plants.

There would be no other effects on any Sensitive plant species besides those mentioned under Effects Common to All Alternatives.

Alternative B (Proposed Action), Alternative C, and Alternative D

One difference between the action alternatives is the proposed vegetative treatments for Units 1-6. The amount of canopy cover reduced and acres of handpiling differs between alternatives. Greater canopy cover reduction can increase impacts to Cypripedium fasciculatum habitat and plants (if they are present). This plant does best where there is sufficient canopy cover to protect the plants from drying prior to fruiting. This is important in drier Douglas-fir habitat types. Handpiling and machine piling could have negative impacts on Allium acuminatum, Clarkia rhomboidea, Cypripedium fasciculatum, and Heterodocon rariflorum plants if they are present.

Alternative B includes commercial thinning and burning in Units 1-6 with an average 45% canopy cover reduction. Unit 1 may have handpiling prior to burning. Alternative C is similar to Alternative B but Units 2 and 3 would be non-commercially thinned and handpiled and underburned. This alternative may provide fewer impacts to potential Cypripidium fasciculatum habitat because less canopy cover would be removed. However, potential negative impacts to individual plants of A. acuminatum, C. rhomboidea, Cypripedium fasciculatum, and Heterocodon rariflorum increases with more acres being proposed for handpiling. Alternative D drops commercial thinning and Units 1-6 would be non-commercially thinned and handpiled and underburned and an average 20% of the canopy cover would be removed. Again, Alternative D may provide fewer impacts to potential Cypripidium fasciculatum habitat because less canopy cover would be removed. However, potential negative impacts to individual plants of A. acuminatum, C. rhomboidea, Cypripedium fasciculatum, and Heterocodon rariflorum increase with more acres being handpiled.

Likewise, acres proposed for ecosystem management burning preceded by understory slashing or small tree thinning involving handpiling and machine piling differs between alternatives. Alternative D has more acres (945) as compared to Alternative C (539) and Alternative B (314).

No Forest Sensitive plants were located during 2011 surveys, there are no known populations of these Forest Sensitive plants near the project area and on the Missoula Ranger District despite several years of surveys for these plants, and the total acres (less than 3,000) of vegetative treatments consisting of thinning and burning are the same for all alternatives. Therefore, the effects of the action alternatives will be considered similar in this report.

Direct and Indirect Effects

Ageratina occidentale

Ageratina occidentale grows in cracks of bedrock outcrops and in associated talus fields in the montane and lower subalpine zones. This plant has been found at elevations from 5,500 to 7,800 feet. Potential habitat for Ageratina occidentale appears to be sparse in the project area. Potential habitat was identified in the southeast corner of Unit 101, east of the trail. This area is rocky and steep. Surveys were not performed in the area because of safety reasons. The proposed ecosystem burn (EMB) would not likely eradicate this plant if it were present since it grows in open talus and rocky habitat.

This plants habitat (rocky outcrops) in a way protects it from fires. The proposed EMB could provide additional openings in and around outcrops and could enhance habitat for this plant. If plants were present and were burned, the tops would most likely be burnt and the roots would likely remain viable since the plants are deeply rooted in rock outcrops. A mosaic of fire intensities is planned within the EMB, which also reduces the potential risk to this plant.

Allium acuminatum and Clarkia rhomboidea

Allium acuminatum is also found in open forested stands on the Plains/Thompson Falls Ranger District on Lolo NF. One area had been thinned and underburned (2005 Munson Creek Underburn, personal observations). Thinning forested stands to open the forest canopy and light to moderate underburns would likely increase the habitat for this plant. Clarkia rhomboidea is an annual plant that is found in dry, open forest slopes with gravelly soils in the montane zone. It has been found on the Plains/Thompson Falls Ranger District, mainly on southern aspects in Douglas-fir/ninebark habitat types. It has been found at elevations from 3200 to 4400 feet. This plant has been located in areas that had planned ecosystem management burns and appears to be well adapted to burns, including those that burn hot (Weber Gulch 2007, personal observations). Diamond clarkia has a very small seed, and when this seed germinates on sites with several inches of duff and organic matter the stem is very elongate and the plant is short. This plant grows taller and more robust in disturbed areas where mineral soil is exposed, especially after fires (Weber Gulch 2007, personal observations).

Most of the proposed thin and burn units contain potential habitat for Allium acuminatum and Clarkia rhomboidea. Both of these species occur in relatively dry, open montane forest dominated by ponderosa pine and Douglas-fir. These plants are adapted to periodic fire since they occur in habitats that historically burned, on average, every 10-20 years (Pfister et al 1977). On the Plains/Thompson Falls Ranger District, populations of Allium acuminatum and Clarkia rhomboidea have been burned using prescribed fire in the last 15 years; these populations persisted after burning (personal observations). Allium acuminatum is also known from a site between Plains and Thompson Falls where the forest has been selectively thinned. Selective thinning and prescribed burning in the project area would maintain dry, open forest similar to sites where Allium acuminatum and Clarkia rhomboidea have been found. Dry montane forest in the project area frequently contains invasive plant species such as Centaurea stoebe (spotted knapweed) and Bromus tectorum (cheatgrass). Prescribed burning and thinning often create habitat conditions, such as disturbed soil and reduced forest canopy that favor the spread of invasive plants. If prescribed burning and thinning do cause invasive plants to spread in the project area, potential habitat for Allium acuminatum and Clarkia rhomboidea could be degraded (Wilcove et al 1998). Project weed resource protection measures will reduce this risk.

Heterocodon rariflorum

Heterocodon rariflorum occurs at scattered locations in the Bitterroot and lower Clark Fork valleys. On the Lolo NF, populations have been found on the Superior, Plains/Thompson Falls, and Ninemile Ranger Districts.

Heterocodon rariflorum sites are characterized by vernal moisture seepage and/or seasonal pooling of shallow water. Known sites are on mossy rock ledges where seepage moistens the soil, seasonally saturated riparian swales, and damp depressions.

Potential habitat for Hetercodon rariflorum may occur throughout the project area in seasonally saturated riparian swales, vernally moist rock ledges, and damp depressions and these populations may come and go dependent on yearly precipitation. Proposed road treatments (decommissioning, storage, temporary road construction, etc.) and culvert replacements may impact individual plants or habitat since Heterocodon populations are found in damp depressions along old roads, other disturbed areas, and open riparian draws. Heterocodon populations could occur in thin and burn units in damp depressions and open canopied riparian swales. Proposed thin and burn activities would open the canopy and may provide additional habitat for this plant if existing habitat conditions are present (seasonally wet depressions). Proposed prescribed burns that occur in the spring are unlikely to affect potential habitat for Heterocodon rariflorum because the habitat is wet from seepage at that time of year and would not burn. A fall prescribed fire is more likely to burn through potential habitat for Heterocodon rariflorum because the vegetation is drier then. On the Plains/Thompson Falls Ranger District, a Heterocodon rariflorum population was burned within the last 15 years. The population’s persistence after burning suggests the proposed burning would not directly reduce potential habitat for Heterocodon rariflorum. Prescribed burning in the project area does carry some risk of indirectly degrading potential habitat if it contributes to invasive plant spread (Wilcove et al 1998). Invasive plants such as Centaurea stoebe (spotted knapweed) and Bromus tectorum (cheatgrass) are already established in potential habitat for Heterocodon rariflorum in the project area, and they could become more common after burning.

Human-created potential habitat for Heterocodon rariflorum, such as damp depressions in dirt roads, would be affected by proposed road decommissioning, road maintenance, and log skidding. In the process some patches of potential habitat would likely be destroyed and some created. However, many dirt roads with potential habitat would continue to exist in the project area.

Proposed herbicide spraying of roads in the project area could help to maintain potential habitat by decreasing competition from invasive plants.

Cypripedium fasciculatum

Cypripedium fasciculatum (clustered lady's-slipper) is a perennial orchid that grows in several different habitats across its geographical range. This plant grows from a rhizome. It has been found on the Ninemile, Superior, and Plains/Thompson Falls Ranger Districts of the Lolo NF.

On the Lolo NF, Cypripedium fasciculatum populations typically occur in Douglas-fir/ninebark and grand fir/ninebark habitat types at elevations of 2500-4700 feet. Cypripedium fasciculatum sites usually have a discontinuous (40-60% cover), multi-layered mature forest canopy, a well-developed mosaic of understory shrubs (especially ninebark), several inches of duff accumulation on the forest floor, an abundance of fallen woody debris at various stages of decay, and minimal soil disturbance. Small pockets of diseased, dying trees are often present.

Several populations of clustered lady's-slipper have been monitored on the Lolo NF after tree harvesting and underburning and plants have survived. This orchid is adapted to fires.

A clustered lady's-slipper population on the Ninemile Ranger District was monitored several years following tree harvesting and burn treatments. Three plots were monitored; two commercial thin and burn plots and one control plot. Plants survived at all plots. In the treatment plots, one plot burned at a hot intensity (all litter and duff consumed) as compared to the other plot that burned at a cool to moderate intensity. Where it burned hot (duff layer consumed), clustered lady's-slipper plants did not show up until 3 years after the burn. Where it burned cool-moderate, some plants continued to grow that season and were present every year after the treatments.

In another monitoring area on the Superior Ranger District, a population was in a forest stand that was thinned and burned. These plants did not respond as well as those mentioned earlier. The plants are still present but turn yellow and dry early in the season. They are on a warmer exposure than the plots at Ninemile.

Areas of potential habitat for Cypripedium fasciculatum occur in most of the proposed thin and burn units, and would be affected by these activities. Several Cypripedium fasciculatum populations on the Superior Ranger District have been found in historically thinned and/or underburned forest, suggesting that these activities would not reduce potential habitat for the species on all sites proposed for treatments.

If thinning and prescribed burning reduce the risk of a stand-replacing fire, they could help maintain potential habitat for Cypripedium fasciculatum in the project area. Considering the project area contains thousands of acres of potential habitat for Cypripedium fasciculatum, the proposed activities should not have an adverse effect on the species if it is present.

If prescribed burning and thinning do cause invasive plants to spread in the project area, potential habitat for Cypripedium fasciculatum could be degraded (Wilcove et al 1998). Project weed resource protection measures (herbicide treatment of roads and open weedy areas adjacent to units) will reduce the risk of weed spread into treatment areas.

Cumulative Effects

Potential habitat for Ageratina occidentale, Allium acuminatum, Clarkia rhomboidea, Cypripedium fasciculatum, and Heterocodon rariflorum may have been affected by past prescribed burning, logging, road building, and recreational developments.

Some past logging in the project area overlaps the currently proposed units. Since these historic activities are similar to the currently proposed activities, they would have similar effects on potential habitat for Allium acuminatum, Clarkia rhomboidea, Cypripedium fasciculatum, and Heterocodon rariflorum. Perhaps the greatest cumulative risk to potential habitat for these Forest Sensitive species is the ongoing spread of invasive plants in the project area. Past and ongoing management activities have undoubtedly contributed to invasive plant spread in the project area, along with other factors such as recreational use, vehicle traffic, and wildlife use. If Marshall Wood project activities contribute to invasive plant spread in the project area, they would add to the cumulative degradation of potential habitat for these plants. Potential habitat for these species would remain widespread in the project area; some of it would be degraded by invasive plants, but much of it would still be dominated by native vegetation. Overall, the project would not cause adverse cumulative effects on any of these species.

NOXIOUS WEEDS

EXISTING CONDITIONS

Inventories conducted in 2002 and 2009 found approximately 2,435 acres of noxious weeds, mostly scattered along trails, roads, and open forested areas within the project area. Inventory size ranges from a single plant to hundreds of acres. Infestations may overlap and be scattered across large areas or dense patches confined to small areas. Spotted knapweed is the dominant weed species within the analysis area (1,161.0 acres). Known weed infestations are listed by unit in Table 42.

Table 42. Known Weed Species Presence by Unit

Unit	Weed Species
1	Spotted Knapweed, Houndstongue, Leafy Spurge, Dalmatian Toadflax
2	Spotted Knapweed, St. Johnswort, Sulfur Cinquefoil, Leafy Spurge,
3	Spotted Knapweed, Cheatgrass, Houndstongue,
4	Spotted Knapweed, Dalmatian Toadflax, St. Johnswort
5	Spotted Knapweed, St. Johnswort, Dalmatian Toadflax, mostly concentrated on trail
6	Spotted Knapweed, St. Johnswort, Dalmatian Toadflax, Oxeye Daisy mostly concentrated on road
60	Spotted Knapweed, Sulfur Cinquefoil, Tall buttercup
61	Spotted Knapweed, Leafy Spurge, Dalmatian Toadflax, Cheatgrass, St. Johnswort, Sulfur Cinquefoil
62	Spotted Knapweed, Common Tansy, Houndstongue, Dalmatian Toadflax
63	Spotted Knapweed
64	Spotted Knapweed, St. Johnswort, Cheatgrass, Canada Thistle, Musk Thistle, Houndstongue, Dalmatian Toadflax, Sulfur Cinquefoil, Leafy Spurge, St. Johnswort
65	Spotted Knapweed, Leafy Spurge, Dalmatian Toadflax, Cheatgrass, Sulfur Cinquefoil
66	Spotted Knapweed, Dalmatian Toadflax, Houndstongue
70	Spotted Knapweed, Cheatgrass, Houndstongue, Leafy Spurge, Sulfur Cinquefoil, Canada Thistle
71	Spotted Knapweed, Cheatgrass, Leafy Spurge, Oxeye Daisy
80	Spotted Knapweed
81	Spotted Knapweed, Cheatgrass, Dalmatian Toadflax

Unit	Weed Species
82	Spotted Knapweed, St. Johnswort, Houndstongue
84	Spotted Knapweed, Dalmatian Toadflax, Cheatgrass, Oxeye Daisy, on road beds and cut and fill slopes
90	Spotted Knapweed, Sulfur Cinquefoil, Tall buttercup; along trail none in unit
91	Spotted Knapweed (Leafy Spurge potential from Unit 61)
92	
100A	Spotted Knapweed, Oxeye Daisy, St. Johnswort, Leafy Spurge, Common Tansy, Houndstongue, Canada Thistle
100B	Spotted Knapweed
101	Spotted Knapweed, Leafy Spurge, Sulfur Cinquefoil, St. Johnswort, Cheatgrass
200	Spotted Knapweed

The implementation of the Integrated Weed Management FEIS/ROD (USDA Forest Service 2007) allows the Lolo NF (including the Missoula RD) to treat noxious weeds under an adaptive management strategy; incorporating mechanical, biological, and chemical weed control along with educational efforts directed at the prevention and management of noxious weeds (preceding environmental assessments have included sections of the project area prior the 2007 Integrated Weed Management assessment). Analysis of the effects of noxious weed treatments is contained within the FEIS. Noxious weed control has been ongoing since 1992 in the form of herbicide treatment, biological control releases, hand-pulling, and educational efforts. Herbicide treatments have and will continue to be applied to trails and open meadows infested with various weed species on a scheduled interval. Biological controls have and will continue to be released on leafy spurge infestations as needed. Hand-pulling methods will continue on houndstongue populations and incidental small infestations discovered in remote, relatively weed-free areas. Treatment of weeds within the Rattlesnake NRA, Marshall Canyon, and Woods Gulch can be implemented under the authority and guidelines of the 2007 FEIS. All methods will continue regardless of the alternative selected in this analysis in order to maintain previous noxious weed control and suppression efforts.

ENVIRONMENTAL CONSEQUENCES

Effects Common to All Alternatives

Noxious weeds would continue to spread and establish at current levels through existing, non-project vectors (roads, trails, wildlife, wind, and dispersed/unauthorized recreational activities; including dogs off leash) within the project area regardless of which alternative is selected. Vegetation cover types would remain the same until the bark beetle mortality surpasses the natural carrying capacity. Trees would begin to rapidly decline and canopy cover would decrease.

Road 99 (TR515) improvements would be included in all alternatives. A portion of the improvements would include filling in some of the dips and resurfacing. This would require fill to be brought in from off-site. Generally speaking, most gravel sources have some level of noxious weed infestations. It would be expected that new weed infestations would result at each of these improvement areas. These areas would be monitored and subsequently treated if necessary to minimize the potential for spread and establishment.

Overall impacts from management action common to all alternatives would be considered minor and long-term due to the nature of noxious weed spread from habitat alterations, increased vectors and inadvertent introduction by humans, wind, water, and wildlife. Generally, impacts from noxious weed invasions would be considered negative due to the loss of native or desired vegetation for ecosystem resiliency.

Alternative A – No Action

Direct and Indirect Effects

Increased human activity and planned disturbances due to management efforts would not occur beyond ongoing management activities (decisions already approved). Ecosystem maintenance burns approved in the Rattlesnake EMB Wildlife Improvement Decision Notice would be implemented at some point. And the decisions made for Section 31 would be implemented as well. These projects would directly impact the potential for noxious weed spread. Each decision includes noxious weed treatments. Potential for spread of existing noxious weed infestation and establishment of new weed infestations would be expected to increase from activities associated with prior decisions. Therefore, direct, negligible (due to subsequent noxious weed treatments) to minor effects would result from the implementation of the No Action alternative.

Indirect effects would include the establishment and spread of noxious weeds from existing vectors (roads, trails, wildlife, wind, and dispersed/unauthorized recreational activities; including dogs off leash violations) within the project area. Vegetation cover types would remain the same until the bark beetle infestation surpasses the natural carrying capacity. Trees would begin to rapidly decline and canopy cover would decrease. As more trees begin to die because of insect and disease the cover types would start to change. This would happen gradually, and if left untreated trees would begin to fall creating microclimates and retaining some shade. Ground-disturbance would mostly be from falling trees and exposed root wads. Under No Action, noxious weed treatments would occur at the current level, which is not that extensive in the project area and would occur as funding became available. Overall, the No Action alternative would have negligible to minor, long-term impacts in terms of noxious weed expansion and establishment. Generally, impacts from noxious weed invasions would be considered negative due to the loss of native or desired vegetation for ecosystem resiliency. No Action would be more beneficial than the action alternatives for noxious weed spread and establishment but would be less beneficial for treatment of existing infestations due to funding and personnel limitations.

Cumulative Effects

Ultimately, if the No Action alternative were implemented, the area could experience a wildfire which would result in a greater disturbance area resulting in large increases in noxious weed invasion (Zouhar et al. 2008). The disturbance areas would vary in intensity and would be random throughout the project area making detection and treatment more difficult than project-related disturbances. Canopy cover would be reduced in most areas. In areas that experienced severe fire intensity, mineral soil would be exposed. Both conditions are conducive to noxious weed invasion on their own, and together increased invasion and expanding infestations would be inevitable (Thomas et al. 1999, Battles et al. 2001, Scheller and Madenoff 2002, Abella and Covington 2004, Wienk et al. 2004, Gray 2005, Lindgren et al. 2006, and Dodson and Fiedler 2006, IN:. Sutherland & Nelson 2010). Impacts due to wildfire would be moderated, both short-term immediately after the fire and long-term if left untreated. Generally, impacts from noxious weed invasions are considered negative due to the loss of native or desired vegetation for ecosystem resiliency and interfere with natural succession processes post-fire.

Lands within the project area boundary not under FS jurisdiction continue to be a threat to noxious weed spread and establishment. Trails and roadways that access the project area boundary, especially used by recreationists, might contribute to the spread and establishment of noxious weeds on NFS lands. Missoula County has been actively mapping noxious weeds on city, county and private land within the county; including most of the project area. Point occurrences (no acre value associated, in most cases) have been physically mapped since 2002. Most of the infestations are not currently being actively managed by the associated landowner. Additionally, blueweed, dyer's woad, perennial pepperweed, and white top are known to infest lands neighboring the entire project area. The Missoula RD would continue to identify weed treatment needs on NFS lands in the project area and treat infestations through implementing the Lolo Integrated Weed Management EIS (USDA Forest Service 2007). With or without a wildfire, the threat of new invaders from neighboring lands is considered minor, as the Forest is always looking for new invaders with the intent of eradicating them from the NFS lands.

Overall cumulative impacts from the No Action alternative would be negligible to minor in terms of noxious weed spread and establishment. Existing infestation would be treated incidentally as funding became available and would result in both short-and long-term control efforts. Generally, impacts from noxious weed invasions would be considered negative due to the loss of native or desired vegetation for ecosystem resiliency this would continue to be the case under the No Action alternative but less so than the other action alternatives due to no addition disturbances from management actions.

All Action Alternatives (B, C, and D)

Direct and Indirect Effects

Given the extensiveness of noxious weeds already present in the project area (both species richness and abundance) the risk of spread of existing noxious weed infestations and establishment of new weed infestations would increase in all units under the action alternatives (Lockwood et al. 2005, Allendorf and Lundquist 2003). Each alternative proposes an increase in ground disturbance, a decrease in canopy density, and a change in cover type. Ground disturbance levels vary by alternative (temporary road building, prescribed fire, thinning, etc. – see the Weeds Specialist's Report for more detail regarding the effects of each of these proposed treatments); however, the resulting direct impact would remain elevated due to the simple occurrence of soil and vegetative changes and increased human activity (Nelson et al. 2008, Aukema and Carey 2008). Additionally, research has shown increases in nutrient availability and decreases in competition often promote invasion of some noxious weeds due to their ability to rapidly uptake nutrients and their efficiency utilizing neighboring areas (Besaw et al 2011, Sutherland & Nelson 2010, Funk & Vitousek 2007). The actions proposed in all action alternatives include reducing competitive vegetation to increase resiliency in trees; which would increase nutrient availability to all remaining species as well, including noxious weeds.

Increased management and ground-disturbance levels could result in moderate impacts to noxious weed establishment and expansion. Resource Protection Measures to monitor and treat noxious weeds would decrease this impact to minor if fully implemented. Though weed treatments would decrease the potential for increased spread and establishment, which is beneficial, the general impacts from disturbance and increased management would be considered negative due to the potential loss of native or desired vegetation for ecosystem resiliency in areas that were not able to be treated.

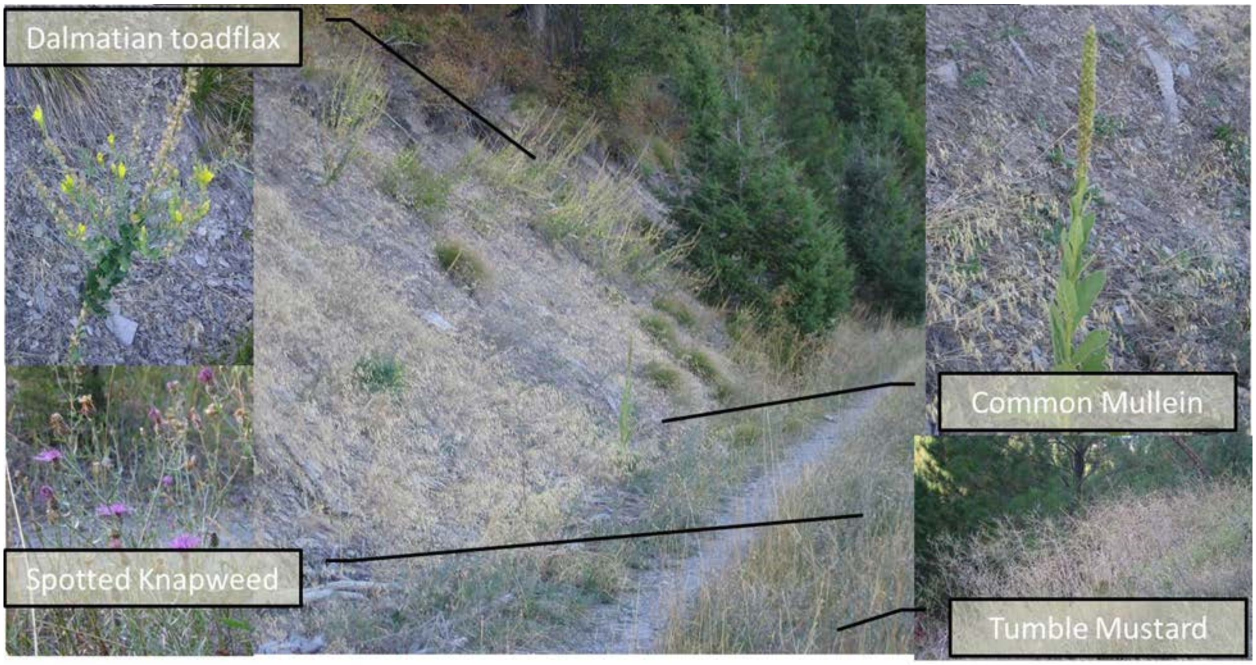


Figure 45. Picture Collage Demonstrating the Need for Treatment along Roads within the Project Area (RD 16803)

Indirect impacts include the possibility of increased vectors through user-created trails (see Recreation Specialist's Report). Similar to roads, user-created trails are a linear disturbance; which facilitate noxious weed spread and establishment (Gelbard & Belnap 2003, Birdsall et al. 2012). Activities associated with project implementation might also increase the potential for noxious weed spread and eventual establishment. Staging areas, vehicles, fill, hand tools, incidental disturbances, and other unexpected sources of weed seed spread and propagation may occur during implementation. However, Resource Protection Measures and BMPs should reduce these impacts. Wildlife is another vector for noxious weed spread and establishment. The project area experiences a great deal of wildlife activity from ungulates, birds, bears, and a wide-variety of mammals. The project area has some limiting landscape features but for the most part it is widely accessible to wildlife. Most units have evidence of heavy use from migration trails to simple ocular observances. This project would not be expected to change the population dynamic of most wildlife species but would allow more of the area to accessible with thinning and burning (see Wildlife Specialist's Report). This would be a negative, indirect consequence of the project that would last beyond the implementation period.

Even though the potential to increase noxious weed populations is expected; the overall extent of noxious weed infestations in the planning area would potentially be reduced due to the associated weed treatments. Herbicides are currently not used extensively throughout the project area. Biological controls have not been released on a regular basis since 2010. Mechanical treatments (hand-pulling and mowing) have been reduced due to a reduced workforce; and educational materials are limited to a couple of posters and signs in the project area. With the implementation of this project, all of these noxious weed management techniques would increase. Noxious weed treatments would increase plant community diversity by decreasing competition from noxious weeds (Rice 2013). Noxious weed treatments would facilitate desired site conditions of the understory by preempting noxious weed establishment and allowing desirable vegetation to take hold since site regeneration is dependent on the composition of the species that result afterward (Radosevich 2007, Nelson et al. 2008).

Effective treatment for cheatgrass is still being explored. Cheatgrass infestations would be monitored until a solution for control becomes available. Existing cheatgrass infestations are expected to expand as part of this project. Overall impacts from the action alternatives in relation to noxious weed spread and establishment would be moderated, both short and long-term and negative. However, the implementation of this project would rely on Resource Protection Measures designed to decrease noxious weed spread and treat known infestations. This would decrease the impact from moderate to minor and limit the extent of the impact to the implementation period (short-term). Compared to the No Action alternative all action alternatives would require prevention measures and treatment of noxious weed infestation which would be more beneficial to the area for controlling, suppressing, and eradicating noxious weeds.

Cumulative Effects

Past noxious weed spread within the project area boundary is facilitated by recreational activities and natural vectors (wind, water, wildlife). Lands within the project area boundary not under FS jurisdiction continue to be a threat to noxious weed spread and establishment as explained in the No Action Alternative. The Missoula RD would continue to identify weed treatment needs in the project area and treat infestations through implementing the Lolo NF Integrated Weed Management FEIS/ROD (USDA Forest Service 2007). Recreational use may decrease and additional vectors would not be developed as part of this project. But recreational use would still remain high and a source of weed spread and introduction.

Cumulatively noxious weed spread and establishment would degrade the native vegetative community, reduce water quality through soil erosion, and reduce wildlife habitat over time. However, noxious weed treatments as part of the implementation including the resource protection measures of this project, noxious weed spread is expected to be reduced (with the exception of cheatgrass). Overall, the project would have a direct benefit to reducing the infestation levels of noxious weeds in the project area. Long-term educational and preventative benefits would also be expected from the implementation of this project under all action alternatives. This would result in a moderate decrease.

SOILS

EXISTING CONDITION

Legacy soil disturbance, disturbance that occurred as a result of past activities and natural disturbance, forms the foundation of the soil conditions on the landscape today. All proposed activity areas (units) currently meet NFMA, the Lolo Forest Plan, and the Regional Soil Quality Standards. Project area landtypes and soils are suited to the proposed actions.

Prior to any activity, all units have less than 15% detrimental soil disturbance with the exception of Unit 200 which is located in Section 33. This section was acquired by the Lolo NF in 2010 and under prior ownership had been managed as industrial timber land. In Unit 200, only non-mechanical site restoration activities are proposed; prescribed fire, road decommissioning, weed treatments, the addition of large woody material, and planting trees would move the unit towards meeting soil quality desired conditions.

All proposed commercial thinning units have less than 10% existing DSD (Alternative B). Units 1, 4, 5, and 6 had evidence of previous harvest but no DSD was detected. Any detrimental effects from past activities have been and continue to be mitigated through natural restoration of soil process and function. Natural restoration includes freeze/thaw and wet/dry cycles as well as the accumulation of fine and coarse organic material. Units 2 and 3 are located on a terrace above

Rattlesnake Creek. These two units have existing DSD of about 10% associated with the settlement and development of the Rattlesnake community (early 1900s) as well as on-going recreation impacts.

Forest floor status was found to be a concern in portions of six units (young stand thinning Units 80, 81, and 82, reforestation Unit 200, and commercial thinning Units 2 and 3). All of these locations have experienced loss of the forest floor at one time resulting in a truncated soil “A” horizon, and/or a thin root tight layer. Here the forest floor does not meet the desired condition leaving the site vulnerable to weed invasion and moisture stress. The root tight zone includes the duff, litter, and surface soil horizon dominated by vegetation roots.

Units 2, 3, 71, 80, 81, 82, and 200 were identified as having potential biological, chemical, or physical soil limitations related to the proposed actions. Review of all other activity units found few harvest and fuel related soil resource limitations; the desired forest floor conditions are currently present or obtainable in 20-40 years.

Environmental Consequences

Alternative A (No Action) - Summary of Effects

Alternative A meets the Lolo NF Forest Plan, the R1 SQS, and the National Forest Management Act for the management of soil resources. No soil disturbance would occur because of land management actions; fire and other landscape disturbances may occur. Alternative A would not add direct, indirect, or cumulative soil effects.

The No Action alternative would cause no new soil compaction, rutting, puddling, soil displacement or decrease in hydrologic function. Soil structure and humus development would continue. There would be no loss of forest floor except with severe wildfire.

Opportunities for road decommissioning and prescribed fire as discussed in previous NEPA decisions would still occur. These projects include trail maintenance, Road 99/Trail 515 maintenance, 1.2 miles of road decommissioning in Section 31, and landscape burning for wildlife habitat improvement across 2,025 acres. Any opportunities for Unit 200 reforestation, road decommissioning, and prescribed fire associated with the Marshall Woods project would be foregone.

Alternatives B, C and D - Summary of Effects

The Marshall Woods project complies with NFMA; analysis does not find that management actions would “produce substantial and permanent impairment of the productivity of the land” or that soils would be “irreversibly damaged”. These findings are based on the assessment of the project activities using the R1 Soil Quality Standards and consideration of soil functional attributes including forest floor depth and groundcover, coarse wood, and soil potential for recovery. The analysis uses current research and Forest-specific monitoring to support all findings.

Planned thinning units would stay within Regional Soil Quality Standards of no more than 15% areal extent of DSD. Long-term effects would not be expected since harvest would be limited to frozen or snow covered ground, dry soils, or would occur over a slash mat. Soil rehabilitation is built into project Resource Protection Measures.

The planned underburning would have a net positive benefit to soils given the influx of nutrients, a diverse and native understory vegetation community, and low burning intensity. Some temporary or local adverse effects from burning large slash piles would occur at log landings; landing would be located where prior disturbance exists to the extent possible. Isolated high severity burning in the center of the smaller hand piled slash piles could occur. Any high severity burn would result in temporary reduced vegetation growth in the center of the burn pile although natural recovery of the burned area is rapid as organic matter is replaced and soil biota repopulates the site.

Loss of coarse woody material would not occur; the Lolo NF Coarse Wood Guidelines would be met. Overall these stands are resilient with forest floors close to or greater than the expected values; organic matter would be sufficient for continued biologic function.

Alternative A would not add direct, indirect, or cumulative soil effects. No additional detrimental soil effects would be realized since ground-based harvest and fuel treatments would not occur. However the benefits of re-introducing landscape level ecosystem management burns and decommissioning of roads would be forgone.

Alternative B would produce the greatest amount of soil disturbance. All units would meet the Lolo Forest Plan, Region 1 SQS, and NFMA. The benefit of mixed-severity landscape level fire is similar to the other alternatives. Alternative B activities would overlap in time and space with existing soil conditions. Fuel treatments and wildfire potential appears to be the most likely on-going and reasonably foreseeable actions that would produce additional cumulative effects on the soil resources.

Alternative C would produce fewer disturbances than Alternative B and more than Alternative D. All units would meet the Lolo Forest Plan, Region 1 SQS, and NFMA. The benefit of mixed-severity landscape level fire is similar to the other alternatives. Alternative C activities would overlap in time and space with existing soil conditions. Fuel treatments and wildfire potential appears to be the most likely on-going and reasonably foreseeable actions that would produce additional cumulative effects on the soil resources.

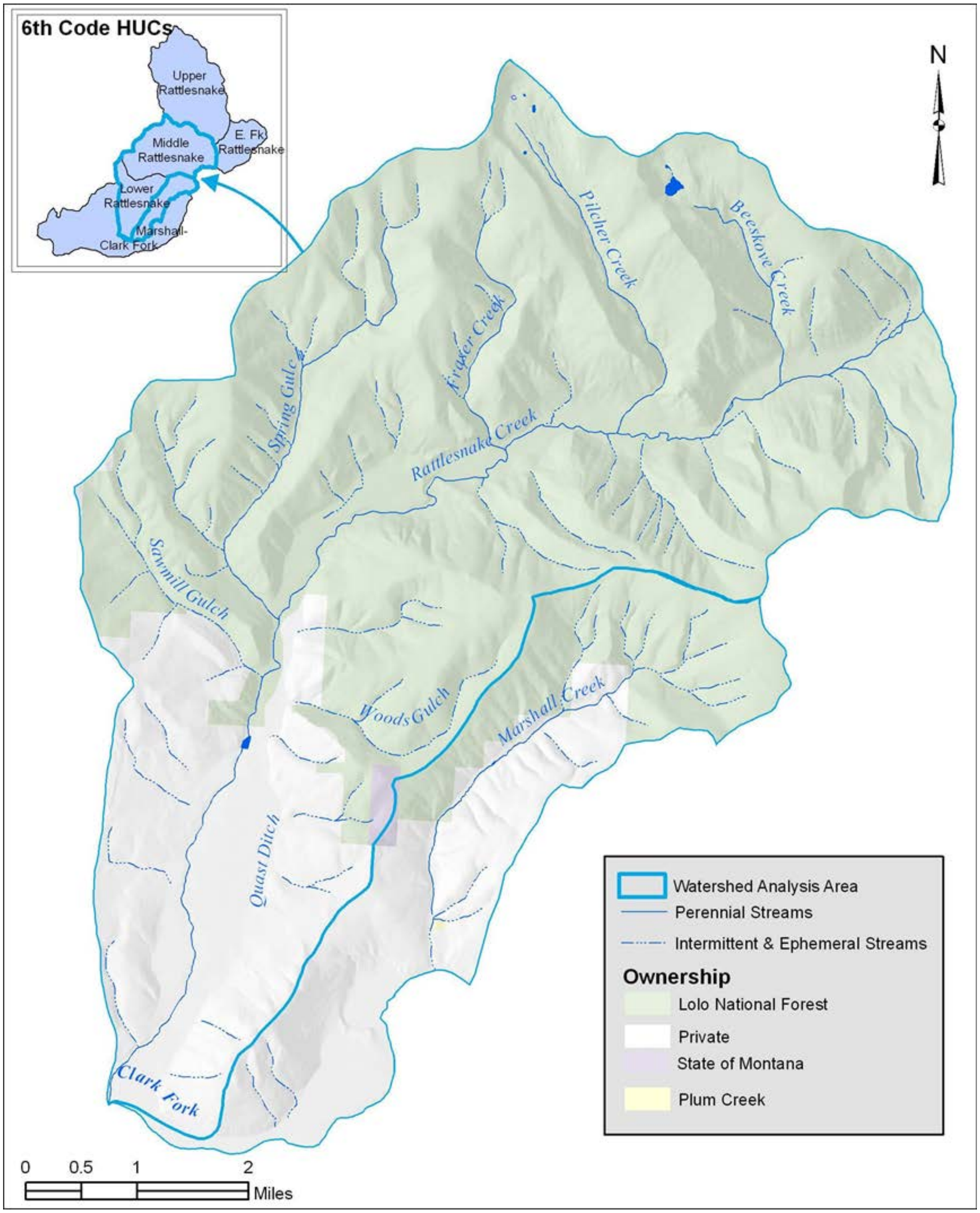
Alternative D would produce the least soil disturbance of the action alternatives because there is no commercial thinning. The benefit of mixed-severity landscape level fire is similar to the other alternatives. Alternative D activities would overlap in time and space with existing soil conditions. Fuel treatments and wildfire potential appears to be the most likely on-going and reasonably foreseeable actions that would produce additional cumulative effects on the soil resources.

HYDROLOGY

EXISTING CONDITION

The Marshall Woods analysis area encompasses the Middle and Lower Rattlesnake Creek and the Marshall Creek watersheds (7th code HUCs – see Figure 46).

Figure 46. Marshall Woods Analysis Area for Effects to Water Resources



Project streams and riparian areas show impacts from ‘chronic’ disturbances and appear to be on a static or slightly upward trend towards recovery. Recovery potential depends on the stream type and has a wide range of responses (Rosgen 1996). Streams in this analysis area generally have “good” to “excellent” recovery potential from most impacts, with active restoration required to mitigate chronic sources.

Water Quality

Rattlesnake Creek is listed by MDEQ as a Water Quality Limited Segment (WQLS), due to impairments from flow alterations. Currently the calculation of a Total Maximum Daily Load (TMDL) for Rattlesnake Creek will not be required, because the cold water fishery impairment results from pollution (i.e., not quantifiable) versus a pollutant such as metals, sediment, or temperature.

Source Water

Mountain Water Company holds senior water rights in the Rattlesnake watershed totaling almost 800 million gallons of water. In addition to their water supply dam on lower Rattlesnake Creek, much of this water is stored behind dams on eight lakes high in the Rattlesnake Wilderness: Glacier, Little, Big, Carter, Sheridan, Worden, Sanders, and McKinley lakes. Today the Rattlesnake watershed serves as a back-up water supply source for the City of Missoula, because the city’s drinking water now comes from high capacity wells in the Missoula Valley.

Roads

Roads have different influences on stream function and sediment deliveries depending on a variety of conditions such as hillslope position, road age and design, soil saturation, geologic substrate, vegetation, and climate.

Road Density

Table 43 displays total road density within the analysis area watersheds. The Middle Rattlesnake Creek HUC has a “Low” road density rating, while the Lower Rattlesnake Creek HUC and the Marshall Creek watershed have road densities that are “Extremely High” according to the findings of CRB (USDA 1996). Lolo NF data indicate similar findings as the CRB assessment because streams were found to show road effects when road densities approached two miles per square mile or more (Riggers et al. 1998). Most of the roads in the Middle Rattlesnake Creek HUC are under Forest Service jurisdiction, while private and county roads are the majority of mileage in the Lower Rattlesnake Creek HUC and the Marshall Creek watershed.

Table 43. Existing Total Road Densities

Watershed HUC	Total Road Miles	HUC Area (Mi2)	Road Density	CRB Road Density Rating	Percent of Roads Under USFS Jurisdiction
Middle Rattlesnake Creek	8.1 (FS 7.4)	24	0.3	Low	91%
Lower Rattlesnake Creek	70 (FS 12)	12.3	5.7	Extremely High	17% (increase of 4% due to recent land acquisition)
Marshall Creek	59.4 (FS 15.5)	8.2	7.2	Extremely High	26% (increase of 14% due to recent land acquisition)

Road Encroachment

Although total road densities are high in the analysis area, there is a difference in the effects that a road can cause based upon proximity to water. Roads within 300 feet of streams can impact sediment delivery, aquatic habitat, and stream temperature. Depending on road condition, terrain slope, and buffer conditions, among others, roads within 300 feet have higher probabilities of sediment delivery over time (Belt et al. 1992).

Table 44 displays road proximities along with the associated road crossings within the analysis area. These adjacent segments of roads are likely to influence sediment loads, riparian vegetation, bank stability, stream habitat, and shading. Stream crossings have the highest potential to deliver sediment to streams and may be more impactive when undersized because stream channel stability is affected (e.g., accelerated bank erosion and scour). GIS analysis of roads reveals that roads encroach within potential sediment delivery distances and riparian areas in all three watersheds. The Marshall Creek watershed has the greatest amount of roads within both 300 feet of streams (11.1 miles) and 100 feet of streams (4.5 miles). Streams are crossed within the Middle Rattlesnake HUC about 0.3 times for one square mile of road, with values increasing to 1.2 times in the Lower Rattlesnake HUC and 4 times in the Marshall Creek watershed.

Table 44. Existing Road Encroachment and Associated Road Crossings.

Watershed HUC	Total Road Miles	Road Miles Within 100 Feet	Road Miles Within 300 Feet	Road Crossings	
				Count	Density (#/mi2)
Middle Rattlesnake Creek	8.1 (FS 7.4)	0.6 (FS 0.6)	3.1 (FS 3.1)	7	0.3
Lower Rattlesnake Creek	70 (FS 12)	1.7 (FS 0.5)	7.0 (FS 2.3)	15	1.2
Marshall Creek	59.4 (FS 15.5)	4.5 (FS 1.1)	11.1 (FS 3.5)	33	4.0

Environmental Consequences

No Action Alternative – Direct, Indirect, and Cumulative Effects

Aside from the activities that are included in all alternatives (see EA Chapters 1 and 2), this alternative would maintain the existing condition. Fire suppression and wildfire would likely be the predominant influences that drive the existing conditions. Flooding and windthrow are also possible natural influences. Directly, indirectly, and cumulatively, the existing road system would continue to contribute various quantities of fine sediment to project area streams. The current modeled existing condition for road sediment loading is approximately 0.1, 6.8, and 10.3 tons per year in the Middle Rattlesnake, Lower Rattlesnake, and Marshall Creek watersheds, respectively. The maintenance and BMP work on the first 3.7 miles of Road 99/Trail 515 will reduce road sedimentation somewhat in the Middle and Lower Rattlesnake watersheds. Undersized culverts would continue to pose risks to stream stability (e.g., road fill scour, channel aggradation, and risk of failure). Tree and shrub growth would continue on infrequently used roads. Water yields in the project area would remain fairly low, unless affected by large-scale wildfire. Additional cumulative impacts are addressed in the Cumulative Effects section below.

Action Alternatives Comparison – Alternatives B, C, and D

Directly, indirectly, and cumulatively, all action alternatives involve short-term sediment delivery from road work, including BMP upgrades and haul, road decommissioning, culvert removals/replacements, and stream rehabilitation; however, long-term benefits (greater than 10 years) to soil productivity, vegetation growth, and stream functions outweigh short-term effects.

Road Influence Indicators

Proposed changes to the transportation network are summarized by project alternative. The main differences among alternatives are proposed haul use and temporary road construction. No haul use or temporary road construction would occur under both the No Action and Alternative D. Haul use mileage is less under Alternative C than Alternative B, because the main Rattlesnake Road/Trail 99 would not be used as a haul route. Routine maintenance would occur along the main Rattlesnake Road/Trail 99 regardless of the Marshall Woods Project (analyzed under all alternatives). Water resources benefits of the Marshall Woods project result from a combination of road BMP improvements, road decommissioning, road storage, and culvert removals/replacements.

Haul Roads and BMPs

Proposed log haul route mileage is one of the main differences between the alternatives. Haul use would occur only under Alternatives B and C, with less haul proposed under Alternative C because the main Rattlesnake Road/Trail 99 would not be used as a haul route. Modest sediment loading increases are expected (<4 years); however, the advantage to haul route use is the application of sediment reducing BMP measures. Therefore road miles treated with BMPs would have reduced sediment delivery in the long-term (multiple years post-haul).

Temporary Roads

Temporary roads would be constructed under Alternatives B and C in the Woods Gulch area (mid-slope and away from water resources). Temporary roads are expected to be in use for up to two seasons, and no sediment loading to water resources is expected.

Road Decommissioning

Road miles proposed for decommissioning are equal among all action alternatives (about 7.4 miles). Road decommissioning is expected to contribute to short-term sediment loading during drainage rehabilitation treatments to road prisms, including culvert removals (1 year). Sediment loading reductions are modeled to occur through the hydrologic 'neutralization' of these road segments (multiple years post-decommissioning).

Road to Trail Conversion

Road miles proposed for trail conversion are equal among all action alternatives (about 1.4 miles). It is anticipated that long-term sediment delivery from trail use would be lower than open road use, because trail traffic and loads are much lighter.

Road Storage

Road miles proposed for storage are equal among all action alternatives (about 1.9 miles). Rehabilitating stream and riparian areas through road storage would assist with meeting the INFISH Riparian Goals and Management Objectives for these areas.

Change in Road Encroachment (density and proximity)

Reductions to road densities from road decommissioning are anticipated in the Marshall Woods project area for all alternatives, including No Action because of previously approved decisions (Table 45). However, no changes would occur in the Marshall Creek watershed unless an action alternative is implemented. Changes within 300 and 100 feet of streams are shown because roads in riparian areas tend to have more effects on water resources. Because there are no changes proposed in the Marshall Creek watershed under the No Action alternative, implementing an action alternative would better align with INFISH Riparian Goals and Management Objectives.

Table 45. Proposed changes in road density and encroachment*.

Lower Rattlesnake Creek HUC **	Existing	Action Alternatives**
Road Density (mi/mi2)	5.7	5.5
Roads within 300 feet of water resources (mi)	7.0	5.0 (-2.0)
Roads within 100 feet of water resources (mi)	1.7	1.2 (-0.5)
Marshall Creek Watershed	**Existing**	**Action Alternatives**
Road Density (mi/mi2)	7.2	6.6
Roads within 300 feet of water resources (mi)	11.1	7.7 (-3.4)
Roads within 100 feet of water resources (mi)	4.5	3.6 (-0.9)

*Changes result from road decommissioning (-).

** These activities would occur regardless of the Marshall Woods project (2008 Section 31 DM).

Road Sediment Delivery Assessment

The sediment delivery assessment was done using models to generate sediment loads for relative comparison. For all alternatives, increases in road sediment loading for the 10-year timeframe are expected over current conditions; however, these increases are offset when considering the sediment savings from culvert removals (Table 46).

The values presented in Table 46 below are a worst-case scenario as they assume all activities occur simultaneously. Short-term sediment deliveries would not result in detrimental stream conditions because: (a) actions would not simultaneously occur; (b) impacts would not occur within one year and would be dispersed over multiple runoff cycles; (c) work and total predicted sediment quantities are further distributed across multiple watersheds; (d) only one portion of a project is active at one time-only a few sections of road are being hauled upon; (e) the most risky period for hauling is in the spring during breakup, which occurs at slightly different time periods due to elevation and aspect so only sections of road are at risk from breakup conditions at any one time; (f) the risk of haul-related sedimentation occurring for more than a few days is very small because the timber sale administrator and/or aquatics specialists visit the project area several times each week, especially when conditions are questionable, and would stop the hauling if conditions were unfavorable.

Table 46. Marshall Woods modeled 10-year sediment budget for all road related activities.

Watershed	Alt.	Tons/ Year*	Increase from Timber Sale (per year)		Increase from Other Activities (per year)**		Long-term Modeled Reduction (per year)	
			Tons	Percentage	Tons	Percentage	Tons	Percentage
Middle Rattlesnake	A, C, & D	0.1	0	0	0.02	28	0.02	28
	B	0.1	0.04	53	0	0	0.06	63
Lower Rattlesnake	A & D	7.1	0	0	0.4	6	0.3	4
	B	7.4	0.3	4	0.4	6	0.4	6
	C	7.4	0.3	4	0.4	6	0.4	6
Marshall Creek	A	10.3	0	0	0	0	0	0
	B & C	12.2	0.2	2	2.5	24	2	19
	D	12.1	0	0	2.5	24	1.8	17

*Includes previously approved BMP activities on road/trail 99.

**Includes Road Storage, Decommissioning, and Culvert Removals.

The proposed Marshall Woods project activities are expected to contribute to short-term sediment loading, but long-term benefits to water resources beyond the 10-year analysis window are expected from proposed road BMP upgrades, storage, and decommissioning. Design criteria and application of BMPs would ensure that water quality standards are maintained. When only considering action alternatives, Alternative D would generate the least amount of sediment within the modeled 10-year timeframe; however, when all project activities and potential offsets are considered on a watershed basis Alternatives C and D would both be considered slightly more beneficial than Alternative B.

Timber and Fuels Management Operations Indicators

Results of the sediment assessment indicate that with regards to water resources, none of the action alternatives would detrimentally impact water resources because of BMP and Resource Protection Measure implementation.

Fine Sediment Delivery Assessment

The net sediment delivery effect of proposed silviculture activities is expected to have few, if any, impacts relative to the proposed road use changes in the project area. The modeling results indicate that most of the proposed silviculture activities causing ground disturbance occur at distances from water resources with little to no probability of sediment delivery. This is also supported by current research (Litschert and MacDonald 2009) which shows that current harvest procedures and BMPs are largely effective at reducing rilling and sediment sources.

Water Yield

Proposed road, timber harvest, and fuel treatment activities are not expected to have detrimental effects on water yields in the analysis area. Under Alternative B, the most extensive treatment proposal, management could increase Equivalent Clearcut Areas (ECAs – a tool used to predict water yield) by about 4%, 7%, and 2% in the Middle Rattlesnake, Lower Rattlesnake, and Marshall Creek watersheds, respectively. Total projected ECA values are below the range of historic stand values (39%) in all analysis watersheds.

Cumulative Effects

Cumulative impacts result when the effects of an action are added to or interact with other effects from past, present, or reasonably foreseeable actions in a watershed. Table 47 displays effects that were considered over a time period of at least 10-20 years.

Table 47. Hydrologic Cumulative Effects Summary Table.

ACTION	Contribution and Possible Trend
Natural Events	
Wildfire	Historically wildland fires were likely a frequent disturbance factor, although only the Upper Rattlesnake Creek HUC (above the project area) has experienced large acreages of recent wildfire. Increases in sediment production and runoff from large fire events likely influenced water quality. Although this may lead to short-term increases in nutrient loading, sediment delivery, and water yields; wildfire is generally a desired 'pulse' event that positively influences water resources.
Human-caused Events	
Wildland Fire Suppression	Wildland fire suppression has likely affected water resources in relation to a possible decrease in water yield because increases in canopy cover have greater water uptake and interception. However, this is not currently negatively affecting water resources. Continued suppression could result in higher intensity wildfire, although even in high intensity scenarios, negative conditions tend to be short-term, or "pulse" in nature, and in the long-term may be beneficial to water resources. Proposed silviculture treatments should reduce the wildfire intensity in treatment areas and should offset the effects of past suppression to some extent.
Timber Harvest	Water yield increases are anticipated from proposed harvest activities; however, treatments could help return water yield to historic levels. Tree recruitment to streams has been reduced in areas where roads and thus tree removal has occurred near streams thus reducing habitat and energy dissipation, such as along Spring Creek. Future forest trends are for increased tree recruitment as natural recovery and tree growth occurs in previously disturbed riparian areas.

ACTION	Contribution and Possible Trend
Young Tree (Noncommercial) Thinning	Young tree thinning has occurred in the analysis area and is proposed. Very small increases in water yield are anticipated from proposed activities, as stands are managed to natural basal areas.
Prescribed burning	Prescribed burning has occurred in the analysis area, is reasonably foreseeable, and is also proposed. By potentially reducing the wildfire intensity in treatment areas, the effects to water resources could be a reduction in sediment loading and more natural water yields.
Road Construction, Maintenance, and Improvements	In the past, road construction has influenced water resources, as described previously. Long-term improvements would continue to occur as road improvements, such as BMPs, culvert upgrades, storage, and/or decommissioning are implemented in the project area.
Recreation	A large part of the project area falls within the Rattlesnake National Recreation Area. Overall, recreation is not creating large-scale watershed impacts. There are many dispersed recreation sites along Rattlesnake Creek. These areas see localized removal of trees and sediment introductions, but effects are minor. Recreational use will continue and likely increase in the future, which may require active management to protect forest resources, especially along stream banks and lakeshores. Project proposals for BMP improvements to Road 515/Trail 99 will address some of the dispersed use along Rattlesnake Creek.
Firewood/ Misc. product gathering	Firewood gathering has occurred and will continue to occur in the future although it is not allowed in the RNRA. Effects are minor and localized. Firewood cutting in RHCAs likely occurs along roads and at dispersed camping areas.
Upper Rattlesnake Dams	Mountain Water Company holds senior water rights in the Rattlesnake watershed. Water storage is enhanced through the operation of small dams on eight lakes high in the Rattlesnake Wilderness. Mountain Water Company inspects the dams every five years. These dams are all rated as Significant and Low Hazard Potential according to the latest inspection report. The construction of the dams altered local water tables and disrupted stream/valley bottom sections where the dams were placed. Initially, the water budgets for these sites may have created deficits in tributary streamflows and possibly in Rattlesnake Creek until the dams were filled. Currently, the dams likely act to dampen the peak of runoff and help to maintain year-round streamflow in the affected tributary drainages. Use of these dams will continue to occur, and detrimental effects on water resources are not anticipated. Routine dam inspections and maintenance are intended to prevent dam failure (which would have negative impacts on water quality).
Private Land Development	The construction of roads and buildings on private land within the analysis area will likely continue into the future, but is limited by the amount of available private lands. Building near water resources, especially within riparian areas and floodplains has likely affected and continues to affect water quality through the localized removal of sediment filtering and shade producing vegetation, and increased runoff from impervious surfaces (buildings, paved roads, etc.).

FISHERIES

EXISTING CONDITIONS

The two major watersheds within the immediate project area are Marshall Creek and Rattlesnake Creek (including Woods Gulch and the lower portion of Spring Gulch). All other mapped tributaries are largely ephemeral. Complete descriptions of the basic characteristics and features influencing the existing condition of these watersheds including land ownership, climate and hydrology, stream channel characteristics, water quality, road densities and road encroachment, and watershed improvement activities can be found in the Existing Conditions section in the Hydrology Specialist's Report. Factors influencing aquatic populations will be emphasized below, but primary concerns are focused on proposed management activities that occur near, or have the potential to affect stream channels that are known to contain aquatic species.

Aquatic Habitat

The Lolo NF baseline assessment rated each of the 19 habitat indicators and the 4 species indicators, as defined in USFWS's systematic process called "A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale" (USDI-FWS 1998b), for each of the three 6th code HUCs within the Rattlesnake and Marshall Creek watersheds, which can be found in Table 48 below (USDA-FS 2007, 2010a). The Lower and Upper Rattlesnake Creek 6th code HUCs are listed as "Functioning at Risk" for most habitat and species indicators, whereas the Clark Fork River – Marshall Creek 6th code HUC is listed as "Functioning at Unacceptable Risk" for most habitat and species indicators. The baseline information is combined with site-specific data and local knowledge of the project area to assess aquatic habitat and species condition.

Table 48. Status of Baseline Conditions with Site-Specific Information for the Upper Rattlesnake Creek, Lower Rattlesnake Creek and Clark Fork River – Marshall Creek 6th Field HUCs. (FUR = Functioning at unacceptable risk, FAR = Functioning at risk, FA = Functioning appropriately).

Diagnostic Pathways: Indicators	Upper Rattlesnake Creek	Lower Rattlesnake Creek	Clark Fork River – Marshall Creek
HABITAT Pathways: Indicators			
Water Quality: Temperature	FAR	FAR	FUR
Sediment	FAR	FAR	FUR
Chemical Contaminants / Nutrients	FAR	FAR	FUR
Habitat Access: Physical Barriers	FA	FA	FAR

Habitat Elements: Substrate Embeddedness	FAR	FAR	FUR
Large Woody Debris	FAR	FAR	FUR
Pool Frequency & Quality	FAR	FAR	FUR
Large Pools	FAR	FAR	FUR
Off-Channel Habitat	FAR	FAR	FUR
Refugia	FA	FA	FUR
Channel Condition & Dynamics: Wetted Width/Max Depth Ratio	FA	FA	FUR
Streambank Condition	FA	FA	FUR
Floodplain Connectivity	FAR	FAR	FUR
Flow & Hydrology: Change in Peak/Base Flows	FA	FA	FUR
Drainage network Increase	FA	FA	FUR
Watershed Conditions: Road Density & Location	FUR	FUR	FUR
Disturbance History	FA	FA	FA
Riparian Conservation Area	FAR	FAR	FAR
Disturbance Regime	FAR	FAR	FAR
Integration of Habitat Determination	FAR	FAR	FUR
SPECIES Pathways: Indicators			
Subpopulation Characteristics: Subpopulation Size	FAR	FAR	FUR
Growth & Survival	FAR	FAR	FUR
Life History Diversity & Isolation	FAR	FAR	FUR
Persistence and Genetic Integrity	FAR	FAR	FUR

Integration of Species Determination	FAR	FAR	FUR
Integration of Species & Habitat Condition	FAR	FAR	FUR

Rattlesnake Creek

Rattlesnake Creek drains high elevation watersheds and maintains relatively stable base flows throughout the winter and summer. Due to the undeveloped nature of the upper watershed, water quality and instream habitat is generally regarded as high quality. Prior to the wilderness designation, differing land uses including logging, road development, and dam construction all occurred in the watershed and had varying levels of undesirable effects on aquatic habitat and aquatic species. The effect of the dams in the headwaters on stream temperature is unknown. Stream gradients are relatively steep, so bull trout habitat is naturally limited.

Spring Gulch

Spring Gulch is the only perennial tributary (third-order) to Rattlesnake Creek within the project area. There is a PIBO (Pacfish-Infish Biological Opinion) monitoring site near the mouth that is treated as a "reference" site, representing a minimally managed condition. In the spring of 2014, the Forest repaired a small area where the recreational trail was actively eroding into the creek. Through the use of brush, woody debris, and hand labor, the Forest was able to re-route the flow and reduce erosion near the trail.

Woods Gulch

Woods Gulch is a second-order intermittent tributary, but lacks a surface connection to Rattlesnake Creek. Surface flow is captured in the Quast irrigation ditch which may overtop to spill into Rattlesnake Creek for only a few weeks a year during high flows. Fish may have inhabited Woods Gulch in the past, as there are anecdotal accounts of cutthroat, but it was sampled in 2009 by Forest Service crews and no fish were found.

Marshall Creek

Marshall Creek is a third-order perennial tributary to the Clark Fork River with a narrow, high gradient valley. The creek has been subject to a number of disturbances: extensive timber harvest and ski area development in the headwaters; a dense network of roads including the main County Road #357 which is within the Riparian Habitat Conservation Area (RHCA) of Marshall Creek for most of its length and has multiple undersized crossings and impoundments that truncate fish habitat and genetically isolate the fish population; and private land developments. Roads have a large influence on the Marshall Creek watershed, with approximately 11 miles within 300 feet of streams, 4.5 miles within 100 feet of streams, and a crossing frequency of 4 times for every one square mile of road. Although the immediate streamside riparian area is vegetated along Marshall Creek, the full RHCA buffer of 300' on a fish-bearing stream is nonexistent due to the presence of roads. This likely influences temperature (due to reduced density of large trees for overhead canopy cover), large woody debris recruitment, sediment delivery, and floodplain connectivity. The effect of the recent fill slope failure on Highway 200 near the mouth at the Clark Fork River is unknown, and did not impact the fish ladder, but may have influenced the lower end of the channel.

MFWP, in conjunction with private landowners, has completed a number of major habitat and fisheries improvement projects within the lower 2 miles of Marshall Creek (below the first impoundment). These efforts include: a fish ladder at the mouth on the Clark Fork River, two culvert replacements on private property, a fish screen, large woody debris additions in four reaches, and riparian fencing on private property. The partial barrier at the undersized culvert on FS Road #2122 (proposed for replacement in the Marshall Woods action alternatives), two culvert barriers on County Road #357, and the private land impoundments at and above stream mile 2.0 continue to fragment fish habitat and genetically isolate fish.

Aquatic Species

Bull Trout

Rattlesnake Creek is the only creek in the project area that is known to support a bull trout population. Both Spring Gulch and Marshall Creek have been sampled via electrofishing, but bull trout have not been detected. The Bull Trout Draft Recovery Plan (USDI-FWS 2002) as updated by the USFWS status review in 2008-2009 (USDI-FWS 2008) delineates Rattlesnake Creek as one of the seven local populations within the Clark Fork River Section 2 (Milltown Dam to Flathead River) Core Area of the Clark Fork River Recovery Unit. Rattlesnake Creek is also designated critical habitat for bull trout under the USFWS (2010) final rule.

Within the Clark Fork River Section 2 Core Area (hereafter referred to as the MCFR – Middle Clark Fork River Core Area), distributions of bull trout are largely restricted from historical patterns, bull trout densities have declined, and the proportion of fluvial to resident forms is likely much different than historically (USDA-FS and USDI-FWS 2013). Historic management activities that resulted in the modification of habitat conditions in Rattlesnake Creek (decreasing large debris jams or increasing fine sediment) likely have a large influence on the population today. Redd numbers for the seven local populations in the MCFR Core Area are very low. Although bull trout spawning occurs in other tributaries, the vast majority of fluvial spawning occurs in four areas - Rattlesnake Creek, Fish Creek, Little Joe Creek (St. Regis River), and Cedar Creek. Redd counts in index reaches tend to be highest in Fish Creek and Rattlesnake Creek. Although annual variability is high, redd counts in all index reaches combined average approximately 65-70. These numbers suggest that over the entire MCFR Core Area, the fluvial adult bull trout population currently ranges from about 120 to 300 fish annually. The declines are largely attributed to habitat alteration, fragmentation and loss, and introduction of nonnative species (USDA-FS and USDI-FWS 2013).

Rattlesnake Creek is the uppermost large tributary in the MCFR Core Area, lying just downstream of the confluence of the Blackfoot and Upper Clark Fork Rivers. The Rattlesnake Creek local population has high significance to the MCFR Core Area. In 1903, Mountain Water Company Dam was constructed approximately 5 miles up from the mouth of Rattlesnake Creek, effectively eliminating all upstream migration of fluvial bull trout. The dam negatively impacted the population for nearly a century. In 2001, a cooperative interagency project was initiated with the intent to improve passage at the dam. From 2001-2003, MFWP and Lolo NF personnel manually moved large, migratory fish past the dam until a fish ladder was installed to allow passage in April 2003. The current distribution of bull trout is probably similar to historic, with some restrictions due to the smaller overall population size.

MFWP conducts annual redd counts in select index reaches where spawning tends to be concentrated. These spawning reaches are located upstream of the project area, with incidental spawning occurring in other locations throughout the mainstem. Rattlesnake Creek within the project area is largely considered a migratory corridor and rearing habitat (MFWP, unpublished data). Although fluvial redd counts have been variable from 4 to 36 in the past 15 years, Rattlesnake Creek generally supports the second highest number of redds amongst the local populations in the MCFR Core Area. Redd counts prior to 2000 averaged about 12 per year and then increased substantially as a result of manual transport and installation of the fish ladder at Mountain Water Company Dam in 2003. Redd counts appeared to remain relatively stable until 2009. Milltown Dam was removed in 2008, and from 2009-present, redd numbers in index reaches have remained relatively low, (ranging from 4 to 15). It is unclear what proportion of the decrease in redds within Rattlesnake Creek is attributable to the removal of Milltown Dam (and the ability of some fish to return to their natal streams in the Blackfoot or Upper Clark Fork Rivers), the possibility that some fluvial spawners died or moved out of the area as a result of metals and sediment suspension, or simply natural variability in the spawning population. Monitoring via redd counts will continue into the future to determine the general population trend.

Rattlesnake Creek is the only south-facing drainage in the MCFR Core Area with a measurable fluvial bull trout population. It is unclear what effect the aspect, historic management activities, or dams in the headwater lakes have on current temperature patterns, but the fact that temperatures in the lower reaches regularly approach 18 degrees C is of concern (MFWP, unpublished data), particularly when future climate projections and interactions with non-native species are taken into account (Rieman et al. 2007, Rieman and Isaak 2010, Wenger et al. 2011, Isaak et al. 2012). Effects of non-native species are discussed below.

Westslope Cutthroat Trout

Westslope cutthroat trout are well-distributed throughout the project area, and are found within Rattlesnake Creek, Spring Gulch, and Marshall Creek. Rattlesnake Creek supports both fluvial and resident westslope cutthroat trout that are connected to the Clark Fork since the ladder installation on the Mountain Water Company dam in 2003. Prior to passage, the dam had a pronounced effect on fluvial cutthroat. Estimates of 90-120 individuals congregated at the dam during spawning migrations in late May-early June, so successful passage there has an obvious benefit for cutthroat as well (Knotek 2004). Additional tagging information collected at the time of ladder evaluation and construction (2001-2003) indicated that cutthroat from Rattlesnake Creek span the Clark Fork River from 5 miles upstream to 25 miles downstream of Rattlesnake Creek. This indicated that Rattlesnake Creek is an important source population of cutthroat to a large portion of the Clark Fork River near Missoula (Knotek 2004). Westslope cutthroat are well distributed throughout the mainstem of Rattlesnake Creek in moderately high densities, averaging around 24 fish/100M, and the area throughout the project area is used as spawning and rearing habitat (MFWP, unpublished data). Although some tributaries are fishless, others hold similar densities of cutthroat as well. The replacement of culverts with bridges likely had a marked benefit for cutthroat in the Rattlesnake watershed. Spring Gulch supports a similar density of cutthroat per 100M, although non-native brook trout are also present. In the lower reaches of Rattlesnake Creek (near the project area), cutthroat are hybridized with rainbow trout (see additional information on non-native species below).

Marshall Creek is an important tributary for westslope cutthroat trout. Extremely high densities of westslope cutthroat trout (>175 fish/100 meters) have been sampled downstream of the FS Road #2122 crossing, and below the impoundment at stream mile 2.0 (MFWP, unpublished data). No other fish species have been detected in Marshall Creek. The impoundment on private land at stream mile 2.0 is a complete barrier to cutthroat movement and has genetically isolated fish found upstream. Upstream of the impoundment, westslope cutthroat trout are genetically pure (MFWP, unpublished data). Below the impoundment, genetic samples show a 95-98% cutthroat contribution, indicating a small degree of hybridization with rainbow trout (Oncorhynchus mykiss). Genetically pure populations are prioritized for conservation under the Cutthroat MOU (MCTSC 2007), but habitat area may be limited upstream of the impoundment. In 2010, Forest Service fisheries personnel sampled the headwater tributary to Marshall Creek in Section 32 and found no fish, indicating that fish habitat is limited to the mainstem of Marshall Creek above the impoundment.

Non-native Fish Species

Non-native brook trout (Salvelinus fontinalis), rainbow trout, and brown trout (Salmo trutta) are all present in the Rattlesnake watershed, creating issues for native species through competition, predation, and hybridization. Brook trout densities are high above the Mountain Water Company dam and throughout the current fluvial bull trout spawning areas, increasing chances for hybridization. Although hybridization is unlikely to result in hybrid swarms due to reduced fertility and survival of hybrids, hybridization results in wasted reproductive effort and is therefore a major threat to bull trout populations (Leary et al. 1983). Bull trout-brook trout hybrids have been detected in electrofishing samples (MFWP, unpublished data). Brook trout also compete with native fish for resources (Benjamin and Baxter 2012), and thus impact the westslope cutthroat population in Rattlesnake Creek and Spring Gulch.

Rainbow trout populations are likely not significant in affecting the bull trout population as there is no evidence in the literature to suggest negative interactions between the two species at the current time. However, hybridization and introgression of rainbow genes has a much larger effect on westslope cutthroat trout (Seiler and Keeley 2009, Rasmussen et al. 2010), and hybrids are common, particularly in the lower reaches of Rattlesnake Creek. In addition, self-sustaining rainbow trout populations in the high elevation lakes likely continue to contribute emigrants to downstream populations (Knotek et al. 2004). As mentioned above, rainbow trout also have a small influence on the westslope cutthroat trout in Marshall Creek. Stresses to westslope cutthroat trout from hybridization are likely to be exacerbated by projected climate warming as well (Williams et al. 2009, Muhlfeld et al. 2014).

Brown trout were detected in Rattlesnake Creek in low densities during previous sampling (1999-2007), but their presence is increasing (MFWP, unpublished data). Brown trout likely affect bull trout to some degree due to spatial overlap in habitat preferences and spawning times, but information on direct interactions between brown trout and native bull trout or cutthroat trout is limited.

Western Pearlshell Mussels

The Rattlesnake and Marshall Creek watersheds are within the generalized year-round range map for western pearlshell mussels, but viable population coverage is spotty and less well understood (MNHP 2013). No specific surveys have been conducted in Rattlesnake or Marshall Creeks, but no sign of mussels have been noted from previous field observations (stream surveys, fish sampling efforts, or walk through visits near the creeks). Fine sediment influx has been attributed to declines of mussels, so potential impacts to any existing mussels and/or mussel habitat associated with the proposed actions will be addressed in the Environmental Consequences section.

Environmental Consequences

Alternative A – Direct and Indirect Effects

Under the No Action alternative, only future foreseeable activities approved under previous decisions (prescribed fire and road decommissioning) and ongoing forest management and maintenance activities (recreation management, road maintenance, etc.) would occur within the project area. There would be no fuels reduction via commercial harvest, thinning, or prescribed burning, no other road decommissioning or construction, and no stream crossing replacements or removals. Therefore, there would be no new disturbances in stream channels or streamside areas. In the absence of management-related activities, there would be no change, positive or negative, from the existing aquatic habitat condition. Aquatic species and instream and riparian processes of habitat development would continue on their current trajectory, and would continue to improve as natural processes allow, or would continue to be impacted by existing infrastructure.

Road maintenance and BMP activities would occur along the first 3.7 miles of FS Rd #99/Trail 515 in the main Rattlesnake corridor. These activities are expected to improve sediment and substrate embeddedness indicators at the project scale by increasing drainage frequency, routing water and sediment off the road into vegetated buffers, and reducing the potential for sediment input to streams. The remainder of the existing road system and undersized culverts would continue to affect streams as described in the existing condition, particularly in the Marshall Creek watershed, or would be subject to routine road maintenance as priorities and funding allow.

The only direct effect to aquatic species and habitat under the No Action alternative would be the retention of the undersized culvert on FS Rd#2122. This crossing would continue to restrict access for westslope cutthroat trout and limit genetic mixing with individuals above the culvert. However, it is only a short distance to the next undersized culvert at the County road crossing upstream, and the private impoundment that eliminates fish passage further upstream.

Indirect effects of the No Action alternative would result from the retention of existing roads and their associated stream crossings and undersized culverts. There are increased risks of sediment input to streams from road surfaces and road fill failures at stream crossings over time as the culverts age and reach or exceed their life expectancy. Several of the stream crossings within the project area are undersized and already have an effect on the channel processes of erosion and deposition. We can expect some of these road crossings and fills to fail in the future, although we cannot accurately estimate when, where, or how much sediment would be delivered. Fill failures can lead to increased sediment in streams which can reduce habitat quality and survival for aquatic species. By retaining all existing roads, the risk of sediment input to streams from road surfaces and potential failures would increase, although vegetation growth on those roads would continue to progress as conditions allow.

Indirect effects would also result from the retention of higher than preferred levels of fuels. Vegetation would not be treated as proposed, increasing the risks of insect and disease outbreak and/or wildfire. Since these are both natural processes, their level of effects cannot be accurately assessed, as they could have both negative and positive effects on the stream system depending on their proximity to streams. In the event of an insect and disease outbreak, large trees would likely die and fall, which could increase large woody debris inputs and habitat complexity, but could also increase water temperatures due to loss of shade. In the event of a wildfire, streamside areas would likely burn in a mosaic pattern, but wildfire could replace large areas of forest and riparian areas. In areas of high fire intensity with high vegetation mortality, impacts to streams could include loss of shade and increased sediment inputs from severely burned soils and/or debris flows. Sediment input from eroding soils and unstable banks could lead to increases in embeddedness, which could negatively impact spawning and rearing habitat for fish and other aquatic organisms. However, tree mortality could recruit large wood input to streams and increase habitat complexity.

Comparison of the Action Alternatives B, C, and D - Direct and Indirect Effects

Water Quality

The indicators for water quality are water temperature, sedimentation, and chemical contamination/nutrients. No effects are anticipated to stream temperature due to the retention of a 50-foot no activity buffer and INFISH RHCA buffers that restrict commercial harvest and retain large trees for overhead canopy cover. No effects are anticipated from chemical contaminants/nutrients due to Resource Protection Measures that include proper handling of herbicides, fuels, and prescribed fire.

Fisheries and Engineering personnel reviewed and laid out temporary road locations which are included in Alternatives B and C. No effects on sedimentation are anticipated from the construction, use or decommissioning of temporary roads because they are located in mid-slope locations with adequate buffer distances from water resources. No direct effects on sedimentation are anticipated from commercial vegetation treatments due to application of BMPs and INFISH buffer retention (USDA-FS 1995, USDA-FS 2013). The thick vegetation that makes up RHCA buffers acts as an excellent filtering source for overland sediment flow. Retaining downed woody debris within the harvest units also provides structures that capture sediment and slow or stop its movement down the slope. Thinning and prescribed burning are not anticipated to have negative effects on sedimentation due to retention of a 50-foot no activity buffer, retention of a duff litter layer and the associated infiltration capacity, and limitation of prescribed burning activities so that only incidental prescribed fire is allowed to creep into riparian areas (USDA-FS and USDI-BLM 2001).

Effects to water quality would arise from short-term sedimentation inputs associated with haul roads and road-related rehabilitation activities, with long-term benefits (see Hydrology Specialist's Report for analysis of proposed haul, road work, and assessment of road sediment delivery). Haul road use is expected to increase sediment production, but BMPs would reduce sediment delivery, and road BMPs are designed to be commensurate with the level of use for each alternative. BMP improvements to the transportation system would provide longer-term benefits because they are on main system roads that would remain open following project activities.

Alternative B would result in the greatest amount of haul, and includes use of the main Rattlesnake corridor along FS Rd#99/Trail 515, and haul routes in upper Woods Gulch and the Marshall Creek watershed. Therefore, Alternative B would have the greatest effect on sedimentation. However, activities that have the potential to affect sedimentation would not occur simultaneously. Haul is proposed in two different watershed areas, and thus would occur on two different routes. Other proposed road related rehabilitation activities would be prioritized as funding is secured, so would likely be implemented at a different time or a different year than haul, particularly if winter harvest occurred because instream activities are restricted to a summer timing window. Alternative C would result in haul road use in the upper Woods Gulch area and the Marshall Creek watershed, with no use of the main Rattlesnake corridor for haul. Alternative D has no commercial harvest, and no proposed haul roads, so would have the least impact on sedimentation.

Other proposed road related rehabilitation activities are the same for Alternatives B, C, and D. Short-term sedimentation is expected from road-related rehabilitation activities and instream work, but long-term benefits would be realized upon completion (see Hydrology Specialist's Report for additional analysis information). The majority of the proposed rehabilitation activities would occur in the Marshall Creek watershed, with the exception of some proposed improvements in Woods Gulch and BMPs on the main Rattlesnake road corridor. The only proposed culvert replacement that is known to occur on a fish-bearing stream is the Marshall Creek culvert replacement on FS Rd #2122. However, other aquatic organisms may be affected by the proposed replacements/removals, and associated stream rehabilitation at crossing sites.

Instream activities during culvert removal or replacement would introduce locally measurable amounts of sediment immediately downstream of the sites. Data from monitoring on the Lolo and Bitterroot NFs (Casselli et al. 2000, Jakober 2002) suggests that each crossing removal or replacement could generate 1.1 to 3.2 cubic yards (1 to 2.5 tons) of sediment as a one-time occurrence. Sediment concentration levels introduced during instream work are expected to decrease to pre-disturbance levels within approximately 24 hours, and most of the sediment released is expected to settle out in the first several hundred feet downstream of the project. Small streams with low fill volumes at road crossings would have reduced effects. Timing of instream work during the lowest flow period, which is outside the spawning window of bull trout and cutthroat trout, is required to help minimize short-term impacts.

Long-term benefits are expected with removal of crossings, decommissioning of riparian road segments, and replacements of improperly sized structures. These activities would reduce the potential for culvert and road fill failure and would reduce the connectivity of the road network with the stream network, thus decreasing the chances for sediment to enter streams. Overall, with the implementation of road-related rehabilitation activities, there would be a short-term gain in sedimentation with long-term beneficial effects through the reduction of chronic sediment inputs from roads and a reduction in unnecessary or undersized culvert and road crossings.

Habitat Access

The indicator for habitat access is physical barriers. The proposed road decommissioning and associated culvert removals and replacements are the same for Alternatives B, C, and D. As discussed above, the only proposed culvert replacement that is known to occur on a fish-bearing stream is the Marshall Creek culvert replacement on FS Rd #2122. However, other aquatic organisms may benefit from the other proposed replacements/removals, and associated stream rehabilitation at crossing sites. Sometimes removal of barriers to fish movement can be negative, for example, if it increases the risk of hybridization. The Marshall Creek westslope cutthroat population near the culvert to be replaced is already identified as a hybridized population, so replacement of this culvert to improve passage would only benefit the species within the lower two mile reach below the private impoundment. The remaining population above the impoundment that has been identified as genetically pure would be unaffected. All action alternatives are thus expected to improve conditions for habitat access.

Habitat Elements

The indicators for habitat are substrate embeddedness, large woody debris, pool frequency and quality, large pools, off-channel habitat, and refugia. Substrate embeddedness is very similar to the sediment indicator, so refer to the discussion above. No effects are anticipated to large woody debris due to retention of a 50-foot no activity buffer and INFISH RHCA buffers that restrict commercial harvest and retain large trees for potential large woody debris in the future. No effects are anticipated to pool frequency and quality, large pools, off-channel habitat, or refugia because the only instream work proposed is at stream crossings, most of which would occur on non-fish bearing segments.

Channel Condition and Dynamics

The indicators for channel condition are wetted width/max depth ratio, streambank condition, and floodplain connectivity. No effects are anticipated to these indicators at the project scale due to buffer retention. Culvert replacements would produce localized improvements by restoring proper width/depth at the crossings and proposed removals would improve streambank condition and floodplain connectivity for the length of the crossing improvement site. However, these effects are relatively minor when considering their extent relative to the stream system and most would occur on non-fish bearing streams.

Flow and Hydrology

The indicators for flow and hydrology are change in peak/base flows and drainage network increase. The Hydrologist modeled projected changes in water yield, and even under the most extensive treatment proposal (Alternative B), Equivalent Clearcut Area (ECA – a tool used to model water yield) values would be below the historic range. In addition, any changes would be decreased by buffer retention. The drainage network is based on active channel length, and there are no proposed changes so conditions would be maintained.

Watershed Conditions

The indicators for watershed conditions are road density and location, disturbance history, riparian conservation areas (RCAs), and disturbance regimes. The proposed temporary road construction under Alternatives B and C would occur at mid-slope locations with adequate buffer distances from water resources, and the roads would be decommissioned after use. Under all action alternatives, the proposed decommissioning of both riparian and upland road segments would improve the indicator for road density and location. The disturbance history is based on the amount of ECA within a watershed, the concentration of disturbance in unstable areas or riparian areas, and the degree of late successional forest in the watershed. No detrimental effects are expected to the disturbance history. With regard to water yield and ECA analysis (see Hydrology Specialist's Report for modeling), refer to the discussion above on peak and base flows. The 50-foot no activity buffer, INFISH RHCA buffers and Resource Protection Measures restrict the level of activities within riparian areas, and there are no proposed changes to late successional forest. RCAs and their functions would be maintained with buffer retention. The disturbance regime is based on the duration and scale of environmental disturbances, the predictability of the hydrograph, the resiliency of the watershed, and the stability of natural processes. Since the proposed project would increase resiliency through vegetation treatments and prescribed fire, and attempt to restore natural processes, the indicator for disturbance regime would improve with implementation of any of the action alternatives.

Subpopulation Characteristics

Subpopulation characteristics are based on four indicators: subpopulation size, growth and survival, life history diversity and isolation, and persistence and genetic integrity. These four characteristics are largely dependent on the cumulative influences of the habitat indicators within the watersheds, as described above, as well as influences in the larger Clark Fork River system downstream. In the project area, localized sediment inputs associated with haul routes and road rehabilitation activities may have a short-term effect on aquatic species, but long-term beneficial effects are anticipated following the proposed improvements and reduction in the number of roads and stream crossings. Replacement of the culvert barrier in Marshall Creek is expected to improve indicators for westslope cutthroat trout, but benefits would be minor due to the proximity of other problematic crossings and the private impoundment. BMP improvements in the Rattlesnake corridor would reduce sedimentation to benefit aquatic species in the Rattlesnake watershed.

Integration of Species and Habitat Conditions

All action alternatives are expected to affect sediment and substrate embeddedness associated with the proposed use of roads and road work. The implementation of Alternative B would have a slightly greater effect on sedimentation than Alternatives C or D due to haul road use in the main corridor of the Rattlesnake watershed. By the same standard, Alternative C would have a slightly greater effect on sedimentation than Alternative D due to haul road use in Woods Gulch and the Marshall Creek watershed. BMPs designed to be commensurate with the level of use on the roads would help reduce or eliminate sediment delivery to streams and improve road conditions over the long-term.

Short-term sedimentation is also expected from road-related rehabilitation activities common to Alternatives B, C, and D in the Woods Gulch area and Marshall Creek. Short-term degradation of the indicators for sedimentation and substrate embeddedness would be offset by benefits anticipated from these treatments. Reductions in road density, stream crossings, culvert barriers, and the potential for chronic sedimentation and/or road and culvert failure would produce long-term positive effects. All of the action alternatives are expected to have long-term positive effects on habitat indicators for sediment, substrate embeddedness, physical barriers, road density and location, and disturbance regime, which are expected to improve subpopulation indicators as well. Although they are important improvements and would improve indicators at the project scale (Table 49), they are minor when aggregated to the 6th field HUC scale and thus would not result in any major changes to the baseline conditions (Table 48).

Cumulative Effects for All Alternatives

Present and foreseeable activities include: road construction, maintenance, and use; road decommissioning; culvert removals and replacements; vegetation management and fuels reduction/prescribed burning; land ownership changes; weed treatments; fire suppression; recreational use; dam operation and maintenance; water withdrawal; and development/subdivision. Many of these actions maintain the need for infrastructure built in the past, thus maintaining a certain level of historic and current impacts. Further discussion of potential cumulative effects of each of these activities is described below.

Road Construction

There is no future foreseeable road construction on NFS lands except for proposed temporary road construction in the Marshall Woods project area. Private road construction will likely continue with further development. The level of effects from road construction depends on the proximity to the stream system and characteristics of the road itself. No effects on sedimentation are anticipated from the construction, use or decommissioning of proposed temporary roads because they are located in mid-slope locations with adequate buffer distances from water resources. However, roads can be a major source of sedimentation and disturbance to riparian areas, and thus would likely have a negative cumulative effect on sedimentation.

Road Maintenance/Use

Road prisms will persist on the landscape, and roads will continue to be used. The existing high road density in the lower watershed areas will continue to have negative cumulative effects on sedimentation where roads are in close proximity to streams and/or lacking adequate drainage and buffering capacity to stop sediment delivery. Road maintenance on NFS lands will continue in both watersheds under all alternatives to prevent damage to facilities, maintain safety, and preclude adverse impacts to resources. The Forest Service conducts routine road maintenance activities based on prioritization and available funding. Road maintenance activities and BMPs would have positive cumulative effects by reducing potential stream sedimentation.

Road Decommissioning and Culvert Removals/Replacements

Road decommissioning identified in the Section 31 Decision Memo approved in 2008 is a future foreseeable action under all alternatives. The Marshall Woods project Alternatives B, C, and D include additional proposed road treatments. Road decommissioning and culvert removals/replacements are also likely to continue based on prioritization and available funding, but specific projects have not been identified at this time. Road decommissioning can alleviate chronic impacts from roads, but may cause a short-term increase in sedimentation depending on proximity to streams and if there are associated stream crossings to be removed. Road decommissioning has benefits to aquatic resources by reducing road density and removing the risk of road failure and sedimentation. Therefore, road decommissioning would have long-term positive cumulative effects on sediment and road density indicators.

Culvert removals and replacements also have short-term impacts from sedimentation (1 year), as described above. However, culvert removals and replacements have long-term benefits due to the restoration of properly sized stream channels or structures that allow the channel to function naturally and provide for aquatic organism passage, as well as removing or decreasing the risk of sedimentation from failure. Therefore, culvert removals/replacements would have long-term positive cumulative effects on sediment, physical barriers, and subpopulation indicators.

Vegetation Management and Fuels Reduction/Prescribed Burning

There are no future foreseeable vegetation management activities known except as proposed within the Marshall Woods project area under Alternatives B, C, and D. As mentioned earlier, Resource Protection Measures and road maintenance and BMPs would reduce or eliminate sediment delivery from haul roads associated with Alternatives B and C, but there may be short-term effects on sedimentation. BMPs, buffers, and other Resource Protection Measures reduce or eliminate potential effects from thinning and harvesting activities. Prescribed burning included in the Rattlesnake NRA Wildlife Habitat Improvement and Ecosystem Maintenance Burning Project approved in 1997 is a future foreseeable action under all alternatives. Five of the eight units are within the Marshall Woods project area boundary, and the other three units are adjacent to the boundary. Of the five units within the Marshall Woods project area, Unit 2 (1,106 acres) was implemented in 1997. No negative cumulative effects are anticipated from implementation of the proposed or previously approved prescribed burning treatments due to retention of buffers and other prescribed Resource Protection Measures which are standard operating procedures. When implemented with Resource Protection Measures, both vegetation management and prescribed burning have positive cumulative effects on the disturbance regime of watersheds by improving natural processes and watershed resiliency through reduction of the potential for high intensity wildfire.

Land Ownership Changes

Land ownership change is a foreseeable action common to all alternatives. Change of ownership would result in a shift of management strategies. This shift may have positive cumulative effects in areas where intensive harvest and haul have occurred in the past, as the Forest Service has no future foreseeable actions for harvest or haul in these areas. As vegetation grows back over time, effects from sedimentation on streams would decline.

Weed Treatments

Weed treatments will continue and would follow the direction provided within the Lolo NF programmatic weed treatment EIS, which includes aquatic protection measures. Therefore, no cumulative effects are anticipated from weed treatments.

Fire Suppression

Fire suppression activities would occur as needed. Effects from wildfire suppression would vary with location and size of the fire. Due to the unpredictable nature of wildfires, cumulative effects from future wildfire suppression activities cannot be quantified.

Recreational Use

Recreational use is likely to remain high or increase. High recreation use near aquatic resources can decrease riparian vegetation and bank stability, and increase soil compaction and erosion, thus increasing the likelihood of sediment input to streams. Recreation-related watershed enhancement projects like the completed Rattlesnake bank stabilization project and the Spring Gulch trail project may become more common to reduce negative impacts and protect aquatic resources. Cumulatively, these projects had short-term effects on sedimentation with long-term benefits. The Forest monitors recreational use and if impacts increase, actions to correct them may be necessary.

Dam Operation/Maintenance

Mountain Water Company (or the subsequent owner) will continue to operate and maintain both the large water supply dam in the lower watershed as well as the series of smaller water supply dams in the headwater lakes of the upper watershed. Cumulative effects are not anticipated unless the dams were to fail or if the fish ladder at the lower water supply dam were to stop working so that fish passage was inhibited. Routine dam inspections and maintenance are required and intended to prevent dam failure.

Water Withdrawal

Water will continue to be withdrawn through existing diversions. Cumulative effects on subpopulation indicators are anticipated where the lack of properly functioning screening devices allows for fish entrainment. Proper operation and maintenance of the existing screens could reduce impacts if completed regularly.

Development/subdivision

Development and subdivision off NFS lands will continue, although specific activities and effects cannot be predicted or quantified.

Effects to Bull Trout Critical Habitat

Rattlesnake Creek is designated critical habitat for bull trout under the USFWS (2010) final rule, and is the only critical habitat within the project area. The potential effects from the Marshall Woods project on critical habitat were assessed as part of the matrix of pathways and indicators. In Table 48, the numbers in superscript following indicators crosswalk the connection from indicators to Primary Constituent Elements (PCEs) of bull trout habitat. PCE 9, with regard to non-native species, is addressed in earlier discussions of aquatic species present within the Existing Condition section. There are no proposed activities to directly influence existing non-native species populations, and project activities are expected to have the same effects as described for native species.

Alternative B would have the greatest effect on sedimentation due to log haul on Forest Road #99/Trail 515. However, BMPs and road maintenance activities proposed under all alternatives would reduce the potential for sediment delivery from the road, and a large portion of the road is located on a high terrace with adequate buffering distance. Potential road-related effects from sedimentation to Rattlesnake Creek due to haul would be reduced or nonexistent with Alternatives C and D. Under Alternative C, the only haul within the watershed would occur in the upper Woods Gulch area which lacks a surface connection with Rattlesnake Creek, and Alternative D has no haul. Road-related rehabilitation activities are proposed for the Marshall Creek and Woods Gulch area, which have no surface connectivity to Rattlesnake Creek and thus would not contribute sediment to critical habitat in Rattlesnake Creek. Other proposed activities within the Rattlesnake watershed are not anticipated to negatively affect critical habitat due to implementation of Resource Protection Measures (see Environmental Consequences and Table 49).

Table 49. Summary of Project Scale Effects on Species and Habitat Indicators

The project scale for fisheries analysis is synonymous with the watershed analysis scale defined in Figure 46. The proposed activities may result in major or minor effects, and these effects may Maintain (M), Degrade (D) or Restore (R) habitat indicators. A major effect would result in a change of condition class (i.e. FAR to FA or FAR to FUR), which occurs at the 6th code HUC scale. This table describes minor effects only, indicating actions that may result in an incremental or cumulative effect, but that do not result in a functional change to the system (in this case, project scale effects).

Diagnostic Pathways: Indicators	Alt. A	Alt. B	Alt. C	Alt. D
HABITAT Pathways: Indicators				
Water Quality:				
Temperature [2,3,5,8*]	M	M	M	M
Sediment [2,3,6,8*]	R	D/R	D/R	D/R
Chemical Contamination/Nutrients [1,2,3,8*]	M	M	M	M
Habitat Access:				
Physical Barriers [1,2,3,9*]	M	R	R	R
Habitat Elements:				
Substrate Embeddedness [1,3,6*]	R	D/R	D/R	D/R
Large Woody Debris [4,6]	M	M	M	M
Pool Frequency & Quality [3,4,6]	M	M	M	M
Large Pools [4,5]	M	M	M	M
Off-Channel Habitat [4]	M	M	M	M
Refugia [2,5,9]	M	M	M	M
Channel Condition & Dynamics:				
Wetted Width/Max Depth Ratio [2,4,5*]	M	M	M	M
Streambank Condition [1,4,5,6*]	M	M	M	M
Floodplain Connectivity [1,3,4,5,7,8*]	M	M	M	M

Flow & Hydrology:				
Change in Peak/Base Flows [1,2,5,7,8*]	M	M	M	M
Drainage network Increase [1,7,8*]	M	M	M	M
Watershed Conditions:				
Road Density & Location [1,5,7]	M	R	R	R
Disturbance History [4,7,8,9]	M	M	M	M
Riparian Conservation Area [1,3,4,5,7]	M	M	M	M
Disturbance Regime [4,7,8]	M	R	R	R
SPECIES Pathways: Indicators				
Subpopulation Characteristics:				
Subpopulation Size	M	R	R	R
Growth & Survival	M	R	R	R
Life History Diversity & Isolation	M	R	R	R
Persistence and Genetic Integrity	M	R	R	R
Integration of Species & Habitat Condition	M	R	R	R

Numbers in superscripts indicate the relationship with Primary Constituent Elements for designated bull trout critical habitat (described below). Indicators with an asterisk* were used for western pearlshell mussel analysis.

Primary Constituent Elements within Designated Bull Trout Critical Habitat:

1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

2. Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.

3. An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates to provide a variety of depths, gradients, velocities, and structure.

5. Water temperatures ranging from 2 to 15˚C (36 to 59˚F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on: bull trout life history stage and form; geography; elevation;

diurnal and seasonal variation; shade, such as that provided by riparian habitat; and local groundwater influence.

6. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount (e.g., less than 12%) of fine substrate less than 0.85mm (0.03 in.) in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.
7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges, or if flows are controlled, they minimize departures from a natural hydrograph.
8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
9. Few or no nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass; inbreeding (e.g., brook trout); or competitive (e.g., brown trout)) species present.

In summary, the proposed management actions would not have long-term adverse effects on inland native fish or aquatic species. Proposed road rehabilitation treatments are expected to have long-term positive effects on the cutthroat population in Marshall Creek. A combined Biological Assessment (BA) and Biological Evaluation (BE) that addresses the potential biological effects of the proposed project on bull trout and bull trout critical habitat, westslope cutthroat trout, and western pearlshell mussel would be prepared following selection of the desired alternative. A Stream Protection Act 124 permit would be obtained from Montana FWP for all instream work.

Preliminary Effects Determinations for Threatened and Sensitive Aquatic Species

The effects determination is based on the limited scope of proposed activities within RHCAs, the proximity of those activities to existing aquatic populations, and the implementation of all prescribed Resource Protection Measures described in EA Chapter 2. The preliminary effects determinations for Alternatives A, B, C, and D would be "**not likely to adversely affect**" bull trout, "**not likely to adversely affect**" bull trout critical habitat, and "**may impact individuals or habitat, but will not likely result in a trend toward federal listing or result in reduced viability for the population or species**" (MIIH) for westslope cutthroat trout and western pearlshell mussels.

Recreation

Existing Conditions

The project area contains some of Montana's greatest recreational opportunities close to an urban setting. The Rattlesnake NRA (which includes most of Woods Gulch), portions of Woods Gulch outside the RNRA, and Marshall Canyon provide premier hiking, mountain biking, running/jogging, dog walking, horseback riding, wildlife watching, hunting, and winter activities within minutes (whether driving, biking, or on foot) from Missoula, Montana. The project area includes access through the city of Missoula where city trails connect (the Green-Way) with city streets to multiple trailheads on NFS land. Recreational use in these areas is year round, non-motorized and continues to increase as outdoor recreational activities become more popular. Today the main impacts on natural resources stem from recreational use, noxious weeds, and fuels management.

Rattlesnake National Recreation Area

The 28,000-acre RNRA includes 73 miles of system trails. Nearly all of these are multiple use (non-motorized) trails with certain designations to minimize user conflicts. Most of the use in the RNRA occurs in the South Zone, which is the area generally within three miles of the main trailhead. Camping, camp fires, discharging firearms, and fishing are prohibited in the South Zone. Approximately 4,400 acres of the project area are within the RNRA.

Main Rattlesnake Corridor (RNRA)

Over the last eighteen years, the Missoula Ranger District has monitored use in the RNRA through the Limits of Acceptable Change (LAC) process and has maintained an annual report. Since 1998, this report has included ocular counts of incidental encounters of individuals and groups within the first three miles of the Main Corridor (TR515/RD99) by the wilderness ranger and/or a mountain bike ranger (snow ranger in the winter). Monitoring efforts for the LAC reports vary widely but it is the only data available. The general consensus, among users and managers, is that recreational use in the RNRA seems to be increasing over the years.

A trail counter was installed on March 14, 2014 at the entrance of the main trailhead of the RNRA. While the counter has its limitations and interpretation of the numbers can be subjective. In total, since March 14, 2014 (through September 22, 2014) there have been 91,489 counts.

Woods Gulch (RNRA)

The Woods Gulch Trailhead is about ½ mile from the Rattlesnake Main Trailhead and includes over 23 miles of trail. The Three Larches Trails (TR513.1 and 513.2), a portion of Sheep Mountain Trail (TR513), and the surrounding areas are within the RNRA (Figure 47). Most of this area is included in the South Zone of the RNRA and has the same restrictions as mentioned for the RNRA. The area is connected to the city of Missoula's "Open Space" Land Preserve known as Jumbo/Jumbo Saddle through trails and closed roads. It also connects to Marshall Canyon, making it a popular mountain bike, running, and horseback riding loops. Additionally, the area is used by other recreationists on an almost daily basis. Woods Gulch is a popular dog walking area since dogs do not have to be leashed while on the trail. On all developed recreation sites (trailheads, parking lots, picnic areas, campgrounds, etc.) under 36 CFR 261.16 on NFS lands dogs must be leashed. Dog feces is supposed to be picked up by the owner and taken away from the area to protect water quality in Woods Gulch. A trail counter was installed June 26, 2011 for the day at the Woods Gulch Trailhead as part of the National Visitor Use Monitoring project; 56 counts were tallied on that day (which was a Sunday).

Figure 47. Woods Gulch Trailhead (within the RNRA, South Zone)

Marshall Canyon

Use in the Marshall Canyon portion of the project area is along old roads to access trails in Woods Gulch and loop routes connecting to the City of Missoula's "Open Space" Land Preserve. Dispersed use is not encouraged but there are no area restrictions specifically addressing camping, fire, or discharging firearms like there are in the South Zone. However, this area is surrounded by city land which may have regulations in place and private lands which requires permission to access. Illegal trail construction has been an issue in the past off of the Sheep Mountain Road (FSR 2122). User-created trails are decommissioned soon after they are discovered to prevent unregulated use in the area.

Figure 48. A Segment of the Three Larches Trail (TR513.1) where it crosses through Unit 5 - Marshall Canyon

Units 1 and 81 are located on or near the current recreational opportunities found in Marshall Canyon. A private ski area that operated on NFS lands under a permit was located in Marshall Canyon. Known as Marshall Ski Area, it discontinued operation in 2003 but held their permit until 2013. The permit was revoked in April 2013 and they are continuing to remove equipment off of NFS land. The area continues to offer mountain biking and trail running competitions on the private land. These competitions bring in additional recreation use to Marshall Canyon and neighboring Woods Gulch and Rattlesnake Creek. In the winter, the ski area allows the public to access the old runs through the private land where skiers or snowboarders can hike, skin-up, or ski up to public land.

City of Missoula

The western border of the project area is Van Buren Street/Rattlesnake Drive which is used to access the RNRA and Woods Gulch. Recreationists may choose to expand the recreational experience by biking, walking, or running these roads. Van Buren Street/Rattlesnake Drive has a bike lane on both sides and a sidewalk on at least one side until the intersection of Rattlesnake Drive, Creek Crossing Road, and Lincoln Road. At this point some recreationists may choose to access city trails off of Lincoln Road/Fox Farm Road and then continue on to the RNRA and Woods Gulch trails; others may choose to continue along Rattlesnake Drive.

The eastern portion of the project area includes Marshall Canyon Road which is used to access Marshall Canyon. There are no designated bike lanes or sidewalks along this road. A common recreational loop for bikers and runners is to start in Missoula, access Marshall Canyon trails by means of Marshall Canyon Road, then traverse over to Woods Gulch along the trail system and return to Missoula by Van Buren Street/Rattlesnake Drive.

Trail Maintenance/LAC

Trails are maintained yearly to trail standards set by the LAC Opportunity Classes (OC) (USFS 1986, Appendix O-4). Some of the standards have been modified to allow multiple uses on the trails. For example, trail clearing widths may be modified on some trails to allow for pack stock passage. Trails are cleared initially during the spring to remove fallen trees and maintain drainage structures and cleared multiple times per year if needed. Trails are brushed on a routine schedule as time and money allow. Trails are within, border, or bisect several of the proposed units. Unit treatments vary by alternative but the unit boundaries are the same for each alternative. Trails are listed for each unit in the table below (Table 50). About 43.7% of the actual trail miles are within the project area and all trails are within OC 3, 5, or 6. For the majority of these trails OC standards are followed. Most of these trails are non-motorized multiple-use trails and are used year-round. Trails 515.1 – 515.6 are horse/hiker trails only.

Table 50. List of Trails and Marshall Woods Treatment Units

Trail Name	Trail Number	Length in Project Area (mi.)	Total Length of Trail (mi.)	Unit(s)	Opportunity Class
Missoula Rattlesnake	112M	0.38	0.59	70	6
Sawmill Gulch Wooten Ranch	24.2	0.15	1.3	70	6
Sawmill Cutoff	24.2A	0.03	0.05	70	6
Wallman	29.1	1.79	2.9	2, 101	3
Wallman Cutoff	29.2	0.69	0.75	2	3, 5
Woods Gulch – Lincoln Hills Tie	326	1.14	1.5	1, 64	NA
Woods Gulch Tie	326.1	0.45	0.45	1	NA (boarders 3)
Sheep Mountain	513	2.74	9.5	1, 60, 63, 81, 90	3 (Units 60 and 90) NA (Units 1, 81, 63)
Three Larches	513.1	1.98	2.19	4, 5, 6, 60, 61	3
Three Larches Cutoff	513.2	0.27	0.64	80	NA
Main Rattlesnake	515	3.28	7.6	2, 3, 70, 71, 100A, 100B	5
Cutoff A	515.1	0.87	0.94	71, 100A	6
Cutoff B	515.2	0.12	0.21	100A	6
Cutoff C	515.3	0.18	0.18	71	5
Cutoff D	515.4	0.17	0.36	71	5
Cutoff E	515.5	0.11	0.26	2, 71	5
Cutoff F	515.6	0.19	0.19	71	5
Cutoff G	515.7	0.42	0.58	3, 100B	5
Cutoff H	515.8	0.28	0.28	3, 100B	5
Stuart Peak	517	0.12	7.34	65, 70	3, 6
Stuart Peak/Spring Gulch	517-A	0.25	0.23	70	6
Spring Curry Cutoff	517-B	0.02	0.03	65	3
Spring Gulch	517.1	1.81	1.8	65	3
Total		17.41	39.87		

The trail system in the Woods Gulch and Marshall Canyon portions of the project area includes several existing roads used as connectors for Woods Gulch to Marshall and Mount Jumbo (Table 51). These roads are managed under Forest Service jurisdiction as 3 to 5 year management interval with some motorized traffic. Currently these roads are in need of drainage structures and other maintenance to meet FS standards for vehicle travel. With the exception of using a bicycle on the segment of Road # 53413 north of the junction with the Three Larches Trail # 513.1, bicycle access is prohibited by Special Order No. F13-069-LOLO-D3 (and this trail is heavily vegetated making bicycle access impossible).These roads are not in a designated OC and are not referred to in the LAC as they were recently acquired with adjacent lands. Over half (59.9%) of the entire road lengths are within the project area.

Table 51. List of Roads Used as Trails in the Project Area (excluding FSR 99, which is included above as TR515)

Road Name	Road Number	Length in Project Area (mi.)	Length of Entire Road (mi.)	Treatment Unit(s)
Marshall Ridge Road	16803	2.91	3.07	1, 80, 81, 82
Sheep Mountain Road	2122	2.11	4.22	1, 81
(part of Three Larch Loop)	53413	0.36	0.91	5, 6
	53414	0.71	1.08	81, 82
(Part of Sidewinder)	63135	0.52	0.52	64
Mount Jumbo	63136	0.44	2.1	64
Sidewinder	63136-A	0.08	0.08	64
Total		7.13	11.98	

Trail Use

The main Rattlesnake (RD99/TR515) Trail is 14.7 miles long and is used to access auxiliary trails, the fishable portion of Rattlesnake Creek (above Beeskove Creek), and the Wilderness. The first 0.8 miles allow for a casual stroll to a stream access point near the horse trailhead bridge. The bank of the stream was fortified in March 2014 to reduce erosion and stabilize the bank. Stream access is still available here for dogs, horses, and wading, and a rock bench was added for visitors to sit and enjoy the scenery. Franklin Bridge is a common destination (approximately 8.1 miles) during all seasons. The trail is groomed for cross-country skiing from the main trailhead to Pilcher Creek during the winter months. The trails are groomed by volunteers with the Missoula Nordic Club. They typically groom around 10 days along the main Rattlesnake Trail. In the winter of 2013-2014 the club reported 6 days of grooming. The majority of the use in the RNRA occurs on this trail at some time during the users' trips.

The Stuart Peak Trail (TR517) and Stuart Peak/Spring Gulch Trail (TR 517.1) are popular for mountain biking, hiking, running, and winter activities (skiing, snowshoeing, mountain biking). With the Stuart Peak Cuttoff Trail (TR517-A) or the Spring Curry Cuttoff Trail (TR517-B) providing nice short loops made for quick outdoor adventures. The Stuart Peak Trail (TR517) continues for 7.34 miles to the Wilderness and Stuart Peak. The Stuart Peak Trail intersects with Curry Gulch (TR28.1) near 1.5 miles which takes the user to Sawmill or Ravine gulches. The Sawmill option would take the user back to the main trailhead and the Ravine Trail (TR34) ends in Grant Creek. The trail also junctions the Wallman Trail (TR29.1) which takes the user back to the main

Rattlesnake Trail (TR515). These trails are accessible year-round but are not groomed for winter activities.

Trails 515.1 – 515.6 are horse and foot trails only and meander off the main Rattlesnake Trail (TR515) towards the creek. These trails were identified in the 2005 trail analysis for Pattee Canyon and Blue Mountain Recreation Areas and the Rattlesnake National Recreation Area (USDA-FS 2005). Resource concerns initiated the analysis which inventoried user-created trails, and identified which trails to keep and which trails to obliterate (based on use and resource concerns). These trails were identified as being congested (by the public and FS personnel) previously and this decision affirmed their designation as horse-hiker routes having minimal resource concerns while dispersing use off the main Rattlesnake Trail (TR515). These trails create short loops with TR 515 (versus an out and back trail experience).

Woods Gulch Trailhead is approximately one-half mile away from the main Rattlesnake Trailhead. The main trail is the Sheep Mountain Trail (TR513) that covers 9.5 miles to Sheep Mountain or to the East Fork of the Rattlesnake Trail (TR514) and connects to the main Rattlesnake Trail (TR515) above Franklin Bridge or junctions with the Sheep Mountain Loop Trail (TR1513) to return back to the Woods Gulch area. There are also several smaller treks from the trail including Three Larches (TR513.1 and 513.2). This trail system also links up with the trails on Mount Jumbo or in Marshall Canyon. Woods Gulch is popular year-round especially for recreational users with dog – leashes are not required in Woods Gulch along the trail but feces pickup and removal is appreciated to protect water quality. Again, on all developed recreation sites (including trailheads, parking lots, picnic areas, campgrounds, etc.) under 36 CFR 261.16 on NFS lands dogs must be leashed.

Marshall Canyon is used to access Woods Gulch and the Mount Jumbo area by means of Road 2122. This road crosses through City of Missoula Open Space and then junctions with the Woods Gulch – Lincoln Hills Tie (TR326) where the recreational user can decide to continue to Lincoln Hills and the Mount Jumbo Trail System or take the Woods Gulch Tie Trail (TR326.1) to the Woods Gulch Trailhead. The Marshall Canyon area is use year-round for all types of recreational use.

Hunting on NFS lands in the project area is permissible but with restrictions. Discharge of firearms in the South Zone of the RNRA is prohibited but hunters may bowhunt during the archery season. Hunting regulations are set by the State of Montana (http://fwp.mt.gov/hunting/) and must be followed and referred to yearly (anything reported here can change). Predator (including but not limited to coyote, weasel, skunk and civet cat) and all non-game wildlife (including but not limited to badger, raccoon, rabbit and fox) trapping year-round in the Rattlesnake National Recreation Area and South Zone (36 CFR 261.58 (b)) is prohibited. The RNRAW is closed to furbearer trapping as per State of Montana trapping and hunting regulations. The majority of the hunters use Sawmill Gulch or Woods Gulch during the archery season. The main Rattlesnake Trail (TR515) is used to access lands north of the South Zone and the Wilderness. The Sheep Mountain Trail (TR513) is the main access trail for the Woods Gulch area and also Marshall Canyon. Most of the hunting in Marshall Canyon is on the eastern side of Marshall Canyon Road using old logging roads to access Mittower Gulch, Woody Mountain, and Johnson Creek areas. The main species being hunted are mule and whitetail deer, elk, and black bear.

Environmental Consequences

Analysis Methods

A Recreation Opportunity Spectrum (ROS) analysis was completed in 1983 and determined the RNRA provided a wide range of recreational opportunities, experiences, and settings. This analysis was used and the public was included to develop the Limits of Acceptable Change (LAC)

Management Direction (Appendix O-4). Other recreation type planning tools that are commonly used in recreation planning include Visitor Experience and Resource Protection (VERP), and Visitor Impact Management (VIM), Benefits Based Management (BBM), Scenery Management System (SMS), and Place-based Planning (PBP) (Cerveny et al 2011). A recent review of analysis methods the Forest Service uses for recreation in analysis documents concluded there is a discrepancy on the utility of biophysical science and social science use in recreation analysis compared to other resources (Cerveny et al 2011). These tools are typically used for analyzing recreational needs and recreation development plans; this project would not improve or develop recreation beyond what exists (except for the proposed additional 0.2 miles of trail construction in Marshall Canyon).

For this analysis mostly on-the-ground knowledge was used to analyze the impacts of the proposed actions. The last 10 years of LAC reports (on file at Missoula RD) were used to determine trends in recreation use in the RNRA as well as on-the-ground knowledge. Marshall Canyon and portions of Woods Gulch not in the RNRA were assessed based on on-the-ground knowledge. None of these areas have consistently been surveyed during National Visitor Use Monitoring (NVUM) which is more of an inventory tool rather than an analysis tool. Therefore, that type of data is not available for analysis support. ArcMap and geographic information system (GIS) data layers were used to analyze the proposed activities in regards to recreation features. Comments and concerns identified during the initial scoping period for this project are addressed or clarified in this section.

The following indicator standards are based on the OC ranking as well as recreational user impacts. These standards were designed to define impacts to recreationists and their experience to provide consistency throughout the analysis. There is little to no scholarly data to support recreational impacts from management activities directly. Most literature is based on economic or visual impacts not direct impacts to the user. Perceptions of fuels reduction management activities varies based on the individual recreationist due to experiences, feelings, values, knowledge, frequency of use of the area and place attachment (MacFarlane et al. 2006, McFarlane and Watson 2008, Winter 2007). This analysis will attempt to assess the impacts to the recreational user based on mostly local and on-the-ground knowledge obtained from past recreation administrative needs and management actions. The following impact definitions are specific to this project.

Negligible: Modification to OC standards would be minimal or would not occur at all. Recreationists would not be affected, or the changes in recreational use and/or experience would be below the level of detection. The recreationist would not likely be aware of the management actions associated with this project.

Minor: Modification to OC standards would be minimal. Changes in recreational use and or experience would be detectable, although the changes would be slight. The recreationist would be aware of the effects associated with the management actions but the impacts would be slight.

Moderate: Modification to OC standards would be minimal to substantial. Changes in recreational use and or experience would be readily apparent. The recreationist would be aware of the effects associated with the management actions and may choose to modify their recreational activity.

Major: Modification to OC standards would be substantial or not consistent with LAC direction. Changes in recreational use and/or experience would be readily apparent and have significant consequences. The recreationist would be acutely aware of the effects associated with the management actions and change their recreational activity for long periods.

Short-term: Occurs only during a portion of a single recreation use period, occurs for the full duration of the recreation use period on one occasion, would not have lasting impacts on the user (e.g., the user returns to the area or would not notice the management action).

Long-term: Occurs for the full duration of the recreation use period on multiple occasions and/or would have lasting impacts on the user (e.g., the user would not return or would continue notice the management action).

Actions Common to All Alternatives (Alternatives A, B, C, and D)

Ecosystem Maintenance Burning

The ecosystem maintenance burning approved in the 1997 Rattlesnake NRA Wildlife Habitat Improvement Decision Notice is common to all alternatives. Burning would increase smoke in RNRA, Woods Gulch, and Marshall Canyon and would affect recreationists using any trail within the project area. Burning would occur mostly in the fall when conditions are suitable (see Fire and Fuels Specialist's Report). Most of the literature related to recreation and fire explores the relationship between burn areas and recreation use and demand. Smoke impacts from prescribed or wildfires are generally related to public health. Smoke can cause problems for those with respiratory and cardiac diseases as well as for the very young and elderly. Smoke contains particles that can irritate eyes, throat, and lungs. Smoke can also cause potential risks to visibility and safety when it is thick. Impacts to air resources are carefully monitored and minimized during prescribed burning operations (see Fire and Fuels Specialist's Report). Fire managers not only have to consider impacts to humans but also Class I Wilderness areas; however the Wilderness portion of the RNRAW is not a Class I Wilderness.

Recreationists sensitive to smoke would be displaced intermittently for the duration of the project implementation activities. This could result in adverse, moderate, and long-term impacts to these recreational users and their experience during the burning periods. Other recreationists may simply notice the smell of smoke or see and pass through the smoke depending on the location of the burning operation (negligible to minor). Impacts to recreational users generally depend on perception of recreation constraints from fire and fire management as well as place attachment (Chavez et al 2008). The majority of the recreationists on the Missoula Ranger District have experienced some level of smoke from wildfires or prescribed burns, and most are recurring users of the project area. The RNRA receives substantially less use in the spring and fall than compared to midsummer so the number of recreationalist impacted would be less during spring and fall burns.

Higher levels of place attachment generally result in higher levels of perceived constraints (Chavez et al 2008). However, the Missoula Ranger District continually ignites prescribed burns with a low level of complaints from the community (pers. comm. Kurpius 2014). The Blue Mountain and Pattee Canyon Recreation Areas have had pile burning and prescribed burning within the last ten years to present day. Air quality is highly managed to prevent major smoke impacts to the community (see Fire and Fuels Specialist's Report). Historically the Missoula Ranger District office or the Air Quality Office (operated by Missoula County) receives very few complaints during prescribed burns close to town (i.e., one to seven calls per burn) (pers. comm. Kurpius 2014). This type of acceptance can be related to the knowledge base of the community about fire and fire management actions. Based on this information the impacts to recreationists from burning would be lower than expected and should not exceed moderate (which would be more on an individual basis). Therefore burning activity associated with this project would result in negligible to moderate, short-term to long-term adverse impact to the recreational user and their experience. In order to mitigate these impacts information about the actions in the area would be publicly announced through newspapers, news broadcasts, the Lolo NF webpage, and other social media platforms to ensure the proper amount of information is provided to the public. Additional efforts would include posting signs at the main trailheads and directly informing cooperators/partners. Burning activities are within the standards for the OCs associated with all units that include burning. Tree cutting is allowed to facilitate prescribed burning in all OCs except OC 1 which is only a portion of Unit 101. All other indicator standards would be met for each factor related to recreational use.

Road (RD99/TR515) Improvements

All alternatives include drainage improvements along RD99/TR515. Some recreationists prefer the challenge of the cobbles found along this route just as some recreationists do not. These cobble areas would be eliminated to smooth out the route. This would have beneficial impacts to those recreationists who prefer smoother surfaces for recreation activities and might possibly encourage more recreation opportunities for users who have avoided recreation activities due to the rough condition of the road. Conversely, this would have adverse impacts to those recreationists who prefer the cobbles and the challenges they create. Regardless of either preference, the road improvements would cause delays in recreation activities and possibly closures along RD99/TR515 while the improvements were being made. The RD99/TR515 would also be brushed to standards and have drainage improvements. These upgrades would be noticeable to the recreating public but would more than likely be favorable to the recreational experience. The drainage improvement would prevent trail widening since the recreationist would not need to avoid puddles and cause vegetation damage to the side of the trail. And brushing would allow a greater line of sight and width for passing, especially in congested areas. All these improvements would result in minor to moderate, short-term negative impacts during the implementation phase; however the improvements would last beyond a single recreation use period and would eventually have long-term beneficial impacts to recreational users and their experience. These improvements may increase use along the main Rattlesnake Trail but would not be expected to exceed visitor encounter limits set in the LAC Management Direction.

Road Decommissioning

The proposed road decommissioning in Section 31 that was approved in the 2008 Decision Memo would probably be most noticeable to hikers, runners, mountain bikers, and the hunting community. The roads in Section 31 are mostly grown in and have light hiker trails down them; for the most part they are not heavily-used. Decommissioning these roads would align the management of the area more with the RNRA MA 28 and OC 4 even though Section 31 is not officially a designated portion of the RNRA.

Cumulative Effects of All Alternatives (Alternatives A, B, C, and D)

The analysis boundary for cumulative effects is the project area considering most recreationists travel from the southern end of the project area northward to the trailheads and connect anywhere in between. Van Buren Street and portions of Rattlesnake Drive were repaved by the city in the summer of 2011. The City of Missoula is anticipating reconstructing Van Buren Street from Holly Street to Missoula Avenue in 2015 and implementing a curb installation project on Rattlesnake Drive from Lolo Street to Creek Crossing Street within the next 3 to 5 years (pers. comm. Harby 2014). Any additional paving or road construction would be temporary and would not be expected to add additional impacts to recreationists. Paving Marshall Canyon Road may be in the reasonably foreseeable future; however, given the short length of the road (a little over 2.5 miles) this action would only contribute minor impacts to the overall cumulative impacts.

Currently, Mountain Water Company is allowed to drive on RD99/TR515 to the Wilderness boundary. Generally, they drive the corridor multiple times per year in order to access and maintain their dams which are located in the Wilderness. Recently, the Mountain Water Company's parent company was purchased by Algonquin, a Canadian power and utilities company. It remains uncertain how frequently they would access Missoula's secondary water supply; however, recreationists along RD99/TR515 would only be disrupted for a brief period while the vehicle passed and it is not expected add any cumulative impacts to recreationists.

Pattee Canyon and Blue Mountain could experience increased use if people avoid the Rattlesnake, Woods Gulch, and Marshall Canyon areas during project implementation. This influx would be noticeable to frequent users of these areas and could cause a change in their normal recreational activities. Projects that may impact recreational use in Pattee Canyon and Blue Mountain would be coordinated to ensure the recreating public has multiple options for outdoor recreation. Every effort would be made to keep the public informed of management activities in the area and the Missoula Valley has plenty of other outdoor recreation options.

Overall, the proposed actions common to all alternatives when combined with past, present, and reasonably foreseeable actions would result in minor to moderate, adverse impacts for the short-term. Given the familiarity of the project area and an understanding of restoration and resilience management activities, the general recreating public would recognize the long-term benefits from the proposed activities.

Alternative A – No Action

Under the No Action alternative, there would be no new direct impacts beyond what exists currently. Recreational use of the area would continue to grow or, possibly, decline based on the social climate. User-developed trails would continue to be monitored and decommissioned as necessary as would other dispersed recreation sites. The trail connector would not be constructed in Marshall Canyon. Additionally, there are no new recreational opportunities being considered in the project area at this time.

Indirect impacts would include the potential for wildfire to disrupt recreational activities given that the overstocked understory could lead to a high potential for a high intensity wildfire (see Forested Vegetation and Fire and Fuels Specialists' Reports). Implementation of the remainder of the Rattlesnake Wildlife EMB decision would decrease some of this potential as that project continues to be implemented (1,100 acres of the 2,998 acres approved acres have been burned in Units 2, 3, 65, 71 and 101 of this project). Given the proximity to private residences, every effort would be made to suppress wildfire immediately. There is a retardant base less than eight air miles away (the Northern Region Aerial Fire Depot), water for helicopter dips is readily available (from the Clark Fork River and Wilderness lakes), and multiple fire crews (volunteer, city, and Forest Service) are available in the area. Even with all these firefighting resources, a wildfire may be difficult to contain or extinguish.

A west or southwest wind is common in this area. Depending on the ignition site (lower Rattlesnake Creek vs. mid Rattlesnake Creek) the fire would not be expected to threaten Missoula to a great extent. However, the area also experiences northeast, downsloping wind events. If lightning struck ridgetops in the area, these winds could send fire down the mountain just as fast as it usually goes up. This immediate threat was evident during 2011 when a wildfire started east of Missoula (i.e., West Riverside Fire). Lots of firefighting resources were needed to prevent the fire from spreading to the ridge for fear of the downsloping winds shifting the fire into the adjacent draw.

Other recent fires on the Lolo NF around Missoula (e.g., Black Cat, Lolo Complex, and Mineral Primm) have demonstrated how forest conditions, which are beyond their normal fire regimes, can result in rapid wildfire growth in short periods of time. The forest conditions of the project area are similar to those areas that experienced fires (see Forested Vegetation Specialist's Report) and would be expected to have a high intensity fire that would be difficult to fight from the ground (see Fire and Fuels Specialist's Report).

There would be the possibility of area closures during fire suppression efforts when environmental conditions would be conducive for an extreme fire event. Post-fire conditions may or may not impact recreational use depending on rehabilitation needs. Recreationists may notice more management activities, such as culvert replacements, revegetation efforts, and similar rehabilitation efforts. These activities would be noticeable but they would not be disruptive or prevent recreational use. Trails may be disturbed during suppression activities and might need to be relocated or reconstructed because of these activities but new additional trail development would not likely occur.

Several researchers have evaluated how recreation values and use change after a wildfire and other forest management actions. Overall reactions and use seem to depend on the intensity of the management action, how frequently the recreational user visits the area, the cause or need of the actions, and the perception of management activities. The recreating public seems to accept low intensity fires and tend to change their recreating habits after large severe intensity fires (Vaux et al 1984, Flowers et al 1985, Borrie 2006, Chavez et al 2008, Kyle et al 2010). Differences in the types of recreational activity also play an important role in recreational use after a fire (Loomis et al 2001). However, in Montana, recreational use is generally not impacted by prescribed or wildfires (Hesseln et al 2004).

The No Action alternative may result in negligible to minor, short-term direct impacts to recreationists in the RNRA, Woods Gulch and Marshall Canyon. Negligible impact would be expected under Alternative A with no wildfire. Minor impacts would be expected should a wildfire start in any of these areas. However, it would be expected that recreation opportunities would not decrease as a result of Alternative A; the user would be aware of changes but their use and demand of the area would not change or the change would be slight. Noticeable change would occur only if a wildfire occurred in the area and changed the adjacent landscape near existing trails similar to those depicted in Figure 49. Alternative A would

Figure 49. A cyclist descends the West Game Creek Trail through an area of forest scorched by the Little Horsethief Fire, Jackson Hole, WY. Photo by Brenton Reagan.

not modify the area to impact the LAC and Opportunity Class perimeters (most of the units are in OC3). If a large wildfire occurred the User Encounters may be exceeded due to the lack of vegetation increasing sight distances given the probability of use remaining somewhat the same. Trail maintenance would need to be increased but trail clearing and maintenance standards would be returned to their current levels shortly after the fire and would continue for many years.

Cumulative Effects of Alternative A

The No Action alternative combined with past, ongoing, and future actions would not elevate impacts beyond what is described for direct and indirect impacts (negligible to moderate, short-term and long-term).

Effects Common to All Action Alternatives – Alternatives B, C, D

This purpose of this project is to manage the ecological risks in the area (fuel build ups and mountain pine beetle hazard) to protect the ecological integrity of the area which aligns with the main purpose of designating the RNRAW in the first place (i.e., to protect the watershed, recreational, wildlife, and educational values of these lands). This project does not include trail improvements, maintenance (beyond what is already being done), or major additions of trails (i.e., the project proposes constructing about 0.2 miles of new trail in Unit 81).

All action alternatives would result in more management activity in the RNRA, Woods Gulch, and Marshall Canyon. This would include increased vehicle trips on RD99/TR515 and along Road #2122 which accesses TR513, TR513.2 and TR326. Vehicles would also be present along trails and in meadows where crews would be working. The passing vehicles may interfere with recreational activities causing the activity to stop or another route to be taken. This would result in minor to moderate, short-term adverse impacts to the recreational user and their experience. Frequent and returning recreational users' experience would be intermittently disrupted over approximately eight to ten years in all three areas resulting in long-term impacts. It would be expected that recreationists that frequent the project area might choose to recreate elsewhere which would disperse recreational pressures in the project area. The Pattee Canyon and Blue Mountain recreation areas would likely see increased use.

As far as routine FS management operations (e.g., trail maintenance, restroom maintenance, and other activities) of these areas are concerned, the presence of contractors and FS personnel might reduce the potential for illegal campsites, structure construction, and other illegal activities (such as dumping), which are typically found yearly in all three areas. This would be a long-term beneficial impact for management. This project would be expected to have very minor direct impacts to other management activities during the project implementation period; however, after the proposed actions are completed recreational management activities may be expected to increase due to indirect impacts from burning, thinning, and trail construction. For example, surface improvements on RD99/TR515 may encourage recreational use up to and beyond the restroom at the 3 mile marker which could require more maintenance at that restroom.

Prescribed Burning

Treatments in all of the units include some type of prescribed burning under Alternatives B, C, and D. Prescribed burning would increase smoke in RNRA, Woods Gulch, and Marshall Canyon and would affect recreationists using any trail within the project area. Prescribed burning would not result in opening user-created trails or trails that have been previously rehabbed (see Resource Protection Measures). Impact would be related to smoke as described under impacts to Ecosystem Maintenance Burning under all alternatives (see Ecosystem Maintenance Burning under Effects Common to All Alternatives section above). Implementation of the prescribed burning portion of

Figure 50. Portion of TR 513.1 at the point where it curves into Unit 6 (ahead). Unit 91 is to the left and Unit 61 is to the right. Unit 91 would include burning hand piles, Unit 61 would include underburning.

this project would take more time and be more widespread than the previously approved EMB. The level of impact to the recreating public would be about the same but the duration would be more long-term. Additionally the prescribed burns would have indirect impacts by reducing the chance for a large wildfire and may increase funding for recreation management in the long-term.

Fire management activities are used to reduce fuels and increase the chances of successful suppression operations. The proposed burning could potentially reduce the costs related to firefighting which could be returned to other resource areas including recreation. While the management of the RNRA emphasizes sustaining a natural appearing environment and maintaining or enhance important riparian/wildlife habitat, wildfire would be confined, contained, or controlled due to the proximity of residential areas and the greater community.

Non-Commercial Thinning

Presence of thinning crews would be evident throughout the implementation of the project. Crews would be operating chainsaws during "business hours" (more than likely 0700 – 1630) when recreational use is lowest. Recreationists would hear the chainsaws and would potentially see the crews depending on the location of the thinning. This type of work was completed in the Sawmill portion of the RNRA in 2009-2011. In general, the recreationists in the area were not largely impacted by these actions and they did not voice concerns throughout the operations. Given that history, the impacts to recreational users and their experience from the actual thinning operations would be minor to moderate, short-term and neither adverse nor beneficial.

Thinning would also open up the stands by removing smaller diameter understory trees (see alternative descriptions) and would alter views from the trails. This might create a scenario that would tempt recreationist to walk off trail and create unauthorized trails (Figure 51). This would probably mostly occur at trail junctions where the recreationist would cut across the forest to access another trail or in areas that were not obvious previously. In order to mitigate trail-cutting and development, where trails intersect, thinning or brushing would not occur (see Resource Protection Measures). The results of the thinning would be noticeable to frequent users but should not interfere with recreational activities (minor, short-term).

Figure 51. Example of trail-cutting in an open stand in a recreation area

A fundamental premise of outdoor recreation management is that the quality of recreation experience is related to the setting (Brunson and Shelby 1991). It is obvious that different activities can produce different experiences but the same activity in a different setting can also produce a different experience (Clark and Stankey 1979). A study done in Finland for urban forest management concluded the majority of the participating residents preferred managed forests when comparing photographs of different management results (Tyravainen et al 2003). Though the research was conducted in Finland the setting was much like that of Missoula in that it is an urban environment much like the Missoula Ranger District where the majority (72%) of the users in the study are locals. Participants in the study preferred the photos of open understories and disliked photos of unmanaged understories with limited sight and access. Whether preferred or not, the results of thinning would be apparent and may change the recreational experience along the trails listed in Table 50, especially for frequent recreationists, where the thinning nears the trail or is visible from the trail. Figure 52 shows a viewpoint of Unit 90 from TR 513 where the trail crosses Woods Gulch. Thinning and burning activity would occur above the trail. Smoke and noise would be noticeable along the trail. Trail closures are not expected and signs would be placed at key locations to alert the users to management activities taking place in the area. Social media outlets would also be used to alert users to management activities. This would lessen the impacts to the recreating public as they would be more aware of what to expect and why the management action was taking place (Tahvanainen et al 2001) (see Resource Protection Measure #54). Overall, thinning would have negligible (to the new user) to moderate impacts to the frequent user; major impacts would be avoided through communication and education of the long-term, positive impacts of the treatment.

Thinning would increase the line of sight for users mostly in Units 60, 61, 64, 65, 70, and 71. The Use and Users/Trail Encounters standard for OC 6 would be retained; however, the same standard for OCs 3 and 5 might be compromised as a result of thinning. Thinning would not result in opening user-created trails or trails that have been previously rehabbed (see Resource Protection Measures). Thinning is allowed to reduce high hazard ladder fuels and to facilitate prescribed burning in OCs 3, 4, 5, and 6. Due to the excess ladder fuels present in these OCs, management direction includes the following actions to taken when indicators/factors are exceeded for ladder fuels in high use areas: dead limbs from trees from the ground up to 10 feet, higher on steeper ground should be removed; small trees and brush close to retention trees that could carry fire up in

Figure 52. Looking into Unit 90 from the bridge on TR 513 in Woods Gulch. This area would be thinned and hand piled and those hand piles would be burned.

to branches should be removed; fuel on steeper ground should require more removal; dead trees, unless needed as wildlife trees, should be removed; and all ladder fuels from around trunks of wildlife trees should be cleared. Additionally, the units thinned should be checked every few years to determine the need for additional ladder fuel treatment. These actions would improve the resilience of the area and help ensure the ecological integrity for future generations.

Aspen/Meadow Restoration

Unit 100A is along the main Rattlesnake Trail (RD99/TR515) and at the head of a major trail junction that accesses the following trails: Stuart/Spring Gulch (TR517 and TR517.1), Curry (TR28.1), Sawmill (TR24.2), and Wallman (TR29.1). Recreationists would notice crews sawing and burning along the trail as they passed the site. Recreationists would be affected by smoke and noise for a short period of time (less than a day) during restoration activities at this site. Unit 100B is within Poe Meadows which is the first opportunity to camp (at undesignated sites) as it is just outside the South Zone boundary. There are approximately ten known sites in this meadow. These sites are monitored and naturalized when encountered. Restoration activities would disrupt camping opportunities in Poe Meadows; however, restoration activities would occur during the day when campers are either getting to the site or leaving. Overall impacts to recreational use and experience due to aspen/meadow restoration activities would be minor to moderate because these activities would be relatively slight but readily apparent. Restoration activities would probably only have short-term impacts to recreational activities due to the size of the proposed treatment units (i.e., total is 40 acres). But the result of the aspen/meadow restoration would last for decades providing long-term enjoyment for the users as the meadow would be maintained and the aspens would recover. Impacts would be negligible to minor depending on how often the users passed the area while restoration efforts were being implemented.

Trail Development

A 0.2 mile segment of trail would be constructed in Unit 81 to connect Road #53414 (which would be converted to a trail as part of this project) creating an additional loop in the Woods Gulch/ Marshall Canyon portion of the project area. New trail construction and converting old roads into trails in Sections 31 and 32 (Units 81 and 82) are common to all action alternatives. Trail development would provide more non-motorized recreational opportunities to users and would allow more area for use to spread from Woods Gulch to Marshall Canyon. This would result in beneficial, moderate, and long-term impacts to the recreational user and their experience. Currently, motorized use is not allowed along the roads that would be converted, other than for administrative use, so this action would not impact motorized recreationists (negligible). Unapproved user-created trails mostly in Section 36 (Units 62 and 91) were decommissioned in the summer of 2014 and are no longer available for use. This action may impact a few recreationists; however, these trails were not authorized and would be decommissioned in the reasonably foreseeable future regardless of this project (negligible).

Road Decommissioning

The proposed road decommissioning in Sections 31, 32, and 33 (Units 66, 82, 81, 84, and 200) would probably be most noticeable to hikers, runners, mountain bikers, and the hunting community. The roads in Section 31 are mostly grown in and have light hiker trails down them; for the most part they are not heavily-used. Decommissioning these roads was not part of the original decision for managing Section 31 (PF). This document would affirm that decision and decommission additional miles. Decommissioning these roads would align the management of the area more with the RNRA MA 28 and OC 4 even though Section 31 is not officially a designated portion of the RNRA.

The roads in Section 33 are more open and provide access to hunting areas mostly by biking due to the length of access (but hiking access is available too). Small spur roads in Section 32 are mostly overgrown and not used. The process of decommissioning would be noticed since heavy equipment would need to be walked in and would operate for several days at time. This would increase the amount of noise not normally in the area (similar to impacts from machine piling). These areas are also outside the RNRA.

In Unit 64, the alternative map displays approximately 0.25 miles of road for decommissioning. The road (RD 63136-B) has naturally grown in with vegetation except for a well-used trail down the middle. It is a portion of the City trail known as the Three Trees Trail. The road would be dropped from the NFS Road System and be allowed to continually grow in (this is known as a 3-DN decommission level). Future maintenance would not occur unless damage to natural resources was developing from the road. The road would not be added to the trail system at this time and would not receive scheduled trail maintenance either. This change would not be noticeable to the recreating public and would have a negligible impact to recreation on this trail.

Creek Bank Improvements

The bridge at Spring Creek would undergo some stabilization improvements to limit resource damage at creek access points. Implementation of bank stabilization would not require more than about one day. Similarly to the Rattlesnake Creek bank restoration action, access would be limited as a result and recreation activity would be disrupted during implementation. Other improvements include reducing stream access points along TR515. These user-created trails have removed vegetation which can increase sediment input into Rattlesnake Creek. This is an unwanted change to the ecosystem and impacts water quality. Though creek access is popular along RD99/TR515; bank improvements at the Spring Creek Bridge and trail removal is expected to cause only negligible to minor, short-term impacts.

Culvert Upgrade

The culvert upgrade on Road #2122 would discourage recreational use during removal and installation. This access point is popular with dog-walkers, runners, mountain bikers, berry pickers, hunters, and hikers as that road connects to trails in Woods Gulch, Upper Marshall Creek, and Mount Jumbo. The culvert upgrade would take about three to seven days. Recreationists coming from Woods Gulch or Mount Jumbo who are unaware of the construction activity would have to cross the creek at another location and be aware of the machinery if operating. This would result in a minor, short-term impact to recreational activities. Efforts would be made to sign access points and alert the public (though media) before and during construction to allow the recreating public to adjust their plans. Informing the public would reduce the chances of the recreating public from using the site which would lessen the expected impacts to negligible to minor, short-term.

Effects Common to Alternatives B and C

These two alternatives include the actions listed in Effects Common to All Action Alternatives as well as commercial thinning in Units 1, 4, 5, and 6.

Commercial Thinning in Marshall Canyon (Unit 1) and in the RNRA (Units 4, 5, and 6)

Log hauling would occur when ground conditions allow – dry in summer or frozen/snow covered in winter. In either season, hauling would not occur during high use periods from 3 pm Friday to midnight Sunday; from 5 pm on the day preceding a State or Federal holiday to midnight of the holiday; from 6 am to 8 am Monday through Friday when school is in session, or from 5 pm to 6 pm Monday through Thursday (see Resource Protection Measure #56). Tree removal in Unit 1 would be a skyline operation that would require closing Road #2122 because it would be used for landing decks and hauling activities. This would basically make the road impassible during the implementation of this portion of the project. This would cut off all access to Woods Gulch and the Rattlesnake from Marshall Canyon through NFS lands; however there is a trail through the City of Missoula Open Space lands that would connect to Mount Jumbo. Implementation of this portion of the project would be expected to take about two months; although winter activities usually include weather-related delays and it could be expected to take longer than two months. Closing this road would impact dog walking, mountain biking, hiking, trail running, and, in the winter, cross-country skiing and snowshoeing. Hunting activities could be impacted if ground conditions were favorable during hunting season and harvesting operations continued. Recreational activities that started in Woods Gulch could use TRs 326 and 326.1 to create a loop back to Woods Gulch or Mount Jumbo.

Figure 53. Character Tree along TR 513.1

Tree removal activities in Units 4, 5, and 6 could result in trail closures in Woods Gulch. Units 4 and 5 are above the Three Larches Trail (TR 513.1). Trail closures are not anticipated but may occur in order to ensure public safety (mainly from rolling debris). Closures would be temporary. The trail is at the top of Unit 6. The closure would essentially close all of the loop activities that recreational users usually pursue in the area. Trail closures would be avoided unless public safety concerns outweighed the benefits of allowing recreational activities to continue. Landings would be located on the temporary roads in these units and should not interfere with recreational activities. Skid trails could be viewed as new trails and could encourage new use of an area. Similarly burn piles could be used as dispersed recreation sites. Current recreational use in the RNRA is meeting OC standards, and additional use could cause the User Encounters to increase beyond the acceptable limits. Efforts would be made to conceal skid trails and other areas where bare ground results from management activities in order to prevent additional use of these areas from recreational type events (see Resource Protection Measure # 7).

Character trees in these units would not be cut preserving the character of some of the trails (see Resource Protection Measure #58) (see Figure 53). Character trees are trees that identify a location (such as the Three Larches) or are unique and considered a destination point. These trees are usually ponderosa pine or western larch trees with diameters larger than 20 inches (at breast height). If a tree must be removed to accommodate log haul, Forest Service personnel would be contacted prior to removal to ensure the character of the trails are maintained to the greatest extent possible (see Resource Protection Measure #58).

Overall commercial thinning in Units 1, 4, 5, and 6 would have minor to moderate impacts on the recreational user for a short time (no longer than 3 months) during implementation. This treatment is designed to reduce and prevent impacts from mountain pine beetle by making the trees healthier and therefore more resilient to future invasions (see Forested Vegetation Specialist's Report). Public perception of ecological risks associated with mountain pine beetle infestations (and resulting dead forests) is largely dependent on ecological knowledge and familiarity with the area (McFarlane et al. 2006, McFarlane and Witson 2008). Most of the studies done on forest management in areas of intensive use (e.g., urban forests or national parks) indicate there is public support for management actions to control infestations and to prevent unfavorable growing conditions, public safety, and aesthetic values (Tyrvainen et al 2003, McFarlane et al 2006, Gundersen and Frivold 2008, McFarlane and Witson 2008). It is also noted that the public generally does not support proactive approaches to protect areas not infested or infested at low levels (McFarlane et al 2006, Muller 2011). In 2013 and 2014, the Missoula Ranger District treated several pine trees in the project area with Carbaryl to prevent mountain pine beetles from re-infesting the trailhead and high use areas. This included treating the first three miles of RD99/TR515 in the RNRA and closing the area during the treatment and one day post-treatment. Forest Service staff was on hand to discuss the treatment and closures, and the public was very supportive of the treatments and thankful for the protection efforts (pers. comm. Campbell 2014). This indicates the recreating public in the Missoula area is knowledgeable about mountain pine beetles and the effects of infestations. Since a purpose of the commercial thinning is to reduce mountain pine beetle hazard (the ecological risk) in order to preserve the area well into the future by preserving the ecological integrity of the forest, it is expected the recreating public would tolerate this management action. Therefore, the impacts from commercial logging would be minor to moderate and possibly negative for the short-term. However, over the long-term impacts would be seen as beneficial to the area for the majority of the recreating public. One could argue there would be major impacts to the recreationists who frequently use the RNRA, but given the amount of outdoor recreation opportunities around Missoula, beyond the RNRA, the most intensive impacts to the recreating public would be reduced to moderate. People who live near the RNRA and Marshall Canyon who use the area daily might have to change their routine for the short-term but this project would be implemented in stages as to not close off more than one area at a time. For example harvesting would not occur in Units 1, 4, 5, and 6 at the same time as Units 2 and 3 (see Resource Protection Measure #53). While this is an inconvenience, another purpose of the project is to reduce fuels to protect and maintain communities within the wildland-urban interface.

Temporary Road Construction in the RNRA (Units 4, 5, and 6)

Three segments (1,200 to 2,400 feet each) of temporary road totaling about one mile would be constructed in Units 4, 5, and 6. These roads would not connect any existing trails and would not be open for recreational use during project implementation to prevent resource damage and noxious weed spread. The road construction and subsequent decommissioning after use would create additional noise that is not normally associated with the RNRA. This would result in negligible to minor, short-term impacts for recreational users using TR 513/.1 and RD16803 (the Three Larch Trail loop) during construction and decommissioning activities. The roads would be closed when not in use with berms, slash, logs or other methods to prevent unwanted recreational use (see Resource Protection Measure #13). The users' recreational habits would not experience impacts from these roads.

Effects of Alternative B

This alternative includes the actions listed in Effects Common to All Action Alternatives and Effects Common to Alternatives B and C, as well as commercial thinning in Units 2 and 3 and machine piling in Units 70 and 71.

Machine Pile

Machine piling is proposed in Units 70 and 71. This would not occur in steeper areas (greater than 30% slope). The use of machines in units along the main Rattlesnake Trail (TR515) would introduce noise that is not normally present or expected in recreation areas. Generally, recreationist do not like loud industrial-type noise while recreating but the noise would only be audible for less than one mile and is not expected to last the entire length of the recreational experience. Noise emission levels for excavators range from 80 to 115 decibels (dB) (Haron et al 2012). Sound louder than 85 dB is considered to cause hearing damage. The person recreating in these units during the use of the excavators would not be close enough or endure the noise long enough to experience these effects (http://www.dangerousdecibels.org/education/information-center/decibel-exposure-time-guidelines/). Machine work would typically occur during lower use periods (Monday – Friday, 7 am to 4 pm (normal working hours)). The machine work would be audible at the main trailhead, the horse trailhead, along the first two miles of TR515, and the Cutoff trails in Unit 71 (TR 515.1 – 515.6) as the users passes through the units. Animals may be dispersed off these units but this type of work is generally not done when ground conditions are moist (like during hunting season) so there should not be impacts to hunting; especially since these units are not regularly hunted.

Commercial Thinning in the Rattlesnake NRA (Units 2 and 3)

The main Rattlesnake (RD99/TR515) would be used as the haul route. Log hauling would occur when ground conditions allow – dry in summer or frozen/snow covered in winter (Resource Protection Measure #5). In either season, hauling would not occur during high use periods from 3 pm Friday to midnight Sunday; from 5 pm on the day preceding a State or Federal holiday to midnight of the holiday; from 6 am to 8 am Monday through Friday or from 5 pm to 6 pm Monday through Thursday (Resource Protection Measure #56). Trail closures or delays would be expected during hauling times and would depend on the season selected for harvesting. Essentially, recreational users would expect the main Rattlesnake corridor to be open after 3 pm on Fridays through the weekend with possible closures during the week. The expected timeframe is six to eight weeks with approximately 80 – 90 loads being removed. Recreational users would expect to see log trucks (160 – 180 trips), landing piles, and heavy machinery as well as operators, Forest Service personnel, and ground crews. Vehicle types would vary from pickup trucks and SUVs, to semi-trucks with trailers, and lowboys and tractors.

If this work were completed in the spring/summer, recreational users could expect an increase in vehicle traffic on the first three miles of the road/trail. Vehicles would slow users down or stop the users' progression while passing during each encounter. Users would expect increases in dust; however, water would be applied to the road as need to reduce dust (see Resource Protection Measure #57); or if conditions were exceedingly bad and could not be mitigated, work would be stopped. Hauling would impact users on the main Rattlesnake Trail (TR515) and auxiliary trails including Stuart (TR 517), Stuart/Spring (TR 517.1), Wallman (29.1), Curry (TR28.1), the Cutoff Trails (515.1 – 515.8), and users coming from Sawmill Gulch or Ravine Creek planning to use the first three miles of the main Rattlesnake Trail. Recreational uses that would be slowed or stopped would include: hiking, biking, walking, horse riding, and fishing (above Beeskove), as well as Wilderness access. Delays would be temporary (for the length of the vehicle) and would result in negligible to minor, very short-term impacts. It would be expected that impacts would not sway to the negative or beneficial very strongly. Overall tree removal would improve the resiliency and reduce the potential for wildfire; ensuring longevity of the area. Temporary closures may be enforced to protect public safety; especially during hauling. The closures would result in a more negative impact than act of hauling but would be necessary to prevent an even more negative experience should someone be injured by a passing vehicle. Closures would have a greater impact depending on the length of closure and where it is enforced (e.g., the main trailhead vs. two miles up). Impacts could increase from minor to moderate. Some frequent users may experience a major impact for the short-term but these users tend to understand the importance of management activities to protect and preserve the long-term sustainability of the area. Whereas infrequent or one-time users may experience a longer lasting major impact – for instance if someone passing through the area wanted to hike in the Rattlesnake and it was closed. This would impact their one-time experience majorly since it would not happen.

Recreational users accessing Woods Gulch, Mount Jumbo or using Van Buren Street/Rattlesnake Drive corridor may notice an increase in vehicle traffic from administration, implementation, and hauling activities. Traffic delays would not be expected but a very short-term noise increase would occur. These impacts would be negligible to minor, very short-term, and potentially negative if noticed at all.

There would be a greater presence of Forest Service personnel and contractors in the Rattlesnake which would cause users to follow rules and regulations better. Group size limits, unauthorized groups, dogs off leash, and biking speed limits would be monitored more frequently than they are now and subsequently they would be enforced more frequently.

The thinning itself would open up the units allowing the user to see further into the woods. This may entice users to explore off-trail and create new trails. Resource Protection Measures were designed to retain buffers around portions of the trails to prevent this from happening (see Resource Protection Measure #s 7, 8, 9, 10, 61). New user-trails could cause additional resource concerns. Landings would be located at approved sites that would not cause additional interference with recreational activities or cause permanent resource damage (see Resource Protection Measure #71). Skid trails could be viewed as new trails and could encourage new use of an area. Similarly burn piles could be used as dispersed recreation sites. Current recreational use in the RNRA is meeting OC standards, and additional use could cause the User Encounters to increase beyond the acceptable limits. Efforts would be made to conceal skid trails and other areas where bare ground results from management activities in order to prevent additional use of these areas from recreational type events (see Resource Protection Measure #7).

Ground conditions would dictate when commercial harvest activities would begin if this work were to be completed in the winter. Typically the ground needs to be frozen or have adequate snow depth, before operations can begin to protect soil resources (see Resource Protection Measure #5). Historically, weather conditions have a pattern of long periods of cold with little snow in the Rattlesnake Valley which could allow for harvest operations to begin and end prior to conditions being suitable for cross-country skiing or trail grooming to begin. Typically, the most use in terms of cross-country skiing occurs after January. The ground can be frozen for months and commercial harvest activities in Units 2 and 3 could be completed prior to the peak cross-country ski season in the Rattlesnake. This would result in negligible impacts to cross-country skiers.

If harvest operations were to occur during the cross-country skiing season, skiing opportunities would be reduced if not eliminated in this area for most of that season. The main Rattlesnake Trail (TR515) would be plowed from the main parking lot to Poe Meadows. This portion of the trail is usually groomed for cross-country skiing. Skiers could access the Stuart/Spring Trails (TRs 517, 517.1) from the horse trailhead but would have to park at the main parking lot. Sawmill would still be open to cross-country skiing but would not be groomed. Dog closures would remain in effect (Spring Gulch closed Dec 1 – May 15; Sawmill and Curry closed yearlong).

This would be a major impact to cross-country skiing in the Rattlesnake for that season. Snowshoeing would still be possible but the snow layer on TR515 would be thin and the user may opt not to use snowshoes until reaching the auxiliary trails or further than three miles in. Plowing the road would open more opportunities for hikers, runners, and bikers in the winter. This type of winter use is not typical of the area or in high demand during normal winters. These users would have to expect vehicle traffic (similar to spring/summer hauling). Avoiding vehicles would be more difficult in the winter as the road would be narrower with the plowed snow piles on the sides. This may require more time to move out of the way but would be considered short-term. These users would be well aware of the management activities due to the obviously plowed road and public information; therefore, users would not be expected to have a negative experience when encountering management activities because they would be informed and expect to encounter the activity.

Activities in Unit 2 would require the use of TR29.1 to extract logs from the unit. This trail would be restored to the original width/tread condition and re-opened immediately to reduce the possibility of new trail development from the recreating public (see Resource Protection Measure #64). The trail would be closed during tree removal for possibly one to three weeks. There is a possibility that skid trails would cross TR 29.2. Any skid trail crossings would be perpendicular to system trails. The skid trail would curve as soon as feasible to minimize the distant view. Slash and debris would be placed within the skid trail for at least the “line-of-sight” to discourage use by recreationists (see Resource Protection Measure # 7).

Overall commercial thinning in Units 2 and 3 would have minor to moderate impacts on the recreational user for a short time (i.e., 3 weeks to 2 months) during implementation. The effects of these treatments and how the public perceives these management activities are the same as those discussed above for the other commercial thinning units (see Commercial Thinning in Marshall Canyon (Unit 1) and in the RNRA (Units 4, 5, and 6)).

Road Improvements in the Rattlesnake NRA (RD99/TR515) to Accommodate Log Haul

In addition to the road improvements (e.g., routine road maintenance) common to all alternatives discussed above, road improvements to accommodate log hauling in Alternative B would also include some tree removal and brushing along RD99/TR515. The necessary clearing height for log hauling would need to be 14 feet which is beyond the LAC standard. This standard would temporarily be exceeded on small fragments of the trail. Future management of the road corridor would continue to achieve the 10-foot limitation. Tree removal operations would cause delays in recreation activities and possibly closures along the route while trees were being felled. This would result in minor to moderate, short-term impacts. Tree removal might change the character of the route in some sections and would be noticeable to recreationists who frequent the area; however, new or low use recreationists would probably not notice a change. However, tree removal should not interfere with recreation activities and the ultimate result would be negligible to minor, short-term impacts to recreation use and experience during spring, summer and fall. Winter recreationists might experience a positive change in snow conditions along RD99/TR515 due to a reduced tree canopy, which would allow snow to accumulate along the road more that it currently does (given the same amount of snow fall). This could create improved cross-country conditions during the winter months. Presumably, as a result, winter recreation use and experience would have beneficial, negligible to moderate (depending on frequency of use), long-term impacts.

Cutting character trees along the road would be avoided but it may be necessary in some cases to allow for the haul truck to use the road. Character trees are trees that identify a location or are unique and considered a destination point. These trees are usually ponderosa pine or western larch trees with a diameter (at breast height) lager than 20 inches. If a tree must be removed to accommodate log haul, Forest Service personnel would be contacted prior to removal to ensure the character of the trails area maintained to the greatest extent possible.

Cumulative Effects of Alternative B

Currently, Mountain Water Company is allowed to drive on RD99/TR515 to the Wilderness boundary (and beyond). Generally, they drive the corridor twice a year in order to access and maintain their dams which are located in the Wilderness. Recently, the Mountain Water Company's parent company was purchase by Algonquin; a Canadian power and utilities company. It remains uncertain how frequently they would like to access Missoula's secondary water supply; however, recreationist along RD99/TR515 would only be disrupted for a brief period while the vehicle passed and is not expected add any cumulative impacts to recreationist.

Christensen (2012) takes a look at NRAs and presents evidence about the interaction between public wildland recreation opportunities and the well-being of local residents based on the economic character of the counties surrounding the NRAs. While timber is a major economic driver, so is tourism and outdoor recreation. This project should not drastically impact either economic driver given the small scale of the commercial operation. Outdoor recreation opportunities in the immediate area should still provide ample recreational use alternatives during implementation of the project.

Cumulatively, with all management activities the impacts from commercial thinning in Units 1, 2 3, 4, 5, and 6 could increase to moderate to major over the short-term (depending on frequency) and long-term for the infrequent or one-time users. Infrequent users may experience long-lasting impacts if they are not informed on forest management practices or have had negative past experiences. Infrequent users include members of the public who may only have one opportunity in their lifetime to visit the area (such as visiting family or friends). If the area is closed during their visit they would experience a major impact. Frequent users would notice the overall progress of the project and impacts would be shorter. However, if the project does not have a positive result for that user impact would extend to longer-term than if the project was positive.

Cumulative Effects of Alternative C

Cumulatively, with all management activities the impacts from commercial thinning in Units 1, 4, 5, and 6 would be similar to Alternative B but lessened with not having commercial harvest in Units 2 and 3. Not hauling down the main corridor of the Rattlesnake would impact fewer users.

Cumulative Effects of Alternative D

The cumulative effects of Alternative D when combined with past, ongoing, and future actions would not elevate impacts beyond for cumulative impacts for all action alternatives (negligible to minor, with possible short-term adverse impacts but over the long-term the recreating public would appreciate and understand the benefits of the propose actions to reduce fire severity and increase resilience of the forest in the Rattlesnake NRA.

VISUAL RESOURCES

EXISTING CONDITIONS

Existing Landscape Character

The project area is in the Rattlesnake/Blackfoot Valleys landscape character type and is located within the rounded foothills and mountain slopes that serve as a backdrop for the Missoula community. Rattlesnake Creek and several intermittent streams define the base of the undulating glaciated terrain. Ponderosa pine and Douglas-fir are the dominant tree species in the project area though mixed conifer including additional western larch and lodgepole pine are well represented. Other common trees and shrubs are western red cedar, Engelmann spruce, alpine fir, grand fir, quaking aspen, Rocky Mountain maple, and alder. Small and sporadic pockets of aspen and cottonwoods and other deciduous vegetation create visual interest in landscape color and texture in the lower riparian areas. Vegetation in the project area varies with denser vegetation on the north slopes and more sparse vegetation on the south slopes showing color change of grasses from green to brown in the summer. Mature ponderosa pine with the distinctive 'yellow bark' patterns common to open grown trees are evident. The outstanding multi-colored displays of wildflowers in the alpine meadows and high basins are evident in late summer. There are numerous natural and man-made openings and various textures throughout the landscape. Recreation trails, day use areas, and a trailhead parking area are evidence of the affinity the public has for the area.

Existing Scenic Integrity

Existing scenic integrity is determined on the basis of visual changes that detract from the scenic quality of the area. Viewed from the use areas and travelways (see Scenery Specialist's Report), the project area has a range of 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 boundaries and recent vegetation harvest units with high contrast. Section 33 in the Marshall Canyon (proposed Unit 200) was recently acquired from private landowners and does not meet the minimum visual quality standards for NFS lands, which are established in the Lolo NF Forest Plan. The majority of this section currently has a Visual Quality Objective of unacceptable modification. 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 regeneration harvests, utilities, and roads have low intactness.

ENVIRONMENTAL CONSEQUENCES

Methods of Analysis Summary

The scenery resources inventory consisted of a detailed evaluation of the project area. 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 (VQOs) as established by the Lolo NF Forest Plan. 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. 3D modeling from viewpoints helped to identify potential for change.

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.

Temporally, "short-term" is used to describe effects that vary between immediately upon project completion up to 5 years, and "long-term" refers to effects that would be visible for more than 5 years after completion of activities.

Alternative A- No Action Alternative

Direct and Indirect Effects

If there is no action taken and the proposed action alternatives project do not take place there would be minor direct effect to landscape character associated existing planned activities with regard to road decommissioning in the way of short-term soil disturbance on existing disturbed trail and road alignments. Beneficial effects would occur as the soil erosion and plant regeneration in restored, which would improve scenic integrity. Ongoing prescribed burning within the project areas would have minor impacts to scenery and would be short term showing exposed contrasting soil, burned vegetation and blackened earth. Additionally roadside brushing, stream access elimination (MP 0.3 and .0315) would have minor impacts to scenery and would be short term. The Spring Creek bridge repair may be evident from the roadside/trail because of soil contrast around the built structures in the short term. However as vegetation became reestablished these impacts would be beneficial in the long term creating healthy visually appealing ecosystems. There would be no change to the landscape character and therefore no direct change in future scenic integrity of the project areas from current conditions.

Potential indirect effects on landscape character and scenic integrity would be the probable loss of large groupings of pine trees because of mountain pine beetle infestation, with even greater mortality in uniform lodgepole pine stands. In addition, for diseased areas the potential fire hazard would increase for a short term then also in the longer term when trees begin to fall over. In the event of a high severity wildfire, the fire scar would potentially damage scenic integrity for the long term as seen from sensitive viewing areas. 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.

Cumulative Effects

The No Action alternative cumulative effects analysis for the scenery resources includes analysis of the proposed treatment areas and the viewsheds of the land area encompassing the project area. Several past vegetation modifications including harvests and prescribed burns have occurred and are ongoing on both private and public lands within the existing viewsheds of the project area. Section 33 or Unit 200 as previously described has very low scenic integrity. Reasonably foreseeable future actions if the No Action Alternative is selected are a continuation of these treatments within the area's viewsheds but limited activity within the Rattlesnake NRA. There would be no direct effects to the landscape character associated with the No Action alternative. However, there would be the potential for increased risk of insect and disease or high severity wildfire spreading over a larger area within the respective viewshed identified. If this were to occur it would add to the existing low scenic integrity of the landscape. Additionally, Unit 200 (Section 33) if left untreated (i.e., no reforestation or adjacent proposed thinning in Unit 63) would continue to show very low scenic integrity.

Conclusion

If the No Action alternative is selected there would be no immediate effect to the landscape character of the project areas. The majority of Forest lands seen within the No Action alternative would meet the Forest Plan VQOs; however the existing low scenic integrity associated with Section 33 that was acquired would not. There is potential for the loss of a scenic integrity levels associated with a vegetation disease or catastrophic wildfire, which would have an increased risk of occurring on a larger scale over time.

Alternative B

Direct Effects and Indirect Effects

Commercial thinning harvests and prescribed burn: Visual impacts associated with the harvesting methods would vary depending on the amount of vegetation removed during implementation as well as relative sensitivity to the surrounding viewsheds. Each harvest unit was analyzed for potential impacts. Foreground and immediate foreground impacts from Trails #515 and #29 associated with these harvesting methods would be more intense and would include soil disturbance, skid trails, landings, skyline or cable corridors, paint marking, scattered slash and slash piles, and tree stumps. Background view impacts would show some vegetation removal from the proposed units resulting in texture changes, creating negative edge and silhouettes effects. Temporary road construction would show contrast in color and form from cut and fill. Some of these effects would appear unnatural, contrasting in shape, line, form, and texture within the characteristic landscape. Impacts would be more evident in the winter months because of snow contrast. Units 4 and 5 would have major adverse impacts because of the high visibility from Missoula and I-90 viewsheds. Unit 1 is also highly visible but could meet a partial retention VQO with resource protection measures implemented. The cable yarding units would have a major long-term effect, primarily from contrasting line and texture associated with skyline corridors and unit edge effects. For a description of impacts see Appendix B - Viewpoint Impacts in Scenery Specialist's Report. Prescribed burning would potentially show short-term impacts of blacked earth and vegetation that would contrast in color. According to the research findings found in "Social Science to Improve Fuels Management: A Synthesis of Research on Aesthetics and Fuel Management" (2000), low intensity burning treatments can actually improve scenic quality. This would be evident in a more diverse landscape with a mosaic of vegetation increasing the scenic attractiveness of an area.

Non-commercial thinning and hand pile/machine pile and burn: This treatment would result in skid trails and ground disturbance including low cut stumps and slash that would contrast in view from adjacent the Rattlesnake access road, trailheads and Trail #515. With design criteria in place these impacts would recover within a growing season and not change the landscape character. Units would have a minor to moderate effect.

Non-commercial thin, hand pile and burn piles: Units 90-92 (248 acres) would reduce hazardous fuel loads by cutting trees less than 10" in dbh. The hand treatments would have less impact than commercial harvest units because of the reduced ground disturbance (no mechanized equipment would be used). Hand piling and burning would occur in areas. Located within the RNRA, the VQO for this treatment area is retention. There are immediate foreground views from Trail #513 adjacent to Unit 90. Foreground views are limited to the upper Rattlesnake community but are mostly screened by vegetation. Treatments in these units would have a minor to moderate effect. There would not be a change in landscape character associated with treatment of these units.

Cumulative Effects

The Alternative B cumulative effects analysis area includes the project area and surrounding viewsheds. Previous timber harvests, prescribed burns, and fires have occurred and are likely to continue to occur on both private and public lands in the viewsheds. Future prescribed burning projects may show impacts of contrasting blackened burnt boles, vegetation, and soil that would lower the intactness for a short term having minor effects. Existing regeneration cuts, utility corridors, and roads show contrast in color, shape and form from middleground and background views contributing to lowering the scenic intactness of the area. These present and reasonably foreseeable impacts of nearby blackened earth and patches of brown trees from prescribed burns and wildfires, and line and texture contrast associated with openings from roads and harvest treatments on public and private lands are evident. Because of the sloping terrain and limited acres of high contrast treatments within the action alternatives, there would be some impacts that would contribute to effects within the viewshed but the overall loss or reduction in the landscape character would not occur. The long-term effects of healthier stand conditions have would have some beneficial impact to the collectively viewed landscape and the negative impacts associated with this alternative would not reach a threshold of lowering the overall landscape character of the defined cumulative effects analysis area.

Alternative C

Direct Effects and Indirect Effects

Commercial thinning harvests and prescribed burn: Under Alternative C approximately 515 acres would be treated as commercial thinning harvests with prescribed fire (Units 1, 4, 5, and 6). Treatment for these units would be the same as Alternative B including the temporary road construction. Direct and indirect effects for these units would also be the same and have a major adverse effect for Units 4 and 5, primarily because of the exposed temporary road and skyline corridors contrast.

Non-commercial thinning and hand pile/machine pile and burn: In Alternative C, Units 2 and 3 would have the same treatment as Units 70 and 71 totaling 539 acres. For Units 2 and 3, there would be a reduction in ground disturbing activities associated with the difference in treatment from Alternative B that would affect Trails #515 and #29. With design criteria in place these impacts would have a minor to moderate effect and recovering within a growing season thus not changing the landscape character for those ground-based units.

Non-commercial thin, hand pile and burn piles: The effects of implementing treatments in units 90-92 (248 acres) in Alternative C would be the same as those for Alternative B. Treatments in these units would have a minor to moderate effect. There would not be a change in landscape character associated with treatment of these units.

Cumulative Effects

The major impacts of Alternative C would similar to Alternative B (see above section on Alternative B Cumulative Effects). There would be some impacts that would contribute to effects within the viewshed but the overall loss or reduction in the landscape character would not occur. The long-term effects of healthier stand conditions have would have some beneficial impact to the collectively viewed landscape and the negative impacts associated with this alternative would not reach a threshold of lowering the overall landscape character of the defined cumulative effects analysis area.

Alternative D

Direct and Indirect Effects

Commercial thinning harvests and prescribed burn: No harvest treatments are proposed for this alternative so there would be no major adverse effects associated with harvesting in the RNRA.

Non-commercial thinning and hand pile/machine pile and burn: No temporary roads would be constructed in this alternative. No machinery log hauling or machine piling in the Rattlesnake corridor (or elsewhere) would occur. No commercial treatments are proposed so there would be no associated skyline corridors or mechanized ground disturbance. With design criteria in place, impacts associated with non-commercial harvest as described in the previous section would recover within a growing season and would not change the landscape character for those identified ground-based units.

Non-commercial thin, hand pile and burn piles: Alternative D includes 357 acres of this treatment. Treatment and impacts would be similar to Alternative B with the addition of Unit 6. Unit 6 is mostly screened by topography from a distant sensitive viewpoint location in the south. Treatments in these units would have a minor to moderate effect. There would not be a change in landscape character associated with treatment of these units.

Cumulative Effects

The Alternative D cumulative effects analysis area includes the project area and surrounding viewsheds. Previous timber harvests, prescribed burns, and fires have occurred and are likely to continue to occur on both private and public lands in the viewsheds. Existing regeneration cuts, utility corridors, and roads show contrast in color, shape and form from middleground and background views contributing to lowering the scenic intactness of the area. The present and reasonably foreseeable impacts of nearby blackened earth and patches of brown trees from prescribed burns and wildfires, and line and texture contrast associated with openings from harvest treatments on public and private lands are evident. The long-term effects of healthier stand conditions have would have some beneficial impact to the collectively viewed landscape and the negative impacts associated with this alternative would not reach a threshold of lowering the overall landscape character of the defined cumulative effects analysis area.

Summary of Effects/Consistency with Forest Plan

Alternative B would have the greatest impacts on scenic integrity primarily because Units 2, 3, 4, 5 and 6 are highly visible and show contrasting visual impacts like skid trails, skyline corridors, and roads. The VQO would not be met for these units and would require a Forest Plan amendment. The effects from the other treatment units would be short-term and recover within 1 to 5 years of project implementation. These treatments would reduce the risk of disease, insect infestation, and high severity wildfire while increasing vegetation diversity, which would increase sustainability and have some beneficial long-term impacts to the visual quality of the landscape. Other proposed restoration activities would have some minor impacts to scenery but would be beneficial in the long term.

Alternative C's greatest notable visual difference from Alternative B would be the reduced visual impacts associated with Units 2 and 3, which would be treated non-commercially. The immediate foreground impacts along Trail #515 would be reduced having a modest reduction in overall impacts compared to Alternative B. Units 4, 5, and 6 of Alternative C are highly visible and show contrasting impacts from skyline corridors and roads. The VQO would not be met for these units and would require a Forest Plan amendment. Other proposed restoration activities would have some minor impacts to scenery but would be beneficial in the long term.

Alternative D would meet the VQOs and also meet the Forest Plan goal and standards for scenery. A reduced amount of intensity of treated acres for this alternative would be notable from Missoula, East Missoula and the Rattlesnake communities' viewsheds. Other proposed restoration activities would have some minor impacts to scenery but would be beneficial in the long term.

Heritage Resources

Existing Condition

Cultural resources can span both prehistoric and historic temporal periods, and may include buildings, structures, sites, areas, and objects of scientific, historic, or social value. They are irreplaceable, nonrenewable resources documenting the legacy of past human use of the area currently administered by the Forest Service.

Multiple cultural resource investigations conducted by Lolo NF personnel and University of Montana students between 1976 to present have identified 21 different sites within the Marshall Woods project boundary.

Environmental Consequences

Effects Common to All Alternatives

Cultural sites are non-renewable resources. Continued natural weathering and deterioration cannot be avoided. All heritage resources are subject to these processes; regardless of this project's implementation, these sites will continue to naturally decay.

Alternative A (No Action)

Direct and Indirect Effects

The 2,998- acre Rattlesnake NRA Wildlife Habitat Improvement and Ecosystem Maintenance Burning Decision Notice burn as proposed was analyzed by the Lolo NF Heritage Program in for the

DN (USDA 1996). Result of analysis yielded No Effect to Historic Properties. Ongoing routine road maintenance activities, including the 3.7 miles BMP Maintenance on FS Road 99/FS Trail #515 which will occur in all alternatives, as well as the 1.2 miles of road decommissioning approved in the Section 31 DM are generally not subject to cultural resource field inventory because disturbance is largely confined to an existing (disturbed) road prism. Additionally, FS Road 99/Trail #515 was used as the main point of access into the Rattlesnake Drainage; therefore received daily pedestrian survey by the Heritage Program.

Cumulative Effects

Heritage resources are subject to natural weathering and vegetation encroachment. Dense ingrowth can occur in the rock-lined root cellars, ditches and foundation features of within the project area. Furthermore, tree mortality and deadfall as well as catastrophic wind or fire events can instantly damage these sites. Alternative A, No Action would likely increase the probability of continued tree mortality and potential wildfire events in the Rattlesnake and Marshall Drainages (See Vegetation and Fire/Fuels Specialists' Reports). Thinning of the suppressed understory can assist in the preservation of cultural resources.

Effects Common to Alternatives B, C and D

These alternatives all include ground-disturbing activities of some kind; with changes in treatment prescriptions. Prescribed underburning in the area would have no effect on the historic cultural resources, as: 1) there are no remaining combustible features related to these sites; 2) burning is not proposed near the historic telephone poles along FS Road #99; and 3) the cultural resource itself (ponderosa pine) is naturally fire-resistant. Two prehistoric sites within the Rattlesnake Drainage are within the RHCA buffer; project actions would not occur near these two sites. All three alternatives would assist in providing a visual landscape similar to the historic character of the area.

Direct and Indirect Effects

Vegetation thinning would open up the landscape, helping to restore the Rattlesnake and Marshall drainages to appear as they once did when the area was actively homesteaded. Thinning near cultural resources could also increase the site's visibility to the public, leading to possible looting and vandalism. As long as the Mitigation Measures and Implementation Plan are implemented, there would be no direct or indirect effects of the project.

Cumulative Effects

Increased exposure to the cultural resources following project implementation can result in site vandalism or looting. Interpretation of the history of the area can assist by educating the public, thereby preserving the historic district.

ECONOMICS

The combination of small towns and rural settings, along with people from a wide variety of backgrounds, provides a diverse social environment for the geographical region around the LNF, including the Missoula Ranger District. Local residents pursue a wide variety of lifestyles but many share a common theme—an orientation to the outdoors and natural resources. This is reflected in both vocational and recreational pursuits including employment in logging and milling operations, outfitter and guide businesses, hiking, hunting, fishing, camping, and many other recreational activities.

Timber, tourism, and agricultural industries are important to the economy of local areas. Despite the common concern for, and dependence on, natural resources within the local communities, social attitudes vary widely with respect to their management. Local residents hold a broad spectrum of perspectives and preferences ranging from complete preservation to maximum development and utilization of natural resources.

Environmental Consequences

The economic measures used for this report are project feasibility, financial efficiency, economic impacts, and environmental justice. These measures, including methodologies, are described below.

Project Feasibility

Project feasibility is used to determine if a project is 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. Infeasibility indicates an increased risk that the project may not attract bids and may not be implemented.

The estimation of project feasibility was based on the Region 1 sale feasibility model, which is a residual value timber appraisal approach that takes into account logging system, timber species and quality, volume removed per acre, lumber market trends, costs for slash treatment, and the cost of specified roads, temporary roads and road maintenance. The appraised stumpage rate from the feasibility analysis was compared to base rates, which in this case is the minimum rate of $3.50/CCF (hundreds of cubic feet). The appraised stumpage rate and base rates for each alternative are displayed in Table 52. For Alterative B, the stumpage rate ($15.91/CCF) is greater than the base rate of $3.50, indicating that the project is feasible, (may attract bids and be implemented). For Alternative C, the appraised stumpage rate ($-13.58/CCF) is well below the base rate of $3.50/CCF. However, the predicted high bid for Alternative C ($5.63/CCF) (the best estimate of the bid price on the sale, if it does attract bids) indicates there is a chance that the project could sell, but the project is marginal at best and may not receive any bids. The predicted high bid for Alternative D is zero because no timber would be harvested.

Financial Efficiency

Financial efficiency provides information relevant to the future financial position of the program if the project is implemented. 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 presents one tool to be used in conjunction with many other factors in the decision-making process. PNV 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.

Financial efficiency analysis is not intended to be a comprehensive benefit-cost or PNV analysis that incorporates a monetary expression of all known market and non-market benefits and costs that is generally used when economic efficiency is the sole or primary criterion upon which a decision is made. Many of the values and costs associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. Therefore, they are not described in financial or economic terms for this project, but rather are discussed in the various resource specialists' reports (e.g., refer to the Fire and Fuels, Wildlife, and Forested Vegetation Specialists' Reports for specific benefits of the project).

Costs for restoration activities 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 appraised timber value.

The financial efficiency analysis is specific to the timber harvest and ecosystem management activities associated with the project (as directed in Forest Service Manual 2400–Timber Management, and guidance found in the Forest Service Handbook 2409.18). Costs for sale preparation, sale administration, regeneration, and ecosystem restoration are included. All costs, timing, and amounts were developed by the specialists on the project's interdisciplinary team. The expected revenue for each alternative is the corresponding predicted high bid from the sale feasibility analysis. 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 PNV was calculated using a 4 percent real discount rate over the seven-year project lifespan (2017-2023). For more information on the values or costs, see the Project File.

Table 52 summarizes the project feasibility and financial efficiency, including the minimum rate, predicted high bid (or estimated stumpage value), total revenue, and PNV calculations. Because all costs of the project are not related to the timber sale, two PNVs were calculated. One PNV indicates the financial efficiency of the timber sale, including all costs and revenues associated with the timber harvest and required design criteria. A second PNV includes all costs for the alternatives, including other activities not associated with the commercial harvest. Table 52 indicates that Alternative B is financially inefficient for the timber harvest and required design criteria, as well as for all activities. The PNV for Alternative B is -$227,000 for the timber harvest and required design criteria and -$2,055,000 for all planned activities. Alternative C is also financially inefficient, with a PNV of -$231,000 for the timber harvest and required design criteria and -$2,287,000 for all planned activities.

The predicted high bid is the basis for the timber revenue estimate. The actual timber value would depend on the market when the timber is sold, and may be higher or lower than the predicted high bid.

Table 52. Project feasibility and financial efficiency summary (2012 dollars)

Category	Measure	Alt A	Alt B	Alt C	Alt D
Timber Harvest Information	Acres Harvested	0	507	282	0
	Volume Harvested (CCF)	0	4,645	2,030	0
	Minimum Rate ($/CCF)	$0.00	$3.50	$3.50	$0.00
	Appraised Stumpage Rate ($/CCF)	$0.00	$15.91	-$13.58	$0.00
	Predicted High Bid ($/CCF)	$0.00	$35.12	$5.63	$0.00
	Total Revenue (Thousands of $)	$0	$163,000	$11,000	$0
Timber Harvest & Required Design Criteria	PNV (Thousands of $)	$0	-$227,000	-$231,000	$0
Timber Harvest & All Other Planned Activities	PNV (Thousands of $)	$0	-$2,055,000	-$2,287,000	-$2,239,000

When evaluating trade-offs, the use of 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 economies, and restoration of watersheds and vegetation. The decision maker takes many factors into account in making the decision.

Table 53 lists the costs included in the PNV analyses, which includes all estimated project costs except for those already included in the timber appraisal. Planning costs (NEPA) were not included in any of the alternatives since they are sunk costs at the point of alternative selection. Sale preparation costs of $13.50/CCF and sale administration costs of $4.50/CCF were included.

Table 53. Activity costs associated with timber harvest, required design criteria, and restoration (2012$)

Project Costs	Alt A	Alt B	Alt C	Alt D
Road Maintenance - Non-Haul Routes[2]	$0.00	$0.00	$44,000.00	$44,000.00
Road Decommissioning[2]	$0.00	$96,000.00	$96,000.00	$96,000.00
Culvert Upgrades[2]	$0.00	$49,000.00	$49,000.00	$49,000.00
Road Maintenance - Haul Routes[1]	$0.00	$90,000.00	$45,000.00	$0.00
Weed Spraying[2]	$0.00	$34,172.00	$34,171.00	$34,171.00
Non-commercial Thinning[2]	$0.00	$400,060.00	$435,950.00	$455,410.00
0Piling/Burning Non-Activity Fuels[2]	$0.00	$156,340.00	$193,465.00	$278,440.00
Hand Pile/Machine Pile Slash[2]	$0.00	$333,075.00	$485,850.00	$597,900.00
Thinning Understory/Slashing[2]	$0.00	$63,150.00	$63,150.00	$63,150.00
Fencing[2]	$0.00	$4,000.00	$4,000.00	$4,000.00
Planting[2]	$0.00	$225,000.00	$225,000.00	$225,000.00
Ecosystem Management Burning[2]	$0.00	$557,700.00	$557,700.00	$557,700.00
Prescribed Burning/Site Preparation in WUI[2]	$0.00	$355,500.00	$355,500.00	$355,500.00
Hand Pile/Underburn Harvest Units[1]	$0.00	$244,200.00	$213,840.00	$0.00
Soils Protection Design Criteria[1]	$0.00	$29,083.00	$3,870.00	$0.00
Sale Preparation[1]	$0.00	$62,707.50	$27,405.00	$0.00
Sale Administration[1]	$0.00	$20,902.50	$9,135.00	$0.00
Total, Timber Harvest & Required Design Criteria	$0.00	$446,893.00	$299,250.00	$0.00
Total, Timber Harvest and Other Planned Activities	$0.00	$2,720,890.00	$2,843,036.00	$2,760,271.00

[1] Associated with the timber sale, but not included in appraisal.

[2] Not associated with the timber sale.

Economic Impacts (Jobs and Labor Income)

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 one to examine the effect of a change in one or several economic activities on an entire economy, all else constant. This examination is called impact analysis. The IMPLAN modeling system (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 2012 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) the 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 the wages they receive. 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. The economic impact area for this analysis consists of two Montana counties, Missoula and Ravalli.

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.

For restoration and reforestation activities, the direct, indirect and induced effects were derived using IMPLAN. The resulting direct, indirect and induced employment and labor income coefficients have been incorporated into a spreadsheet developed by the Regional Economist for the USFS, Northern Region.

The analysis calculated the jobs and labor income associated with timber harvest, reforestation, and restoration activities. In order to estimate jobs and labor income associated with timber harvest, the timber harvest levels were proportionally broken out by product type (see Table 54). In order to estimate jobs and labor income associated with reforestation and restoration activities, expenditures for these activities were developed by the resource specialists.

A job (as defined in IMPLAN) is an annual average of monthly jobs. Thus, one job lasting 12 months = two jobs lasting six months each = three jobs lasting four months each. Each of those examples would appear as one job. That one job lasting 12 months can be either full-time or part-time; but it does last for 12 months. When jobs are counted this way, one cannot tell from the data the number of hours worked or the proportion that are full or part-time or anything about seasonality; only that they are yearlong. These jobs are different than full time equivalent (FTE) jobs. However, they can be converted to average FTE jobs by using industry-specific FTE to Employment ratios (number of FTE jobs in an industry divided by total employment in the industry). These ratios are all less than one because Employment contains part-time jobs (so there are more jobs than there are FTEs).

Estimates of average year-long part-time and full-time jobs shown in Table 55 are heavily dependent upon the implementation period of the project. The estimates shown in Table 55 reflect the average over an estimated implementation time of 7 years (2 years for the timber portion of the project). If the actual implementation period is shorter than this, more jobs would be supported over a shorter period of time. Conversely, if the implementation period is expanded, fewer jobs would be supported annually but for a longer period of time. Also, within the implementation period of a project, numbers of jobs supported may or may not be distributed evenly over time depending upon the nature of the project.

Table 54. Percentage of timber harvest by product type

Product Type	Alt A	Alt B	Alt C	Alt D
Sawmills	0	79	79	0
Log Homes	0	0	0	0
Post & Poles	0	0	0	0
Pulp	0	21	21	0

Table 55 displays both direct and total estimates for employment (part and full-time) and labor income that may be attributed to the alternatives. Since the expenditures occur over a 7-year period, the estimated impacts of jobs and labor income would be spread out over the life of the project. Most of the timber harvest and wood processing jobs would occur over the first 2 years of the project. These are not new jobs or income, but rather jobs and income that can be attributed to this project.

Estimates in Table 55 indicate that Alternative B would maintain approximately 37 direct jobs spread over the life of the project, equating to an average of 10 direct jobs per year. These direct jobs would lead to an additional 23 indirect and induced jobs spread over the life of the project, or roughly 8 jobs per year. All together, these jobs would provide roughly $1.9 million of direct labor income and $3.1 million in total labor income over the life of the project.

Alternative A would maintain zero jobs and provide no labor income.

Alternative C would maintain approximately 32 direct jobs, equating to an average of 7 direct jobs per year. These direct jobs would lead to an additional 18 indirect and induced jobs, or roughly 4 jobs per year. In total, these jobs would provide roughly $1.7 million of direct labor income and $2.5 million in total labor income over the life of the project.

Alternative D would maintain approximately 28 direct jobs, equating to an average of 4 direct jobs per year. These direct jobs would lead to an additional 13 indirect and induced jobs, or roughly 2 jobs per year. All together, these jobs would provide roughly $1.5 million of direct labor income and $2.0 million in total labor income over the life of the project.

The analysis assumes the timber volume processed would occur within the designated impact area. However, if some of the timber were processed outside the region, then a portion of the jobs and income would be lost by this regional economy.

Table 55. Total employment and income (2010 dollars) over the life of the project

Analysis Item	Alt A	Alt B	Alt C	Alt D
Direct Employment	0	37	32	28
Total Employment	0	60	50	42
Direct Labor Income (Thousands of $)	0	$1,948	$1,729	$1,531
Total Labor Income (Thousands of $)	0	$3,094	$2,499	$1,993

Definitions:
1. Employment: The total full- and part-time wage, salaried, and self-employed jobs in the region.
2. Labor income: Includes the wages, salaries, and benefits of workers who are paid by employers and income paid to proprietors.

Environmental Justice

As stated in Executive Order 12898, it is required that all federal actions consider the potential of disproportionate effects on minority and low-income populations in the local region. The principles of environmental justice require agencies to address the equity and fairness implications associated with Federal land management actions. The Council on Environmental Quality (CEQ) (1997) provides the following definitions in order to provide guidance with the compliance of environmental justice requirements:

"Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent, or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis..."

"Low-income population: Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect."

None of the alternatives would restrict nor alter opportunities for subsistence hunting or fishing by Native American tribes. Tribes who may be affected by activities on the Lolo NF are included on project mailing lists and have the opportunity to comment on project proposals.

This analysis shows that, overall, when all activities are considered, Alternative B would produce more jobs and income than the other alternatives. It is unlikely, that implementation of Alternative B would adversely affect minority or low-income populations.

Cumulative Effects

The financial efficiency of the project would not be affected by the past, present, or reasonable foreseeable future actions in the project area. Other projects occurring in the economic impact area will have cumulative economic impacts. Many activities listed in Appendix D of the project EA have the potential to contribute cumulatively to jobs and labor income provided by implementing Alternative B.