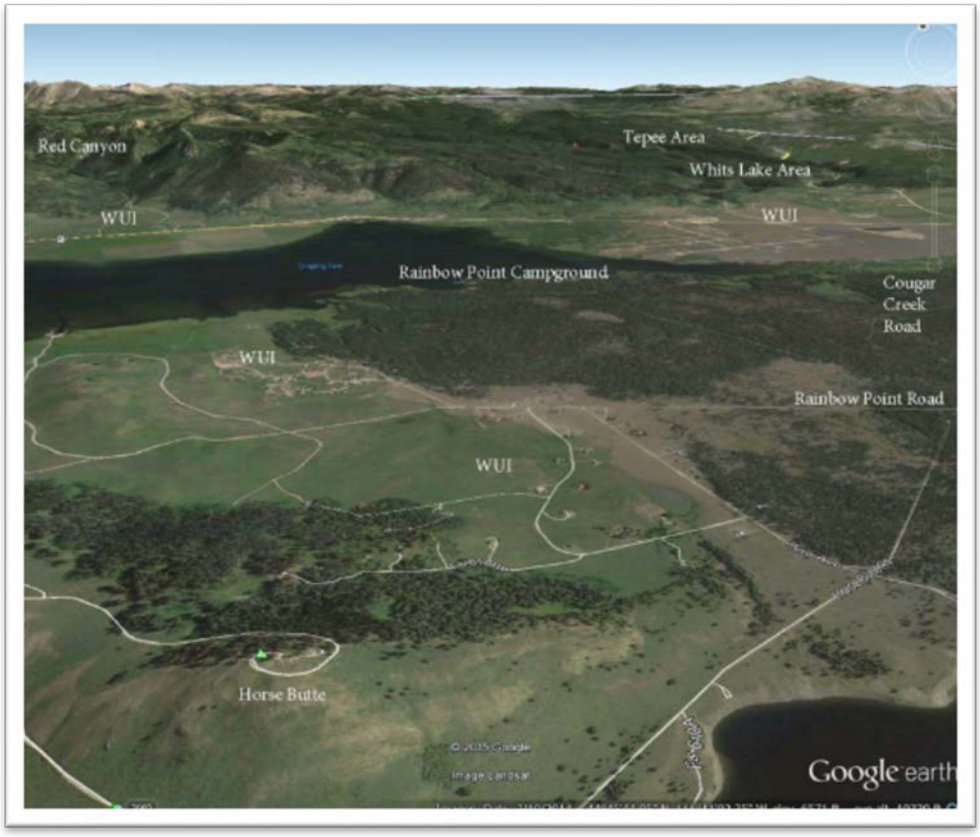
United States Department of Agriculture

North Hebgen Multiple Resource Project

Environmental Assessment

Volume I of II – EA and Appendices A, B

Aerial View of a portion of the Project Area - Looking North from Horse Butte



Forest Service Custer Gallatin National Forest, Hebgen Lake Ranger District March 2017

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*The Cover page includes an aerial view of a portion of the Project Area from Horse Butte looking north into the project area. This view is only a portion of the project area. The image came from Google Earth imagery on 5/15/2015.

Edits are shown in italicized text in the Environmental Assessment (EA)

Page # in the EA	**Description of edits made to the text**
Throughout	Typographical errors and minor wording clarifications were fixed throughout the document. These did not change the context so they are not italicized.
6-13	Clarification to purpose and need descriptions.
13	Rainbow Point Campground ranked 3rd in risk to grizzly bear of the 164 USFS recreation sites assessed for the GYE.
14	Added discussion in Public Involvement about the Comment period since Draft EA.
17, 21, 25	An additional implementation tool was listed. Reworded the Travel Plan Modification included in action alternatives.
30-31	The discussion about a speed limit reduction was modified and a request for a "no roads alternative" was discussed.
63, 65, 66, 67, 68	Minor editorial changes
65, 66. 69, 70, 72-79	Updates to grizzly bear analysis
88	Discussion was added to the conclusion for the weeds issue.
90, 91, 93	Scenery analysis updates/clarification
111	Added to the conclusion for the Climate Change Effect analysis.
113	Update to economics discussion regarding non-monetary benefits.
124	Discussion was added to the conclusion for the roadless issue.
139	*12212016TemporaryRoadManagementCompilation* was added to the Transportation Analysis Summary.
145, 153	Acknowledgement that the Red Canyon TMDL is in progress and includes a commitment to ensure compliance with the outcome when finalized.
156-167	Updated Canada Lynx analysis
179	Updated effects analysis for Black Backed woodpecker
183	Updated MIS discussion
188-192	Updates to the elk analysis
194-198	Updates to the northern goshawk analysis
202	Updates to the analysis for wildlife vehicle collisions
203-204	Added 3 species to the migratory bird analysis
Appendix A A-1 to A-33	Discussion was added in *each category of design feature* explaining how the features are implemented during project design and implementation due to comments received questioning how the work would be implemented and funded. **Monitoring items were converted to blue bold text so they were more readily identifiable.**
A-8	Forest vegetation standards and monitoring were updated.
A-31, 32	Grizzly bear related practices were updated.
A-40	Corrected road information for road FSR 2523-A
Appendix B B-4, B-5, B-9	Incorporated the Finding of No Significant Impact into the Decision Notice so deleted it from the EA andmoved Appendix C into Appendix B. Made minor clarifications for Improvement Cut, Sanitation Cut and White bark pine daylight treatments.
Appedix C Volume II	Appended Volume II which inlcudes Appendix C which is the Response to Comments on the Draft EA.

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Introduction

The Agency prepared this environmental assessment to document the NEPA process used for this project and to determine whether effects of the proposed activities may be significant enough to prepare an environmental impact statement or if a Finding of No Significant Impact (FONSI) is appropriate. By preparing this environmental assessment (EA), the intent of agency policy and direction to comply with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations (40 CFR 1508.9) is met.

The EA describes the need for action, the alternatives considered, direct, indirect and cumulative environmental impacts of the action alternatives, and agencies or persons contacted.

The purpose and need section provides background information related to project development, describes the purpose and need for action and public involvement. The next section describes the alternative development process the no action alternative and three action alternatives, as well as alternatives that were considered but not given detailed study. Next is a discussion of environmental impacts. The effects section is organized in two categories of issues. There are no significant issues related to this project. The first group of issues was used in alternative development to resolve conflicts concerning alternative uses of available resources in the project area (eg. balancing the long term benefit of increased aspen while minimizing the adverse effect of temporary reduction in secure habitat for grizzly bear). The second group of issues are other issues considered and includes a summary of impacts. The last section lists contributors and coordination. ***Appendix A includes Design features and mitigation common to action alternatives. Appendix B is a Description of Treatments. Volume II of the EA is Appendix C which includes the Responses to Public Comments). All specialist reports are available for review on the Gallatin Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request from the Team Leader contact on the cover page.***

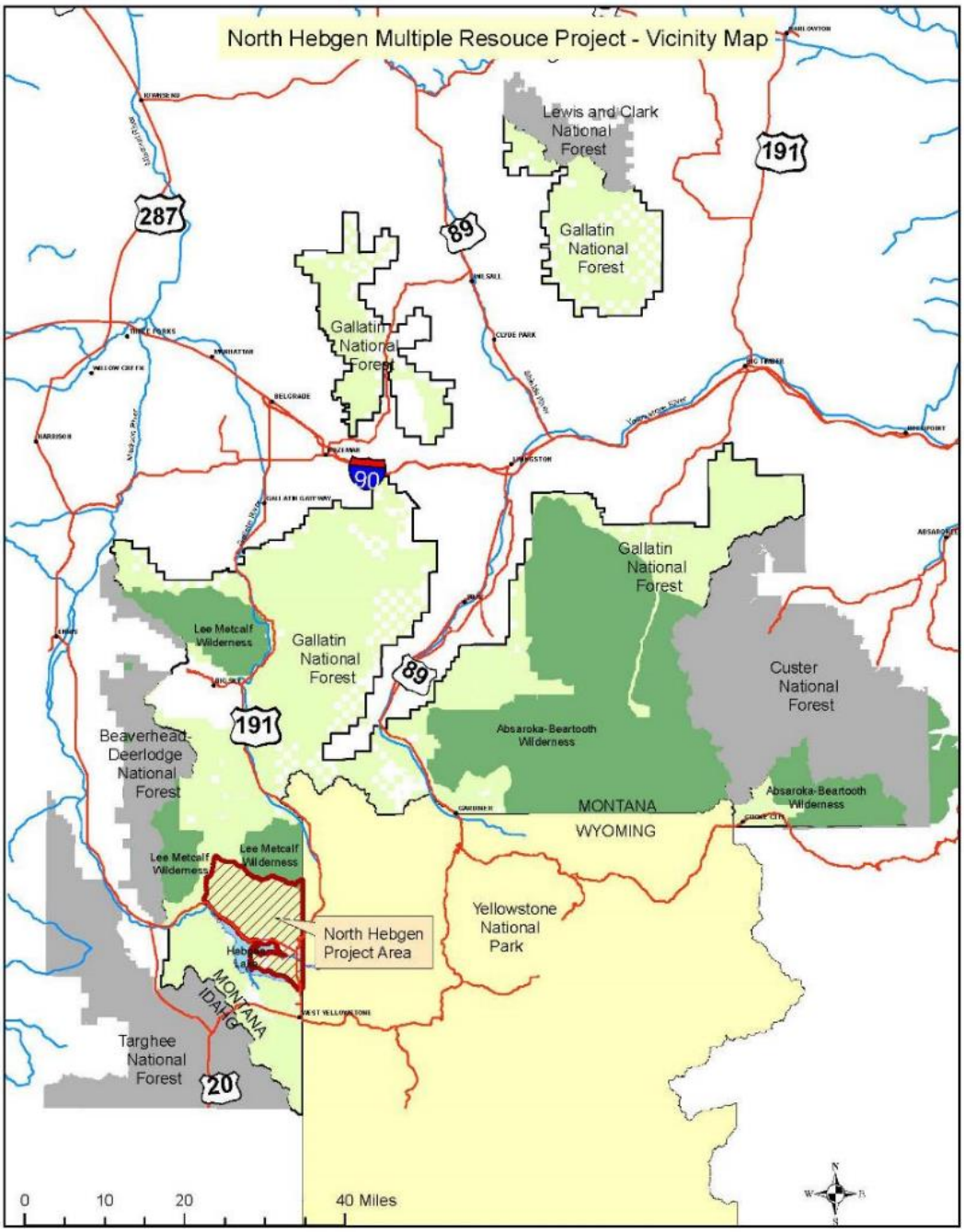
Location and general description of the Project Area

This project area is in the Greater Yellowstone Ecosystem, abuts Yellowstone National Park and includes extensive private land. The project area is located in the Tepee Creek drainage from south of the Cabin Creek Wildlife Management Area to the Madison Arm of Hebgen Lake, and from the Yellowstone National Park Boundary west to the Horse Butte peninsula and the vicinity of Red Canyon on the North side of Hebgen Lake. Treatments are proposed in portions of sections 24-26, 35, 36, T 11 S, R 04 E; sections 17, 19, 20, 29-34, T 11 S , R 05 E; sections 2, 11, 13, 15, 22-27, 35, 36, T 12 S, R 04 E; Sections 3-6, 8-10, 19-22, 27-34, T 12 S, R 05 E and Sections 3, 4 , 10, T 13 S, R 05 E. The project area also includes portions of the Madison 1-549 Inventoried Roadless Area (IRA) close to system roads. Figure 1, that follows, is a vicinity map of the Project Area.

The elevation, topography, and aspects within the analysis area are variable. Elevation ranges from approximately 6,400 feet to over 10,300 feet. All directional aspects and slope shapes (concave and convex) are present and slopes generally range from less than 20% to sheer cliffs. Hebgen Lake is a major feature of the area with all major streams draining into the lake. (Konen 2015, p. 15) The analysis area is about 74% forested and 8% being non-forested, the rest is in transition areas (ibid p. 19). Subalpine Fir mix and the lodgepole pine mix forest dominance types dominate the analysis area, at 31.1% and 29.3% respectively (ibid p. 40). The forested area consists of about 79%

mature[1], trees, 19% pole size and 2.4% seedling /sapling (ibid p. 20). Forest canopy closure is greater than 60% in 51% of the area, and in 33% of the area, the canopy closure is about 40-59.9% (ibid p. 25). Fire, insects, and diseases have been the most influential historic disturbances in the project area (ibid p. 13).

Figure 1. Vicinity map for the Project Area.



[1] Mature forest in this categorization includes trees > 10 inches in diameter, Pole Forest is trees between 5.0 – 9.9 inches in diameter and seedling /saplings are trees less than 5 inches in diameter.

Purpose and Need for the Proposal

The purpose and need was identified through the Hebgen Duck Landscape Assessment (GNF 2012) as a way to implement standards and move toward goals in the Gallatin Forest Plan (USDA 1987 as amended 2015) and to address national fire/fuels policy priorities (Interagency Federal Wildland Fire Policy Review Working Group 2001) (National Fire Plan 2000) (Gallatin County 2006). A *Project Development Summary* with background information from the listed guiding documents is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491[2] .

This proposal is a multiple resource proposal intended to address six management "needs" in the North Hebgen project area.

1. **Create wildland fuel conditions in the wildland urban interface (WUI) that result in low intensity surface fire with low resistance to control. These conditions would provide for public and fire fighter safety and less wildfire risk to homes, improvements, powerlines and evacuation routes (FP-II-31) (Interagency Federal Wildland Fire Policy Review Working Group 2001) National Fire Plan (2000) (Gallatin County 2006).**

In the project area, there are an average of 9.5 wildland fires per year. Typically, two percent escape control and become large fire events with high resistance to control. Due to high recreation use as a gateway community to Yellowstone National Park, 68% of fires are generally human caused (campfires). Eighty percent of the project area is in designated WUI (wildland urban interface) and all of the proposed fuels treatments are within designated WUI (GCCWPP 2006). There is 6.5 miles of critical infrastructure (powerlines) and over 500 structures (values at risk) with additional outbuildings distributed throughout the project area on the flats and near the north shore of Hebgen Lake (Jones 2016). A significant risk to life and property exists wherever forest stands prone to crown fire lie in proximity to residential or recreational development. Therefore, assessing the susceptibility of forest stands to crown fire and designing fuel and silvicultural treatments to reduce susceptibility have become priorities for many land management agencies (Scott and Reinhardt 2001). In association with the National Fire Plan and ensuing appropriations, the Federal Register (January 2001) lists the West Yellowstone area, as a community in the vicinity of Federal lands that is at risk of wildfire.

Fire Behavior results were determined for the PRE condition and POST condition/effects. The modelled flame lengths indicate intense surface fire and likely transition to crown fire for the existing condition in much of the area (Jones 2016). These conditions have a high resistance to control. Fuel treatments can have positive and desired effects of reducing flame length, crown fire potential, resistance to control and increased tree survival (Agee, J.K. 2002). The changes would increase Public and Firefighter Safety and reduce risk to values.

In the action alternatives, the following proposed treatments are designed to address this need: Intermediate harvest- commercial thin, sanitation, Regeneration harvest – clearcut, overstory removal and group selection, Powerline clearing and Precommercial thin. **See Appendix B for a description of the proposed treatments.**

[2] Reference to "Project Webpage" throughout these North Hebgen NEPA documents refers to this weblink: http://www.fs.usda.gov/project/?project=45491

Figure 2. The photo on the left show the existing stand condition on the Flats along evacuation routes and the powerline corridors. There are continuous ladder and crown fuels. These conditions indicate a high resistance to control during fire suppression. The photo on the right shows a unit that has been thinned and represents the desired condition post treatment. The crown fuels are not continuous and the ladder fuels have been reduced.

2. **Create wildland fuel conditions along the Tepee Creek Road that result in low intensity surface fire with low resistance to control that would help fire managers to compartmentalize and contain wildfires to specific drainages and to provide for public and firefighter safety for ingress and egress on this road (FP II-2, II-31)**

The six mile length of Tepee Road FSR#986 from Highway 191 north to Tepee Creek Trailhead #151 is a heavily timbered narrow road corridor that runs along the divide that separates Johnson/Whit's Lake area from the Little Tepee and Tepee Creek drainages. The road corridor currently has a surface ladder and crown fuel configuration that has a high resistance to control.

Figure 3. Photo on the left shows Tepee Creek Road System – representing the continuous tree cover or "fuels". The photos on the right shows an un-thinned stand and a thinned or treated stand *along a road.* The right side of the road shows the desired condition post thinning.

Modeling indicates that high intensity fire would be expected to occur along most of the route (Jones 2016). Access to the area by responding firefighters is hazardous due to the limited visual openings and the potential for entrapment given the one way in and one way out scenario. The roadway would be an opportunistic and strategic location to establish a fuel break *that will provide fuel conditions that promote low intensity surface fire* that can compartmentalize and contain wildfires to specific drainages. It would also provide for public and firefighter safety for ingress and egress given an

active wildland fire event. Fuel Break is defined: "An area, strategically located for fighting anticipated fires, where the native vegetation has been permanently modified or replaced so that fires burning into it can be more easily controlled. Fuel breaks divide fire-prone areas into smaller areas for easier fire control and to provide access for firefighting. (Gallatin County, Community Wildfire Protection Plan; 2006). Compartmentalization of fires by fuel breaks, which may or may not be laid out in a connected network, can help to reduce fire size but generally will not reduce damage per unit areas burned outside of the fuel breaks themselves (Agee and others, 2002). The fuel condition would likely be reevaluated in 15-20 years, to determine whether to maintain the fuel break. The condition on the landscape and social priorities may change in that timeframe.

In the action alternatives, the following proposed treatments are designed to address this need: Intermediate harvest- commercial thin, sanitation, Regeneration harvest – clearcut and overstory removal, Precommercial thin and hand thin.

3. Remove conifer competition in aspen stands to improve aspen regeneration and growth in aspen stands (FP II-21).

Aspen is a deciduous tree that contributes to ecological diversity, supports a variety of plant associations, and provides important habitat for many species of wildlife. Aspen sustainability is a topic of interest in forest ecology (Rogers et al., 2013). Aspen and riparian areas are considered the most biologically diverse communities in the West. These communities are rich in insect and plant diversity, both of which contribute directly to the diet of grizzly bears. Ungulate species such as moose and elk rely heavily on young aspen shoots for forage. These areas, therefore, provide important foraging areas for grizzly bears, gray wolves and their prey species. (Frost 2015) Migratory bird species also rely heavily on aspen communities.

Figure 4: Two examples that represent existing aspen conditions in the project area with conifer competition limiting growth and regeneration of aspen. The photo on the right shows an aspen stand released from conifer competition by an improvement cut.

Conifer encroachment has occurred over a long period of time; encroachment includes large conifers as well as sapling and pole size trees competing with aspen for light, nutrients, and waterfilling in the aspen clones. Field observations indicate that aspen sustainability in the project area is threatened by competition with encroaching conifers, primarily Douglas fir. This is true for all aspen stands. (Frost 2015) The existing condition of all aspen communities in the analysis area is unknown; however field observations indicate that the primary threat to aspen sustainability is competition with and encroachment of conifers, primarily Douglas-fir (Konen 2015). These stands

are in all stages of encroachment from large conifer takeover to sapling and pole size trees filling in the aspen clones. -Aspen is scattered throughout the project area and is most notable at lower elevations near the forest/grassland interface on Horse Butte, in Red Canyon, along Whits Lake Road, on Fir Ridge, and at the base of Tepee Creek Road. It is expected that aspen would [continue to] decline over time; as field observations indicate that conifer encroachment represents the greatest threat to aspen sustainability within the analysis area. Conifers can shade out aspen and severely limit the possibility of aspen suckering (Shepperd et al., 2006).

In the action alternatives, the following proposed treatments are designed to address this need: Intermediate harvest - commercial thin and improvement cut.

4. **Increase the presence of white bark pine forest. The desired condition is to encourage whitebark pine establishment where cone producing mature trees provide a seed source and/or to reduce inter-tree competition around healthy whitebark pine trees to allow the forest stands to reach cone producing age sooner. (FP p. II-21, III-54).**

Whitebark pine (WBP) exhibits influence on ecosystem processes at multiple scales and serves as both a keystone and foundation species. As a keystone species, WBP maintains subalpine biodiversity and its nuts provide an important nutritional source of food for several wildlife species, including grizzly bears. The WBP seed crop is one of the four main food sources sustaining grizzly bear populations in the Greater Yellowstone Ecosystem (GYA). Whitebark pine nuts are highly nutritious and are sought after by many other species of wildlife, as well. As a foundation species, WBP is often the initial colonizer on sites with difficult growing conditions. Once established, it ameliorates site conditions, enabling other plant species to colonize. Severe population declines in WBP communities are attributed to white pine blister rust, mountain pine beetle, fire suppression, wildland fire, and climate change (GYCCWBPS, 2011; Keane et al., 2012; Mahalovich, 2013). Within the GYA, large scale mortality of WBP is driven by a recent mountain pine beetle outbreak, wildland fire, and to a lesser extent, blister rust (Mahalovich, 2013).

Figure 5. Stand conditions in Upper Tepee showing young vigorous WBP with an overstory that is suppressing the understory. This stand is in need of restoration.

Whitebark pine exists primarily in the northern half of the analysis area at elevations greater than 8,000 feet. A recent effort to map and assess WBP stands in the GYA was completed by the Greater Yellowstone Coordinating Committee (GYCC) Whitebark Pine Subcommittee in 2010. This map was derived from a variety of data sources and includes the relative abundance of WBP and a stand level condition assessment ranking as described in the Whitebark Pine Strategy for the Greater Yellowstone Area (GYCCWBPS, 2011). An ecologically-based score was assigned to each stand in regards to its priority for protection and restoration and was based on canopy damage and stand structural data. Stand condition scores ranged from 0 to 9; with higher scores indicting a higher priority for either protection (viable stands) or restoration. In the project area, there is an estimated 20,660 acres of WBP stands ranging from WBP dominated to WBP mixed stands. (Konen 2015) Virtually all of those stands have a need for protection rated at 5-9, and roughly 8,300 acres have a need for restoration rated at 5-9. Proposed treatments are limited to Tepee and Little Tepee Creek near the existing roads in order to balance costs to implement and constraints in the Northern Rockies Lynx Management Direction (NRLMD) (2007) and the Roadless Rule (2001). The

treatment methods proposed in North Hebgen are restoration treatments which address 13% of the stands identified for restoration. Whitebark pine stands would be expected to continue to decrease as a result of competition from more shade tolerant species and continued susceptibility to insects and disease. This would reduce the availability of this important food source for a number of wildlife species including grizzly bears and, potentially, increase the likelihood of negative grizzly bear encounters in the fall as bears search for alternate food sources. *While Costello and others (2014) found that grizzly bear were not necessarily compelled to use less secure habitats due to declines in whitebark pine seed availability, the likelihood of contacts with humans in the fall while bears search lower elevations within their home ranges for alternate food sources may increase*.

In the action alternatives, the following proposed treatments are designed to address this need: Regeneration harvest – *seed tree* and overstory removal and daylighting.

Figure 6. Dense mixed conifer stands with whitebark pine that is being out competed by shade tolerant lodgepole pine and subalpine fir. The photo on the left represents the dense stand condition proposed for the daylight treatment, or restoration. The photo on the right shows a "daylighted" whitebark pine.

5. **Create a more resilient forest. The objective of these treatments is to maintain a diverse, vigorous, and adaptable forest landscape by providing for a mix of species composition, stand structures, and age distribution. This objective would maintain desired vegetative condition, reduce long term losses caused by insects and diseases and actively control damaging agents. (FP II-2, 21, 25, III-56)**

Forest insects and disease are major disturbance processes in forests of the Northern Rocky Mountains. There effects can range from small scale disturbances, killing individual trees, to wide spread outbreaks causing extensive tree mortality. Native forest pests have been part of our forests for millennia and function as nutrient recyclers, agents of disturbance, members of food chains, and regulators of productivity, diversity, and density (Black, 2005). Forested stands within the project area are currently being impacted, or are at risk of being significantly impacted by a variety of disturbance agents. Mountain pine beetle, lodgepole pine (LPP) dwarf mistletoe, western spruce budworm (WSB), Douglas-fir beetle, and white pine blister rust are specifically of concern. The objective of some forest health treatments would be to reduce long term losses and actively control damaging agents.

Mountain Pine Beetle (MPB): Given calculated hazard ratings, loss predictions, observed MPB, species composition, and suggested population dynamics; continued susceptibility and mortality from MPB is expected in the LPP, WBP, and limber pine components of the analysis area under the

no action alternative. Future outbreaks in the analysis area are expected to result in significant mortality in currently moderate and high hazard stands (Jackson and Egan, 2013)(Konen 2015).

Douglas Fir Beetle (DFB) populations within the analysis area are currently minimal. However, Jackson and Egan (2013) report observations that indicate populations were elevated in recent years. They also report that in moderate and high hazard stands elevated DFB activity is anticipated during the next significant drought period; where drought is combined with physiological stress associated with western spruce budworm (WSB) defoliation. Modeling of DFB activity within high hazard conditions indicate up to a 40% mortality rate may occur if environmental conditions (such as drought) are conducive to beetle-attack over multiple years (Negron et al. 1999). Continued susceptibility and mortality from DFB is expected in the analysis area under the no action alternative based on calculated hazard ratings, loss predictions, observed DFB, and the combined effects of WSB. Douglas-fir stands on Horse Butte rate at high susceptibility to DFB attack, contain root and butt rots affecting over mature and younger trees, and WSB defoliation has caused moderate to high levels of damage in over story (20-50% crown defoliation) mid-story (60-90% crown defoliation) and understory (up to 100% crown defoliation) vegetation (Konen 2015).

Figure 7. This photos shows a common stand condition showing loss of aspen from competition and Douglas fir from WSB. Treatments proposed would increase the vigor and health in this stand condition for these desired species.

Western Spruce Budworm (WSB) is the most active and widespread damaging forest insect within the analysis area as noted in Aerial Detection Surveys (ADS) and observations. See Figure 7. Jackson and Egan (2013) observed recent defoliation in multiple canopy layers [of Douglas fir] and most significantly in understory stems where up 100% crown defoliation was observed. They also report that the potential for continued WSB defoliation is high in some areas due to high density canopy layers, levels of crown connectivity, and the presence of multiple canopy layers. In areas not dominated by lodgepole pine or whitebark pine, hazard ratings were primarily high and remained at those levels overtime. Continued impacts from WSB are expected in susceptible areas within the analysis area, impacts include reduced growth and seed production, top kill, mortality.

Lodgepole Pine Dwarf Mistletoe (LPDMT) Much of the lodgepole pine dominated areas within the analysis area are infected or have infections of LPDMT in the vicinity. See Figure 8 for an example of stand conditions. The spread, intensification, and impact of LPDMT have been studied extensively and provides insight into expected effects to LPDMT from the no action alternative. Spread is common from overstory to understory trees. Impacts of LPDMT include reduced growth, reduced resiliency to insects and fire, and mortality (Dooling et al., 1986).

The entire project area was evaluated for forest health concerns but the areas selected for treatment were limited to locations that generally met other desired conditions such as the need for improved fire fighter and public safety and were readily accessible. Some areas, managed in the past are losing vigor due to overcrowding. These stands would be improved by thinning small trees (< 5inches) to improve growth while at the same time reducing ladder and crown fuels. These units are primarily along evacuation routes and near private land.

Figure 8. Lodgepole pine stands with dwarf mistletoe in the overstory and understory.

Figure 9. This lodgepole pine stand represents the "carpet of lodgepole pine".

Douglas fir forest is minimally represented in the area due to stand succession, limited potential habitat and ongoing attacks from Douglas fir beetle and WSB (Figure 7). Retention of Douglas fir forest is important because this species is fire tolerant and presence of Douglas fir adds to species diversity, in a landscape dominated by lodgepole pine forest. A diversity of species increases landscape resiliency in the event of epidemic level attacks by insects or disease. The desired condition is to maintain or increase Douglas fir forest.

There is very little species or age class diversity in lodgeole pine stands in the slopes above Whit's Lake Road. A carpet of (LPP) lodgepole pine tends to dominate the slopes allowing very little sun to reach the forest floor, the end result is little or no forage or age diversity. See Figure 9. In these stands, the desired condition is to create openings that will result in forage and age diversity (FP II-18, 21, III-54, 65).

Although aspen and whitebark pine enhancement is discussed separately, those treatments also increase vegetative diversity in a fairly uniform landscape resulting in increased resiliency on the landscape (FP II-21).

In the action alternatives, the following proposed treatments are designed to address this need: Intermediate harvest - commercial thin, improvement cut, sanitation, Regeneration harvest – clearcut, overstory removal and group selection, Powerline clearing and Precommercial thin.

6. Increase sight distance and reaction time to reduce the likelihood of collisions between wildlife and vehicles along Highway 191 and to reduce negative human/grizzly bear encounters around Rainbow Point Campground due to limited sight distance.

Mortalities occur every year along Highway 191 within project area boundary because of vehicle collisions with animals such as grizzly bear, elk, deer, moose, and bison, as well as many others. Sight distance is limited along U.S. Highway 191 because of dense forest cover. Vehicles travelling at high speeds have limited sight distance and reaction time, which results in a higher likelihood of wildlife injury and death, as well as human injury and death due to collisions. The number of collisions could be reduced if drivers had longer sight distances from the road periphery to the edge of the forest. The dense forest adjacent to the Highway contributes to lower sight distance. In the action alternatives, the following proposed treatment is designed to address this need: Highway Thin.

Visibility of animals to drivers may be improved by removing vegetation from the side of a highway (Federal Highway Administration, 2008), pg. 92). The report explained that once a driver sees a road hazard, it may take 0.7 to 1.5 seconds to move their foot from the accelerator to the brake. With a speed limit of 70 mph on Highway 191, a collision with wildlife could easily occur before a driver

has a chance to brake. The sooner a driver sees an animal, the better the chances are that the driver has enough time to react and avoid a collision (Federal Highway Administration, 2008, pg. 92). Several studies support this conclusion. (Puglisi, Lindzey, & Bellis, 1974) as cited in (Federal Highway Administration, 2008) found that deer collisions occurred less where vegetation was more than 75 feet from the highway. (Lavsund & Sandegren) as cited in (Federal Highway Administration, 2008) reported that deer collisions decreased as distance between the highway and forest cover increased. (Meisingset, Loe, Brekkum, & Mysterud, 2014) found that vegetation clearance resulted in fewer deer collisions in the winter season. Moose-vehicle collisions were reduced by 20% by clearing vegetation from the highway (Lavsund & Sandegren) as cited in (Federal Highway Administration, 2008). (Andreassen, Gundersen, & Storaas, 2005) as cited in (Federal Highway Administration, 2008) found that forest clearing resulted in a 49% reduction in wildlife collisions.

Sight distance is also limited in and around the Rainbow Point Campground due to dense forest cover. The campground is one of the busiest campgrounds in the Northern Region of the Forest Service and resides in the primary conservation area for grizzly bear. There have been numerous unintended encounters near the campground that have ended in a range of outcomes from nuisance bear habits that result in removal of the bear, to human fatalities. *In 2014 the Greater Yellowstone Coordinating Committee (GYCC) ranked USFS recreation sites in the GYE according to their relative risk to grizzly bears (2014 GYE campground risk and infrastructure survey). This ranking was based on a number of factors, including grizzly bear occupancy, availability of food storage containers, information boards, trash receptacles and service, and others. Rainbow Point Campground ranked 3rd in risk to grizzly bear of the 164 USFS recreation sites assessed for the GYE.* This area is to be managed for the safety and enjoyment of users (FP-III-2). *In 2014 the Greater Yellowstone Coordinating Committee (GYCC) ranked USFS recreation sites in the GYE according to their relative risk to grizzly bears (2014 GYE campground risk and infrastructure survey). Rainbow Point Campground ranked 3rd in risk to grizzly bear of the 164 USFS recreation sites assessed for the GYE.* The objective is to reduce the likelihood of a surprise encounter between bears and humans.

In the action alternatives, Highway Thin is designed to address this need along Highway 191. Intermediate harvest (commercial thin) is proposed at Rainbow Point Campground.

Public Involvement

Collaboration with the public started in 2011 for this project as the interdisciplinary team (IDT) worked to complete the Hebgen Duck Landscape Assessment. The District Ranger and IDT members met with numerous entities such as the Interagency Bison Management Plan (IBMP) partners, the Hebgen Basin Fire Department, local Homeowner groups, local, state and federal government representatives, the Greater Yellowstone Coalition, Defenders of Wildlife, tribal representatives from the Nez Perce Tribe and the Confederated Salish Kootenai Tribe (CSKT) and concerned citizens. Public outreach was conducted through the West Yellowstone News and other regional newspapers, at scheduled meetings for various organizations and on an individual basis. We held meetings and field trips with these groups, as well as Montana Fish Wildlife and Parks and Yellowstone National Park representatives.

The Custer Gallatin Working Group (CGWG) formally began collaboration for this project in the spring of 2015. The CGWG is a collaborative established in July, 2014 to develop agreement around priority areas and approaches for project work on the Custer Gallatin National Forest, and to help facilitate completion of those projects at the local level. CGWG members represent a wide range of

stakeholder interests in the management of the Custer Gallatin. The twenty-four designated seats on the collaborative include County Commissioners, representatives of Conservation NGO's, the Skiing industry, Agriculture and Ranching, Quiet and Motorized Recreation, Hunters, Anglers, Outfitters, Mining, Recreation and Economic Development, and the Timber industry.

Figure 10. Public field trip on 9/25/2015 in Upper Tepee.

During scoping, comments were solicited from 1/6/2015 until 2/10/2015 with an extension for those that requested additional time. The Forest received fifty two comment letters from 45 individuals and 12 entities including advocacy groups, businesses and agencies. Comments were received on numerous issues relating to aesthetics, aquatic and amphibian species, aspen, clarification of the purpose, need and proposed action, climate change, costs to implement, cumulative effects, fire/fuels, forest health, forest plan consistency, implementation requests, invasive weeds, inventoried roadless area, NEPA process and disclosure, recreation and special uses, roads, snags, social issues, soils, vegetation (old growth, diversity, other), wildlife – diversity, elk, birds, bison, general (multispecies requests), management indicator species, threatened and endangered species - grizzly bear, Canada Lynx and wolves. The comments were extensive and included many nuances. Key messages are summarized in a few categories in a *Summary of Public Comments* received (IDT 3/2015) and content analysis was completed (IDT 2016).

The Team also sponsored a series of public meetings with the Custer Gallatin Working Group Collaborative Committee and the public. Meetings and/or field trips were held in 2015 on: 1/27, 4/21, 7/15, 8/5 and 9/16. These were opportunities for the Forest Service to provide more detail about the purpose and need, proposed actions and the alternative development process in response to the requests for better explanation. The public also had the opportunity to ask questions and visit the treatment areas. After the public meetings, the *Public Comment Summary* was updated on October 27, 2015 (IDT 10/2015) to reflect feedback from the field trips and public meetings. The update was sent to all commenters and interested persons. The Scoping documents and Comment Summaries were posted on the Custer Gallatin Webpage at http://www.fs.usda.gov/project/?project=45491, along with other supporting documents and documents requested by the public.

A 30 day comment period was held in June 2016. Eighteen letters were received. A public meeting was held and seven people signed in. Response to these comments are addressed in Appendix C (Volume II). The EA and specialist reports were updated as discussed in the Responses. The District Ranger continues to meet with the CGWG monthly with project updates.

Issues

Issues serve to highlight effects or unintended consequences that may occur from the proposed action, providing opportunities during the analysis to explore alternative ways to meet the purpose and need for the proposal while reducing adverse effects (FSH 1909.15 12.42).

Table 1: List of Resources Considered.

Issues that were the focus of interdisciplinary interaction and alternative development in order to balance competing interests related to the beneficial and adverse impacts. While all issues would be mitigated there are different levels of beneficial and adverse effects.	**Other issues of interest**
How well the purpose and need would be achieved related to: • Fuel reduction in WUI to increase firefighter and public safety and reduce risk to values • Creation of fuel conditions along Tepee Creek Road to help compartmentalize and contain wildfire • Removal of conifer competition in aspen stands • Increased presence of whitebark pine forest • Creation of more resilient forest and to reduce long term losses from insects and disease. Temporary roads/decrease in grizzly bear secure habitat Temporary roads/increased risk of invasive weed spread Displacement of wildlife in high use areas and migration routes (Fir Ridge, Whits lake and Red Canyon)* Harvest activity/Impacts to sense of place discussed in terms of scenery.	Project activity impacts to : Air Quality Aquatic Species Climate Change/Carbon Flux Heritage Inventoried Roadless Area Impacts Range Recreation Sensitive Plants Soils Transportation Water Quality Wildlife *Canada Lynx* *Sensitive Species* *Management Indicator Species* *Other terrestrial and bird species* *Increased sight distance and reaction time to avoid undesirable wildlife /human encounter*

*This issue is discussed under elk with the other issues since this discussion was a very small part of the analysis.

Alternatives

The Alternative Development Process

NEPA requires that the agency study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources. (36 CFR 220.7(b)(2)(i)). At the time alternatives were developed it was clear that there would be competing interests related to the beneficial and adverse impacts and those issues helped drive alternatives.

The scoping proposed action was modified as a result of preliminary analysis and scoping input. Those changes are reflected in Alternative 2, the Proposed Action presented in this EA. The specific changes and rationale for the modifications are discussed under the Scoping Alternative in Alternatives Considered but not Given Detailed Study. Further analysis helped to identify and/or

refine the needed design features and mitigation that are common to action alternatives. These incremental changes and modifications to the proposed action and design features are documented in Appendix A. All of the action alternatives are consistent with laws and other applicable direction but the range of potential impacts and benefits varies between alternatives.

Alternatives Studied in Detail

Alternative 1 – No Action Alternative

The proposed action would not occur under this alternative. The processes of vegetation succession and forest insect dynamics would continue without management intervention. Ongoing uses would continue such as firewood gathering, Christmas tree cutting, recreation, road and trail use, permitted uses, wildfire suppression consistent with Gallatin Forest Plan direction. Not implementing the proposed treatments and associated activities would forgo the following benefits of implementing the purpose and need for action.

Alternative 2 - Proposed Action Alternative (Preferred Alternative)

The proposed action alternative was designed to meet the purpose and need for action which would implement standards and move the project area toward goals in the Gallatin Forest Plan and address national fire/fuels policy priorities. Figure 12 and Figure 13 display the treatment units by treatment type and includes the general locations for proposed temporary roads for this Alternative. Alternative 2 includes the main components in the following Table.

Table 2. Alternative 2 – Proposed Action and Preferred Alternative

Purpose of Treatments	**Acres of Proposed Treatment**
Aspen enhancement	701
Improved forest resiliency	962
Fuels reduction in WUI, Evacuation Routes, Powerlines and Fuel break	2,898
Whitebark Pine Enhancement	1,129
Increased sight distance and reaction time for improved wildlife/human safety	205
Methods or Treatments[3] Planned	**Acres**
Daylight by thinning around Whitebark Pine	843
Group Selection Harvest	695
Hand thinning	16
Highway Corridor Thinning	138
Intermediate harvest	2,288
Post and Pole harvest	177
Precommercial Thin	1,020
Powerline Corridor Thin	140

[3] Appendix C includes a more detailed description of the treatments and associated fuel treatment activity. A detailed listing of treatment details by unit for each Alternative is available on the project website on the Gallatin Forest webpage called *UnitbyUnit TreamentDetails_Alternative #.*

Regeneration harvest	591
Estimated Total Acres treated – 5,900 acres (rounded)	
Design Features and Mitigation Common to Action Alternatives Listed in Appendix A	
Temporary Road construction, closure and rehabilitation – 21 miles	
Site specific Gallatin Forest Travel Plan Modification of Standard E-4 - to allow treatments in the Little Tepee Creek and Red Canyon Creek watershed to proceed despite existing instream fine sediment levels of 28.5 and 34% which exceed the 26% standard for Category A streams.	

Associated Activities.

Activities may include, but are not limited to thinning with mechanized equipment, slashing small trees, whole tree yarding, yarding unmerchantable material, hand and machine piling, pile and broadcast burning, hauling of commercial material, firewood removal, biomass reduction such as chipping, erosion control, construction of and rehabilitation of skid trails, landings and temporary roads.

Figure 11. One example of temporary road closure after one year near the propject area.

An estimated 21 miles of temporary road would be needed to implement the proposed action. Temporary roads, when prescribed, are intended to minimize the cost of transporting logs and fuel consumption by transporting logs by more efficient log trucks rather than ground-based skidding and to protect adjacent resources such as sensitive soils and stream courses that would be adversely affected by repeated ground-based skidding. Temporary roads, by design, are a single entry access and not intended to be a permanent part of the road system. As such would be located and constructed to minimize investment, dirt moving, and disturbance. Following use, these roads would be permanently closed and rehabilitated to meet adjacent land management objectives with no regard to future access, this includes obliteration if needed, recontouring, seeding, and slashing of the corridors. Temporary roads will be closed and rehabilitated before termination of the timber sale contract. See Figure 11 for an example of road rehabilitation after one year

Temporary roads are not constructed to safely accommodate mixed commercial and public traffic, so all temporary roads would be closed using appropriate methods, *generally gates or other physical barriers during periods of harvest activity*. During administration of the project, travel on temporary roads would be limited to administrative use. Appendix A includes detailed road management information for system roads to be used for implementation.

Implementation

The project is estimated to take 8-12 years to implement. The activities proposed would be implemented with Forest Service crews, service contracts, one or more timber sale contracts and/or stewardship contracts. Value from the wood products removed and sold could be re-invested into the project area through stewardship contracting, *standard timber sale contracts* and other mechanisms. All primary treatments, associated activities, mitigation and other restoration projects would be considered for implementation with timber receipts. Appropriated funding dollars would also be

available to implement treatments and associated activities. Most of the restoration or protection activities would be included in the primary contract so those activities would not require additional funding. As a result, the cost to implement commercial harvest and restorative measures in that contract is factored into the bid prices. For example, temporary road closure, skid trails and landing rehabilitation are provisions in contracts that are incorporated whenever construction is included in contract language. Other funding sources, such as grants, would be considered as well for all project related activity.

Alternative 2 specific mitigation:

- No other projects that affect secure habitat below baseline levels would be implemented in the Madison #2 Bear Management Subunit (BMS) until this project has been completed.
- Project roads that affect secure habitat below baseline levels in the Madison #2 BMS, collectively, would be available for project use for no longer than 3 consecutive years and then closed to all motorized travel. This includes temporary roads to units 23, 25, 29, 36, 41, the units between the Rainbow Point Campground and Rainbow Point Road and the Horse Butte Units. Project roads that affect secure habitat below baseline levels in the Madison #2 BMS would be decommissioned such that secure habitat will be restored within one year after road closure.
- Helicopter flight paths would follow the most direct line to a landing that is determined to be safe by the operator.
- No ground based mechanized operations would occur in unit 218 to maximize protection of undeveloped character. Work would be done by helicopter or hand crews. Unit 218 is within the roadless area polygon, not adjacent to an existing road (Johnson Lake Trail #90 bisects it on a north/south axis). In the vicinity of Unit 218 (+ or – 100 yards), Johnson Lake Trail #90, and heavily traveled guest ranch trails, ensure that stumps would be cut as low as practical.
- Approximately 71 acres of treatments are proposed in the Madison 1-549 Inventoried Roadless Area (IRA) adjacent to system roads.

Changes from the “Scoping Alternative” improve consistency with Forest Plan direction and intent, increase overall efficiency and effectiveness while reflecting sensitivity to valuable wildlife habitat along the riparian buffer. Specific changes to Alternative 2 (Proposed Action) from the scoping alternative are documented in Appendix A and are discussed in Alternatives considered but not given detailed study – Scoping Alternative (page 31).

Figure 12. Alternative 2 (Proposed Action) North Half Map.

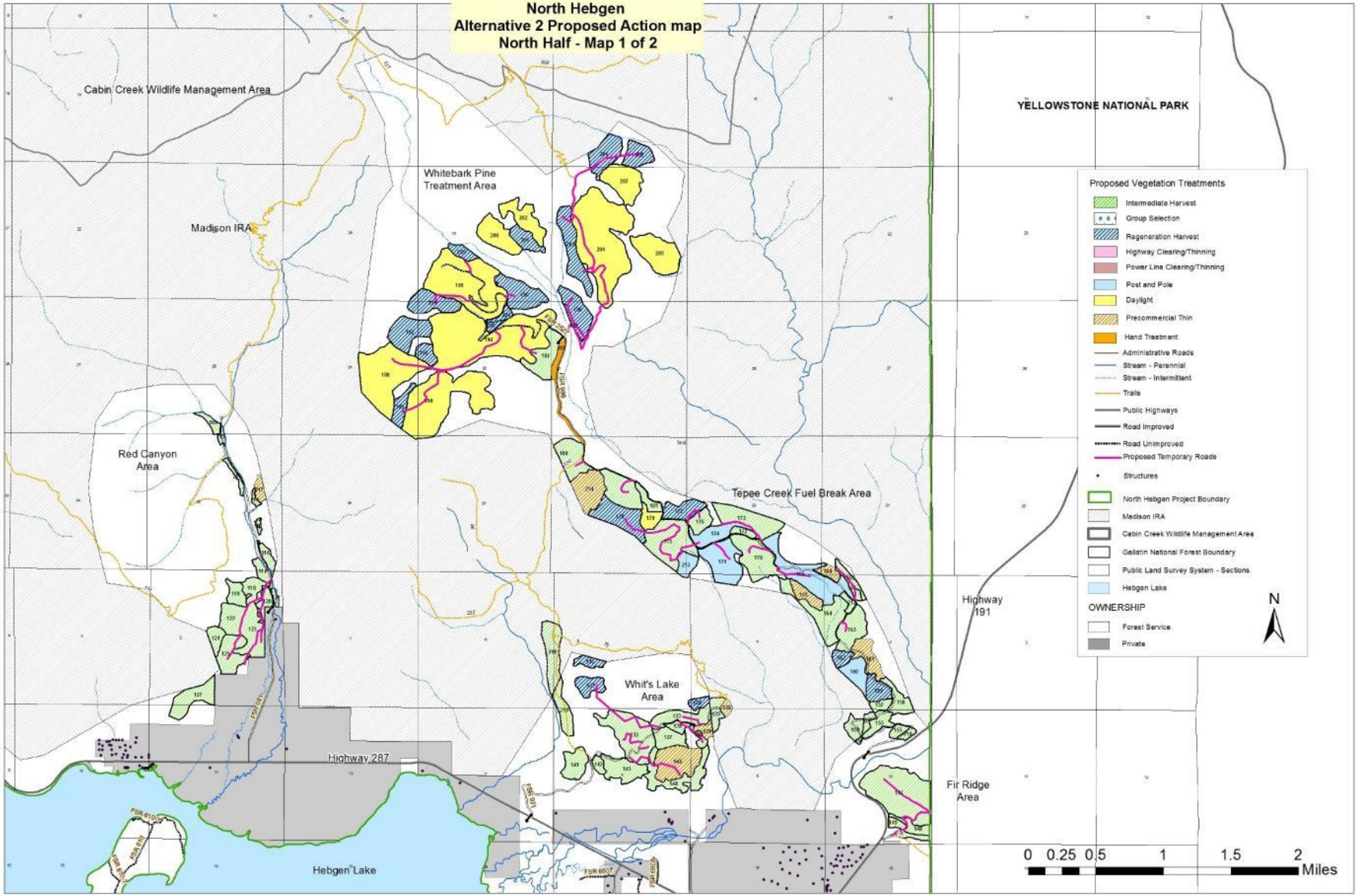
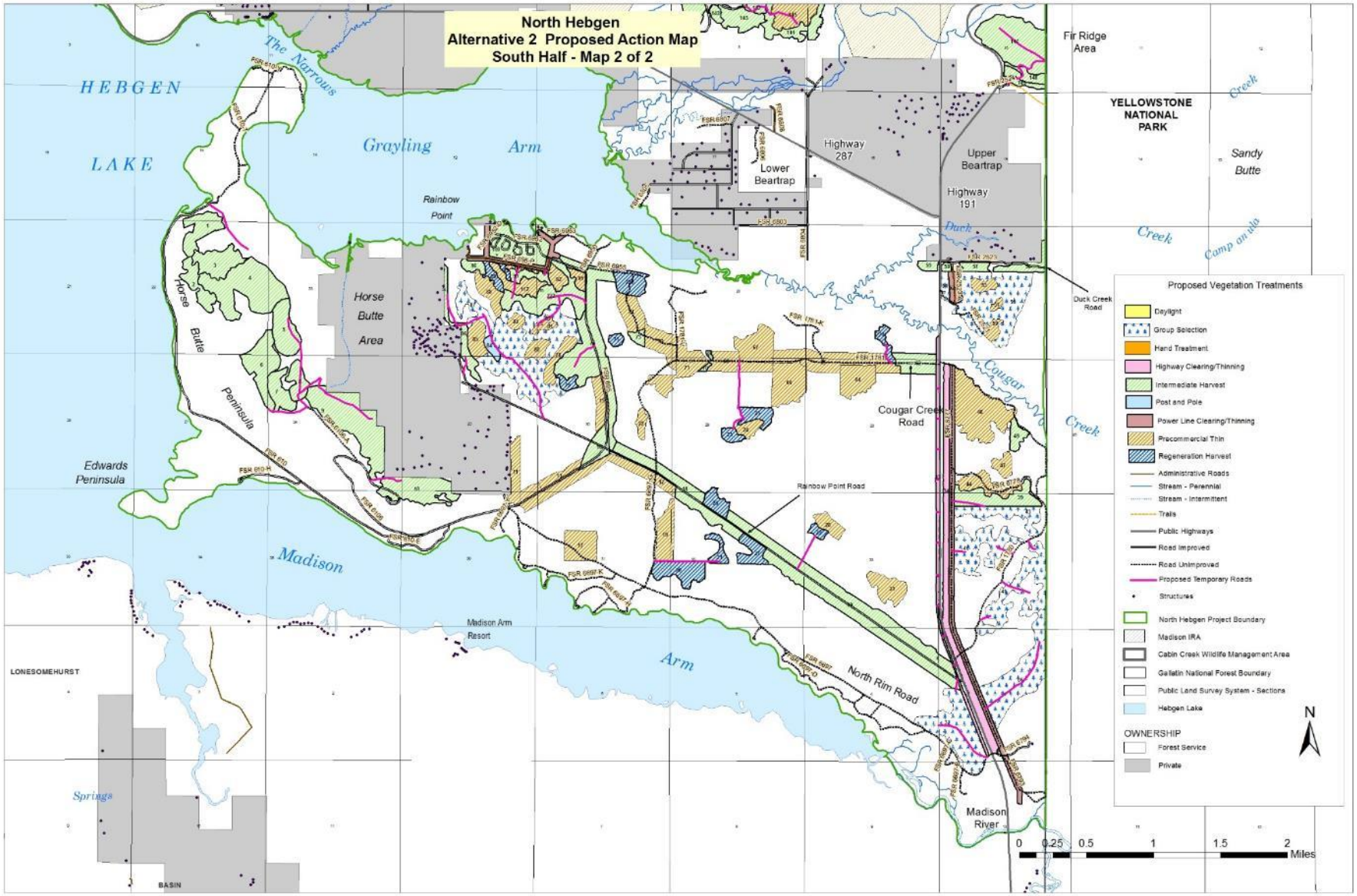


Figure 13. Alternative 2 (Proposed Action) South Half map.



Alternative 3

This alternative was designed to address the purpose and need and to minimize concerns related to impacts from temporary roads. Specific changes for Alternative 3 are listed below and the elimination of those temporary roads and the units associated with them would reduce impacts to:

- grizzly bear secure habitat in Madison 2 Bear Management Subunit;
- risk of invasive weed spread;
- displacement of wildlife in high use areas and migration routes;
- changes to sense of place related to the recreation experience and scenery impacts near Horse Butte, Rainbow Point Campground and Fir Ridge.

Alternative 3 includes the main components in the following Table.

Table 3. Alternative 3

Purpose of Treatments	**Acres of Proposed Treatment**
Aspen Enhancement	192 acres
Improved forest resiliency	668 acres
Fuels reduction in WUI/Evacuation Routes/Powerlines and Fuel break	2,670 acres
Whitebark Pine Enhancement	1,097 acres
Increased sight distance and reaction time for improved wildlife/human safety	205 acres
Methods or Treatments Planned	**Acres**
Daylight by thinning around Whitebark Pine	843
Group Selection Harvest	467
Hand thinning	16
Highway Corridor Thinning	138
Intermediate harvest	1,612
Post and Pole harvest	170
Precommercial Thin	960
Powerline Corridor Thin	132
Regeneration harvest	494
Estimated Total Acres treated – 4,830 acres (rounded)	
Design Features and Mitigation Common to Action Alternatives Listed in Appendix A	
Temporary Road Construction, Closure and Rehabilitation – 12 miles	
Site specific Gallatin Forest Travel Plan Modification of Standard E-4 - to allow treatments in the Little Tepee Creek and Red Canyon Creek watershed to proceed despite existing instream fine sediment levels of 28.5 and 34% which exceed the 26% standard for Category A streams.	

Figure 14 and Figure 15 display the treatment units by treatment type and includes the general locations for proposed temporary roads for this Alternative. Alternative 3 incorporates all aspects of Alternative 2, with the exception of the following changes.

- Eliminate all of units 1-5 and a portion of units 6-10 on Horse Butte to reduce impacts to secure habitat for grizzly bear in the Madison 2 BMS, risk of weed spread, concerns related to sense of place related to scenery and recreation experience and wildlife displacement. The trade-off is lost opportunity to enhance aspen and provide for firefighter and public safety near Horse Butte.
- Eliminate units 23-25, 28, 29, 36 and 41 along with temporary roads. This change would reduce impacts to secure habitat in the Madison 2 BMS and the risk of weed spread. The trade-off is lost opportunity to enhance forest health and improve timber stands that are losing vigor due to over- crowding.
- Unit 50 and 55 would be reduced in size to treat within ½ mile of structures only for WUI protection. This would also enhance the riparian buffer along Cougar Creek and the lakeshore and reduce possible displacement along the migration route near Cougar Creek.
- Eliminate the temporary roads that temporarily impact grizzly bear secure habitat on the Flats south of Rainbow Point Campground. As a result, harvest treatments would be limited to areas accessible from the existing roads. Units 77, 81, 84, 86 and 87 would be reduced in size. This change would eliminate impact to secure habitat in this area, risk of weed spread, while lessening concerns from nearby residence related to impacts to their "sense of place" and desire for the area to be left alone. This change would enhance the riparian buffer. The trade-off is lost opportunity to provide for firefighter and public safety near private land, the campground and along primary evacuation routes.
- Reduce treatment extent and temporary roads in Red Canyon, Whit's Lake, Fir Ridge and Upper Tepee including the following units and associated temporary road: 127, 130, 131, 144, 147-149, 189, 201, 218 and 219 and portions of units: 118, 119, 122, 124, 125. These changes would reduce the amount of temporary road and associated risk of weed spread. In some cases there would be less impact to secure habitat and less wildlife displacement along migration routes. The primary trade-off is lost opportunity to enhance aspen and improve forest health.

Figure 14. Alternative 3 North Half Map

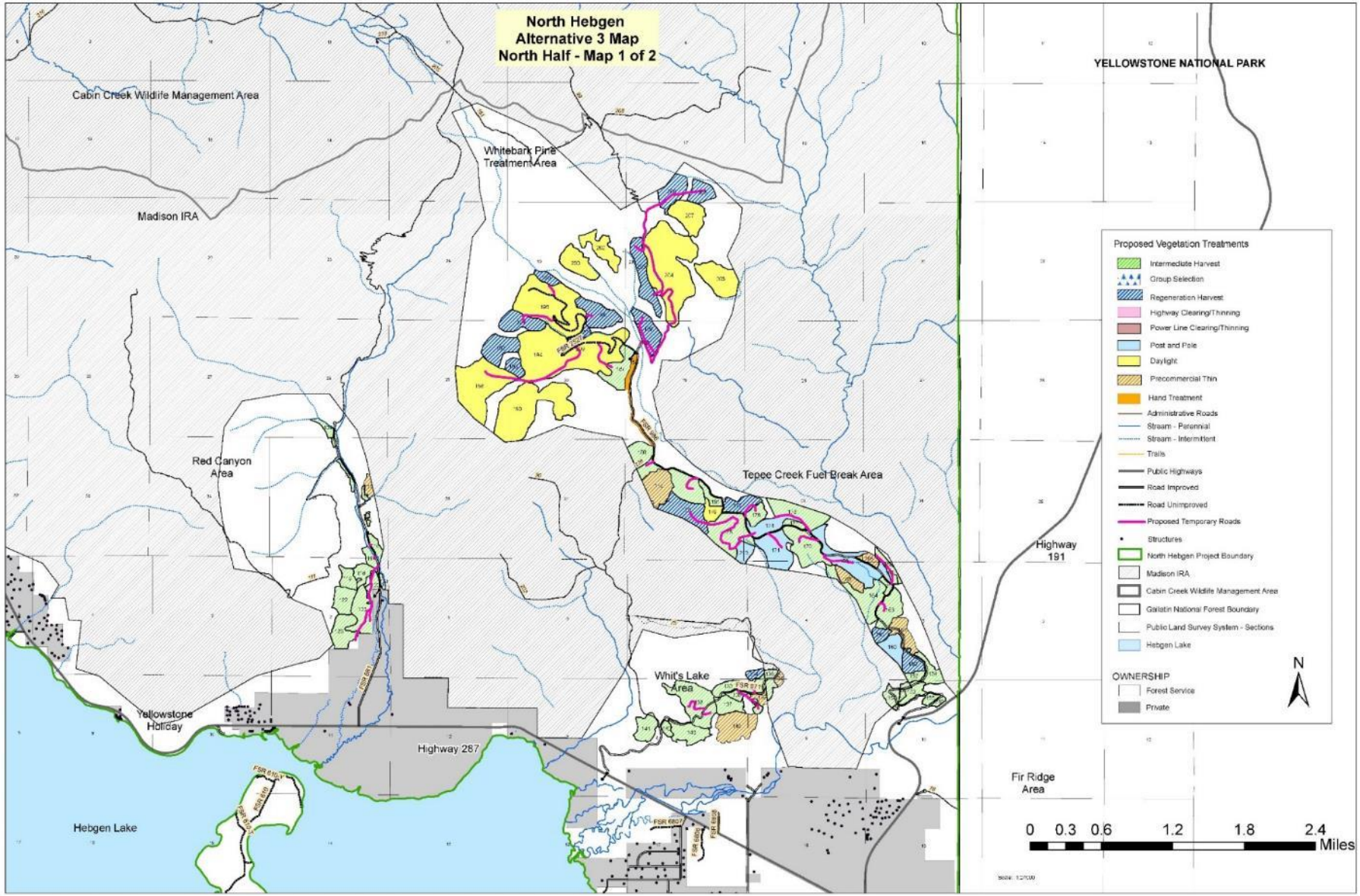
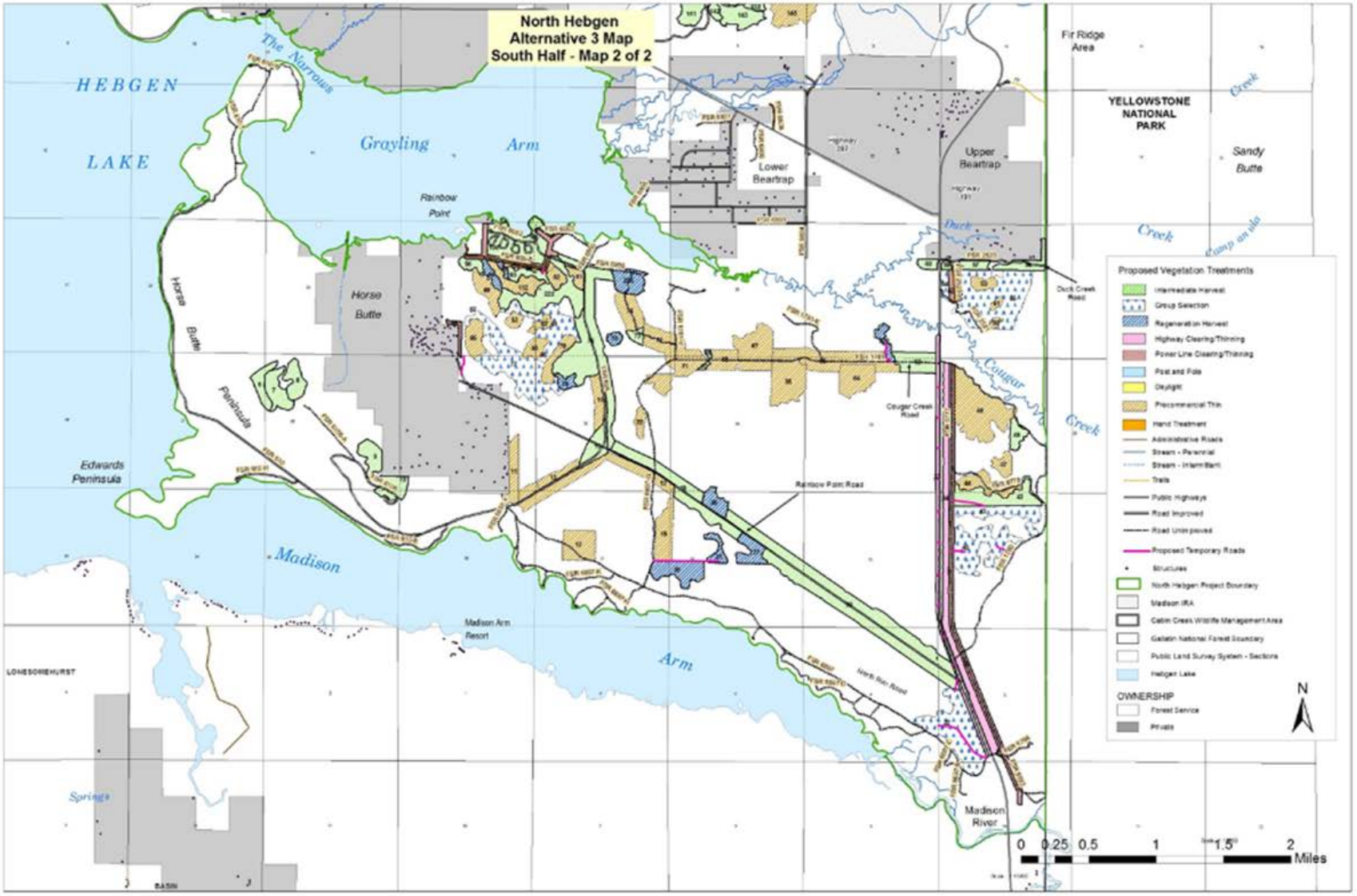


Figure 15. Alternative 3 South Half Map.



Alternative 4

This alternative was designed to minimize concerns related to impacts from temporary roads, while at the same time providing an option that achieves purpose and need related to fire fighter and public safety and aspen enhancement more effectively than Alternative 3. Specific changes for Alternative 4 are listed below and the elimination of those temporary roads and the units associated with them would:

- Reduce impacts to grizzly bear secure habitat in Madison 2 Bear Management Subunit;
- Reduce risk of invasive weed spread;
- Reduce displacement of wildlife in high use areas and migration routes;
- Reduce changes to sense of place related to the recreation experience and scenery impacts near Horse Butte, Rainbow Point Campground and Fir Ridge;
- Improve fire fighter and public safety compared to Alternative 3;
- Reduce conifer competition in more aspen forest than Alternative 3.

The alternative includes the main components in the following Table.

Table 4. Alternative 4.

Purpose of Treatments	**Acres of Proposed Treatments**
Aspen Enhancement	372 acres
Increased forest resiliency	753 acres
Fuels reduction in WUI/Evacuation Routes/Powerlines and Fuel break	2,870 acres
Whitebark Pine Enhancement	1,097 acres
Increased sight distance and reaction time for improved wildlife/human safety	205 acres
Methods or Treatment Planned	**Acres**
Daylight by thinning around Whitebark Pine	843
Group Selection Harvest	514
Hand thinning	16
Highway Corridor Thinning	138
Intermediate harvest	1,920
Post and Pole harvest	177
Precommercial Thin	1,004
Powerline Corridor Thin	140
Regeneration harvest	534
Estimated Total Acres treated – 5,300 acres (rounded)	
Design Features and Mitigation Common to Action Alternatives Listed in Appendix A	
Temporary Road Construction, Closure and rehabilitation – 17 miles	
Site specific Gallatin Forest Travel Plan Modification of Standard E-4 - to allow treatments in the Little Tepee Creek and Red Canyon Creek watershed to proceed despite existing instream fine sediment levels of 28.5 and 34% which exceed the 26% standard for Category A streams.	

This alternative incorporates all aspects of Alternative 2 with the exception of the listed changes and mitigation unique to this alternative. Figure 16 and Figure 17 displays the treatment units by treatment type and includes the general locations for proposed temporary roads for this Alternative.

- Eliminate units 2 and 5, a portion of units 4 and 6 and the associated temporary roads on Horse Butte. These changes reduce impacts to grizzly bear secure habitat in Madison 2 BMS, risk of weed spread, address social concerns related to wildlife displacement and recreation experience. The trade-off is lost opportunity to enhance aspen.
- Eliminate units 23-25, 36 and 41 and the associated temporary roads, as well as the temporary road to unit 29. This change would reduce impacts to secure habitat in the Madison 2 BMS and the risk of weed spread. The trade-off is lost opportunity to enhance forest health and improve timber stands that are losing vigor due to over- crowding.
- Unit 50 and 55 would be downsized to treat only within ½ mile of structures for WUI protection. This change would enhance the riparian buffer and reduce possible displacement impacts along a migration route close to Cougar Creek.
- Eliminate all of unit 86 and the associated temporary road along private property except the powerline corridor. These changes would reduce impacts to the risk of weed spread and concerns from nearby residence related to impacts to their "sense of place", recreation opportunities and desire for the area to be left alone. The trade-off is lost opportunity to provide for firefighter and public safety near private land and the campground.
- Eliminate unit 127 in Red Canyon and units 144, 218, 219 up Whit's Lake Road. These changes would reduce the risk of weed spread and displacement along a wildlife migration route. The trade-off is lost opportunity to enhance aspen forest.
- Change the treatment in unit 147 (Fir Ridge) to an improvement cut for the benefit of aspen. Conifer removal would generally occur within 1.5 to 2 conifer trees heights from the edge of aspen stands. The unit size would be reduced in extent to leave the area untreated where elk migration is concentrated based on use indicators visible in the unit. These changes reduce conifer competition in aspen on 50 acres. This single purpose prescription, would leave conifers that are not encroaching on aspen in place, providing more cover within the 50 acres treated and leaves about 50 acres untreated that were in Alternative 2. The temporary road associated with mechanized harvest in unit 147 would be eliminated. Less temporary road and vegetation removal would reduce impact to secure habitat, risk of weed spread and displacement along a wildlife migration route.
- Eliminate units 189 and 201 (Upper Tepee) and associated temporary road, which reduces the amount of temporary road, impacts to secure habitat and risk of invasive weed spread. The trade-off is lost opportunity to treat whitebark pine.
- No other projects that affect secure habitat below baseline levels would be implemented in the Madison #2 Bear Management Subunit (BMS) until this project has been completed.
- Project roads that affect secure habitat below baseline levels in the Madison #2 BMS, collectively, would be available for project use for no longer than 3 consecutive years and then closed to all motorized travel. This includes temporary roads to the units between the Rainbow Point Campground and Rainbow Point Road and the Horse Butte Units. Project roads that affect secure habitat below baseline levels in the Madison #2 BMS would be decommissioned such that secure habitat would be restored within one year after road closure.

Figure 16. Alternative 4 North Half Map.

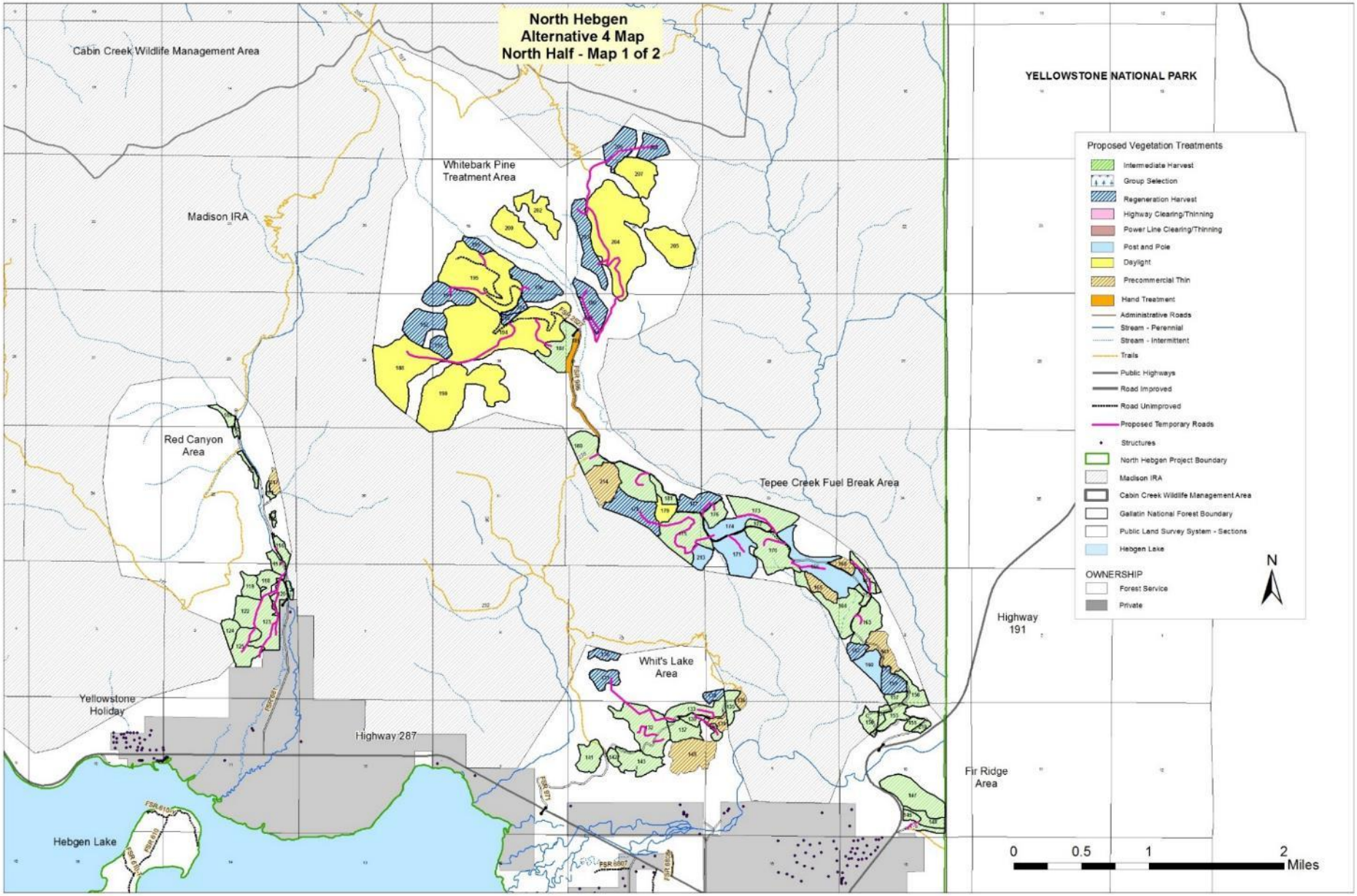
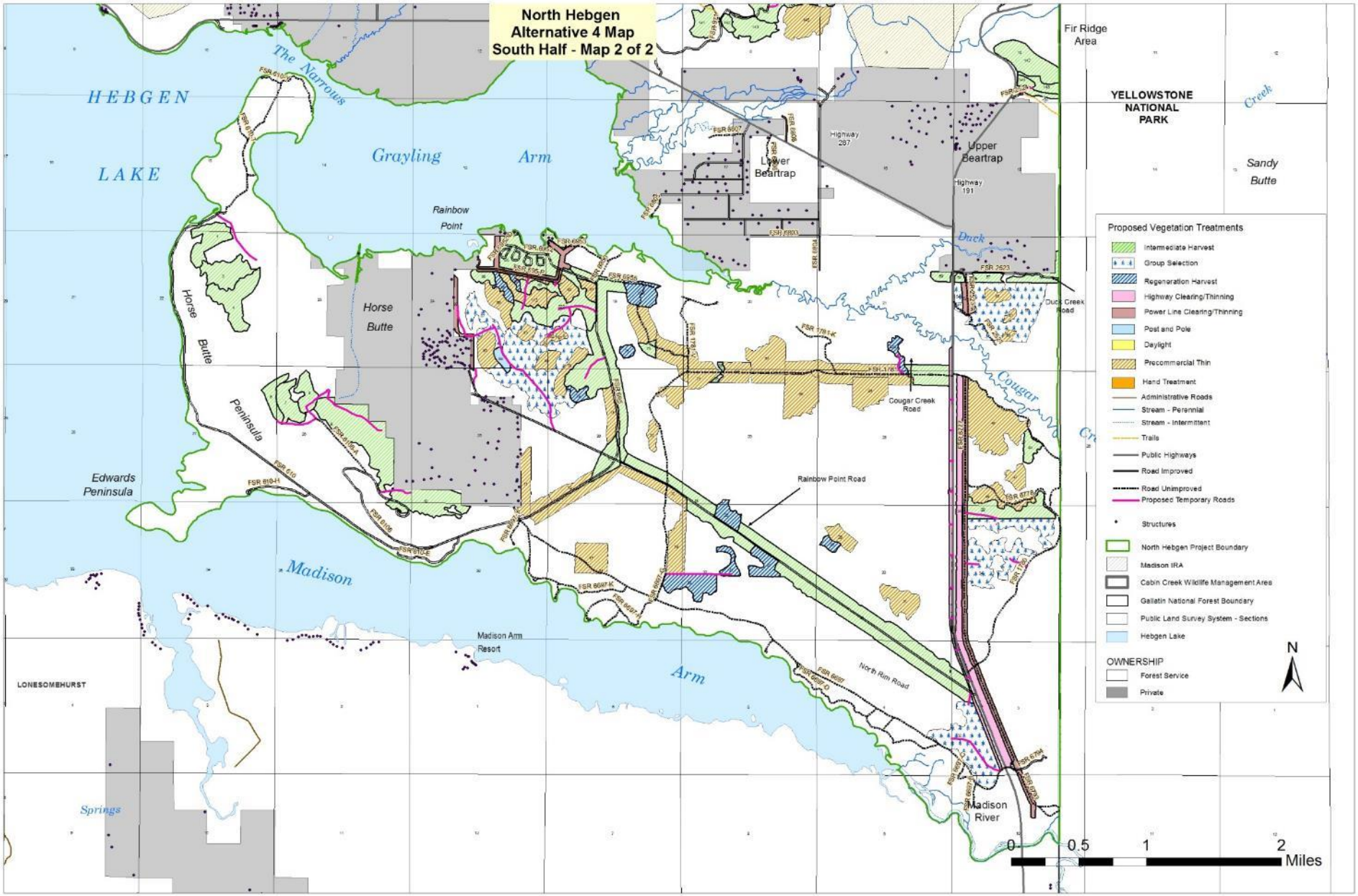


Figure 17. Alternative 4 South Half Map.



Alternatives Considered but not Given Detailed Study

Scoping Alternative

During the scoping timeframe, preliminary analysis by specialists indicated that the alternative that was presented to the public for "Scoping" was not consistent with Forest Plan direction or in some cases could be designed to better meet the management intent. As a result, several changes were made to the "Scoping Alternative" to improve consistency with Forest Plan direction and intent, increase overall efficiency and effectiveness while reflecting sensitivity to valuable wildlife habitat along the lakeshore and Cougar Creek. The scoping alternative was then eliminated from detailed study. Alternative 2, the proposed action reflects changes from the scoping alternative.

The "scoping alternative" included all of the components of Alternative 2 and the following actions. The scoping alternative included additional treatment in Little Tepee Creek and a higher level of associated impacts to westslope cut throat trout (WCT) habitat in Little Tepee Creek. A prescribed burn was included but eliminated due to inconsistencies with current Lynx Direction (NRLMD 2007). The riparian and wildlife travel corridor near the lakeshore had less protection. Unit specific changes (13-15, 39) were made to better contain weed infestations. Prescriptions in units 16, 34 and 35 were modified to reduce potential visual impacts in partial retention view corridors. The primary purpose and subsequent prescriptions were clarified in the area between Highway 191 and Yellowstone National park boundary. In unit 126, the western portion of 127 and 146 the treatment method was expensive and marginally effective so the units were dropped. Unit 126 and 146 (Whit's Lake) would have altered roadless character in an area that has a high degree of roadless integrity. Elimination of these changes adhere to the intent of the Roadless Rule (2001) more effectively (Roadless Rule 2001). Overall, efficiency and cost effectiveness was improved with these changes as well. Non-essential temporary roads were eliminated (about 4 miles). The proposed action was reduced from about 8,200 acres to 5,900 acres and from 25 miles to 21 miles of temporary road. A summary of these changes are documented in Appendix A.

Helicopter Alternative

The agency received a request to consider an alternative that eliminated all temporary roads by requiring only helicopter logging for the proposed units. In summary, electing all helicopter harvest in order to avoid temporary roads does not eliminate the impacts from temporary roads because some roads would still be needed. Helicopter logging is not as effective at achieving fuel reduction because of the high costs and technical difficulty associated with effectively treating activity slash in helicopter units. A helicopter logging operation and associated fuel treatment costs would incur considerable expense for the taxpayer, in excess of $6.6 million.

Helicopter logging does not eliminate the need for temporary roads because log landings would be needed in proper proximity to helicopter units. Temporary roads provide access to those landing locations. There are some other operational trade-offs also. Helicopter landings are three times the size of landings required for ground based harvest to allow for helicopter operations. The activity related slash generally stays in the unit during helicopter logging because it is not economically feasible to fly slash out of the woods. As a result, a second entry for slash treatment would be necessary to reduce activity fuels to acceptable levels. Depending on the situation, options could include broadcast burning (in some habitats), hand piling or lop and scatter of small material.

Total cost to implement a logging project is dependent on volumes, but some assumptions were made for the North Hebgen project to allow a reasonable cost comparison of alternative 2 under a

helicopter scenario, versus a ground based harvest scenario. The preliminary cost to implement alternative 2 with ground based harvest is about 25% of the cost to implement helicopter harvest operations. While helicopter logging would require about $6.6 million in appropriated funds to implement harvest units, ground based harvest would provide an estimated $708,000 in receipts. These type of receipts can be reinvested in resource work, which gives the agency additional options for financing activities such as secondary fuel treatments, weed control, hand treatments, and/or day lighting units (Motzko email 5/2015).

The cost comparison is basic, some direct cost items of note are not estimated. Estimates do not include the cost of temporary road construction and slash treatment. Both logging methods would require temporary road, ground based harvest requires more. Both methods would require slash treatment but the cost of slash work is mostly incorporated in logging costs for ground based harvest. Slash costs for helicopter logging would require a second entry of considerable expense.

With mitigation and design features that have been identified for this project, ground based harvest and associated temporary road effectively achieves the treatment needs, mitigates potential impacts from temporary roads, adheres to Forest and Travel Plan standards and is consistent with other direction, such as state laws. In addition, the value of the wood product more than covers the cost to implement the work without additional appropriated dollars when implemented using ground based harvest methods.

Because the project can be implemented without incurring excessive helicopter costs, it is undesirable to incur the costs of helicopter logging to avoid temporary road construction (Seth 12/2015). In addition to being an acceptable activity on national forest system lands, monitoring has shown that the undesirable impacts associated with temporary roads are indeed temporary and can be effectively mitigated (Lamont 2015c).

Other Alternative requests

The Forest Service (FS) received a request to consider a **speed limit reduction to reduce wildlife vehicle collisions (WVC) along 191** rather than implement the proposed thinning treatment. The commenter also recommended additional signage, wildlife crossings with funnel fencing, and modification of the highway design itself." The Forest Service recognizes that these other options would reduce the risk of WVCs on 191. The Montana Department of Transportation is the oversight agency for management of Highway 191. *However, agencies with a stake in this issue met in October 2016 to discuss these and other options. A seasonal speed limit reduction and additional signage have been adopted by MDT (201610_Email_US191).* In an ideal world, a few options would be implemented. The FS did not analyze this alternative in detail *instead the FS has joined forces with agencies such as MDT to address this issue independent of the NH Project*. The Forest Service sees benefit from the thinning and would prefer to implement it even if one or all of the other options were implemented by MDT. In that case, there would be a combined benefit.

We received a request to **consider prescribed burning the south facing slopes** from Johnson Lake Trail to Red Canyon, the south facing slopes of Mount Hebgen and the south facing slopes of Horse Butte. Burning these areas will provide high quality forage for elk and bison, perhaps retaining more elk in the Basin throughout the winter. The interdisciplinary team considered this request early in the planning process and determined that aspen are doing well in these areas and burning would set the aspen back rather than speed up regeneration. In addition, in most of these areas, there is not enough material on the ground to carry a prescribed burn. This alternative was not considered in detail because prescribed burning was determined to be ineffective at achieving the goal.

We received a request to **remove dead trees only and to let locals do the harvesting** for their personal use. This tool is limited in effectiveness and would not meet the purpose and need for action. Firewood removal by locals would not address excessive surface, ladder or crown fuels that are at issue in fuel reduction treatments near homes, improvements, powerlines, evacuation routes and the Tepee Creek Road. Further, firewood removal would not meet the objectives for aspen, whitebark pine or reducing undesirable wildlife encounters along Highway 191 and near the campground. Consequently, firewood removal is included as an associated activity that could help to achieve the desired future condition and to accommodate firewood access requests. For these reasons, this alternative was not considered in detail but was incorporated in action alternatives as a tool.

Commenters wanted consideration of an alternative that **limits treatments to those needed to reduce home ignition per Cohen, 1999 and consideration of treatment only within 100 feet of structures**. Cohen, 1999 considers only radiant heat to propagate home ignition. It does not include firebrand ignition sources. Firebrands that result in ignitions can originate from wildland fires that are miles away (Graham et al. 2004). The value of manipulating fuels around structures to provide a margin of safety is an accepted practice and is the responsibility of the individual homeowner. Cohen, 1999 is not consistent with the purpose and need of this project in that his recommendations only address structure protection and the 'home ignition zone' and discourages community fuel management protection objectives and firefighter and public safety. The North Hebgen Multiple Resource Project includes more objectives than reducing wildfire risk to homes and there are other values besides homes that are at risk, such as powerlines, evacuation routes and Forest Service improvements (infrastructure). The other purposes for the project would not be met including enhancement of aspen and whitebark pine, evacuation route safety, ability to contain or compartmentalize a wildfire from the Tepee Creek Road or reducing the risk of undesirable wildlife/human encounters. Although fuel reduction near homes is an important part of the action alternatives, it is only one part of a multipurpose project. For that reason this type of alternative was not considered in detail.

A commenter would like to see an alternative developed that **develops safety zones** instead of escape routes. The weakness in this consideration is that safety zones are only effective if you can get to them so the evacuation route must be treated to assist with safe passage. In effect the treatments would serve as both. Commenters requested **less treatment along roadways (50 feet and 15 feet)** that are proposed to create safer evacuation routes. Public evacuation by law enforcement and firefighters requires routes that reduce the threat of harm and loss of life. Safety Zone guidelines in the Incident Response Pocket Guide, 2014 were used to determine the needed fuel treatment for evacuation routes. A safety zone is an area where firefighters, law enforcement and the public can survive a wildfire without a fire shelter. Excessive radiant heat to skin and supper heated air to the lungs can be fatal. Calculations were based on flat terrain, radiant heat only and tree heights of 50 feet that produce a continuous flame height of 100 feet (crown fire). The needed separation distance between humans and flames is four times the continuous flame height. Therefore, to ensure human safety along evacuation routes, a distance of 400 feet would need to be treated to meet the minimum criteria for a safety zone. Treatments would thin over-story trees, reduce ladder and surface fuels to eliminate crown fire potential. The North Hebgen project only proposes treatments along evacuation routes that involve national forest land. Treatments limited to a lesser distance would not meet the objective of providing safer evacuation routes so these alternatives were not considered in detail.

A "No Roads Alternative" was requested. The 'helicopter alternative' and the 'no action' alternatives address this activity but a short discussion was also included in Volume II, Appendix C page B, B-43.

Environmental Effects of the Proposed Action and other Action Alternatives

Introduction

This section describes the environmental impacts of the proposed action and each action alternative and whether they meet the purpose and need for action. Information in this chapter is based on reports written by the Interdisciplinary Team Resource Specialists listed in *Preparation and Consultation* section of the EA. Disclosure is focused on providing sufficient evidence and analysis, to determine whether to prepare either an EIS or a finding of no significant impact (FONSI).

This section is organized in two categories of issues. The first group of issues was used in alternative development to resolve conflicts concerning alternative uses of available resources in the project area (eg. conflict between implementing aspen enhancement while at the same time reducing secure habitat). More discussion is provided for the issues used to formulate alternatives because they were the focus of interdisciplinary action. The second group of issues includes other issues considered and includes a summary of impacts. Analysis indicates that there are no significant impacts related to this project. *The Finding of No Significant Impact (FONSI) is now part of the Decision Notice, a draft FONSI was Appendix B in the Draft EA.* All specialist reports are available on the Gallatin Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request from the Team Leader Contact on the EA cover page.

The North Hebgen ***project area*** is on the Hebgen Lake District of the Custer Gallatin National Forest and is approximately 73,250 acres. Proposed treatments are limited to less than 8 % of this area. The project area was the outer boundary of where treatments were considered and is based on the Hebgen Duck Landscape Assessment (2012) Area. The **analysis area** is the area used for determining direct, indirect, and cumulative effects for the natural resources considered in this analysis. The spatial and temporal bounds of the analysis area used for the effects analysis is identified and described for each resource in the specialist reports, and may vary from resource to resource.

Environmental effects can be direct, indirect, or cumulative. They can be long or short duration. Direct effects are those caused by the action and occur at the same time and place. Indirect effects are those caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). In most cases, direct and indirect effects are discussed together. Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7).

As past actions are most often considered in the existing condition, cumulative effects analysis builds upon this existing condition assessment by considering the incremental addition of direct and indirect effects of proposed, as well as present and reasonably foreseeable actions. While impacts can be differentiated by direct, indirect, and cumulative, the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time. A list of past, present and reasonable foreseeable actions considered by all specialists is included with all specialist reports which are available on the Gallatin National Forest or in the Project Record at the Bozeman District Office.

Issues that were used in alternative development to resolve conflicts

Fire and Fuels

This summary documents the direct, indirect and cumulative effects associated with the susceptibility of wildland fire risk and fire hazard within the project area and how well the alternatives address the fuels related purpose and need. This information is summarized from the *Fire/Fuels Report (Jones 2016)* that is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request.

Alternative 1 – No Action

Direct, Indirect and Cumulative Effects

Fuels:

- Fuel profiles would continue to generate more reproduction and growth in the understory. Ladder and surface fuel loadings would increase over time within the entire project area.
- Fuel conditions in the WUI on lands bordering national forest service lands would continue to support intense and severe wildland fires. Human and natural fire starts have a high potential to leave private lands and burn onto national forest lands and vice versa.
- There would be continued high potential of large fire growth north of Hebgen Lake, with no fuel break along Tepee Road to modify fire behavior and compartmentalize a fire to north or south of the proposed fuel break. Fuels would remain continuous with no barriers to limit spread.

Fire Behavior:

- Fire behavior characteristics and output would produce increased surface fire flame lengths, greater potential for active crown fire and high resistance to control. A flame length of 4 feet is the maximum height where firefighters building handline become ineffective and then must rely on fire engines and heavy equipment to help hold hand constructed fireline. Beyond an 8 foot flame length fire engines and heavy equipment are not effective and all ground resources must abandon direct attack on the fire. During active crown fire events firefighters and emergency responders would only utilize indirect attack tactics and focus on public/firefighter safety.

Public and Firefighter Safety:

- Public and Firefighter safety would continue to be the number one priority for any given wildfire. Public and firefighter safety would not be improved and an aggressive fire suppression response would continue with limited management options.
- Wildland Urban Interface (WUI) areas and values to protect would remain threatened by fire during stand replacement fire conditions. Evacuation routes are used by firefighters and emergency responders as access and egress to perform emergency operations. Evacuation routes would not be improved to resemble safety zones. These routes identified to evacuate homeowners and forest users during an emerging wildfire could become unusable. Firefighters do not perform operational tactics within 100 feet of powerlines (critical infrastructure). A continued wildfire threat for powerline damage and power outage would remain a probable consequence. The lines would not be defensible.

- Crown fire initiation or transition from a surface fire to a crown fire is the most intense and severe in terms of effects to the resource, the threat to nearby values at risk and its influence on public/firefighter safety. Crown fire potential remains the same and would increase over time.

Environmental Effects Common to Action Alternatives

Fuel Reduction and Fuel Treatments

The proposed fuel reduction techniques focus on reducing the potential for crown fires and high intensity surface fires in treatment units, and thus reducing the resistance to control. Thinning of trees would reduce the crown density. Removing understory trees would increase the canopy base height, making it more difficult for a crown fire to be initiated. The thinning would focus on removing trees to a desired spacing between boles in both the overstory and understory leaving preferred species and healthy trees versus diseased or suppressed trees. The proposed surface fuel treatment would reduce the amount of surface fuel to approximately 15 tons/acre or less to lower potential flame lengths. This would decrease resistance to control and reduce the likelihood of crown initiation.

A significant risk to life and property exists wherever forest stands prone to crown fire lie in proximity to residential or recreational development. Therefore, assessing the susceptibility of forest stands to crown fire and designing fuel and silvicultural treatments to reduce susceptibility have become priorities for many land management agencies (Scott and Reinhardt 2001). The spatial continuity and density of tree canopies in combination with wind and physical setting in the North Hebgen area provide the conditions required for rapidly moving fires that typically consume the crowns (needles and small branches) of large forest areas. Canopy base height, canopy bulk density (canopy weight for a given volume), and canopy continuity are key characteristics of forest structure that effect the initiation and propagation of crown fire (Albini 1976, Rothermel 1991). Thinning to reduce canopy bulk density to less than 0.10 kg m-3 is generally recommended to minimize crown fire hazard and for the most part below this point, active crown fire is difficult to achieve (Graham and others 2004). The North Hebgen treatments are designed to meet fuel treatment principles and to create a desired effect near WUI values, in powerline corridors, along evacuation routes and to support a fuel break. Table 5 describes the effects of fuel treatment principles.

Table 5. Fuel Treatment Principles and the Effect

Principle	Effect	Advantage
Reduce surface fuels	Reduces potential flame length	Improves control and reduces torching
Increase canopy base height	Requires longer flame to start torching	Reduces torching
Decrease crown density	Makes tree-to-tree crown fire less likely	Reduces potential for crown fire
Retain larger trees	Increases proportion of trees with thicker bark, taller crowns	Increases tree survival
Adapted from Agee, J.K. 2002. Fire behavior and fire-resilient forests. In: Fitzgerald, S. A., ed. Fire in Oregon's forests: risks, effects, and treatment options. Portland, OR: Oregon Forest Resources Institute: 119.126		

Table 6. Treatment type, descriptions and treatment acres by Alternative that have a Fuel Treatment Primary or Secondary[4] purpose.

Fuel Treatment Type(s)	Fuel Treatment Description	Alternative 2 Acres	Alternative 3 Acres	Alternative 4 Acres
Intermediate -Improvement -Comm. Thin -Sanitation or Salvage	-30 to 20 ft. tree bole spacing (overstory and understory) -Activity fuel whole tree yarded to landing and piled for burning. Burn piles. -Residual and natural fuel kept to 15Tons/Acre on site **for all treatments**.	**1364 Primary** *428 Secondary*	**1201 Primary** *381 Secondary*	**1338 Primary** *431 Secondary*
***Regeneration** -Clearcut, -Seed Tree -Overstory, -Group Select	* Regeneration treatments exceed the fuel reduction prescription(s) above as the purpose and need are focused on forest health and whitebark pine enhancement. Fuels would be the same as intermediate treatments.	**456 Primary** *577 Secondary*	**400 Primary** *349 Secondary*	**447 Primary** *380 Secondary*
Post and Pole	-Thinning by personal use permit or small commercial operators -Fuels lop and scattered, trampled, masticated, chipped or hand/machine piled. Burn piles.	**177 Primary** *0 Secondary*	**170 Primary** *0 Secondary*	**177 Primary** *0 Secondary*
Pre-commercial / Hand Thin Immature Stands	-Thin to 12 to 20ft tree bole spacing - Fuels lop and scattered, trampled, masticated, chipped or hand/machine piled. Burn piles.	**773 Primary** *263 Secondary*	**768 Primary** *208 Secondary*	**768 Primary** *251 Secondary*
Powerline-Highway Corridor Clearing /Thin	-Reduce fuels 100 ft. of power lines -1st 50 ft. off center, remove all trees -2nd 50 ft. thin trees at a 15 to 20 ft. spacing - Fuels; WTY to landing, lop and scatter, trample, masticate, chip or hand/machine pile. Burn piles.	**127 Primary** 138 Secondary	**132 Primary** *138 Secondary*	**139 Primary** *138 Secondary*
Daylight Thin for WBP	Target WBP as leave tree. Thin all trees within 20-30 feet that are < 5 inch dbh. Log and scatter, trample, masticate, chip or hand/machine pile. Piles are to be burned.	**0 Primary** *843 Secondary*	**0 Primary** *843 Secondary*	**0 Primary** *843 Secondary*
TREATMENT TOTALS	**Primary Acres** *Secondary Acres*	**2897** *2249*	**2671** *1919*	**2870** *2042*

[4] Secondary benefit indicates that while fuels is an identified need there was another need such as Forest Health that drove the treatment type and/or prescription. The treatment as proposed would address both the primary purpose and fuels.

Table 7. Summary comparison of environmental effects to the Fire and Fuels Resource showing Fire Behavior Output and Post Treatment Condition

RESOURCE ELEMENT	INDICATOR	ALTERNATIVE 2 Measures	ALTERNATIVE 3 Measures	ALTERNATIVE 4 Measures
WILDFIRE RISK **- RELATIVE RISK near values on a scale of High to Low**	**FIREFIGHTER AND PUBLIC SAFETY** Values at Risk include: -Structures -Evacuation Routes -Powerlines -Fuel Break	***LOW risk due to wildfire hazard reduction in key areas.*** Post Treatment: -Structures - 634 **(Low)** -Evacuation – All **(Low)** -Powerlines – All **(Low)** -Fuel Break **(Low)**	***HIGH risk because key areas near homes are not in treatment units.*** Post Treatment: -Structures - 216/418 **(High *)** -Evacuation - All **(Low)** -Powerlines **(Moderate **)** -Fuel Break **(low)**	**MODERATE risk because important areas are treated but not all of the areas.** Post Treatment: -Structures- 120/514 **(Low to Moderate ***)** -Evacuation **(Low)** -Powerlines **(Low)** -Fuel Break **(Low)**
WILDFIRE HAZARD	**FIRE BEHAVIOR for treated acres**			
As you can see from the Table, all treated areas experience a change in fire behavior to a desired condition. Whether areas that would benefit from treatment are included in the alternative is the real indicator.	Crown fire transition is undesirable. Fire remains a surface fire without transition. Flame lengths less than 4 feet are desirable to enable effect fire suppression tactics.	**Transition to Crown Fire expected** Pre-Treatment **Yes** Post Treatment **No** **Surface Flame Length (feet)** *Intermediate and Regen Harvest* Pre-Treatment **8 Feet** Post Treatment **2 Feet**	**Transition to Crown Fire expected** Pre-Treatment **Yes** Post Treatment **No** **Surface Flame Length (feet)** *Intermediate/Regen Harvest)* Pre-Treatment **8 Feet** Post Treatment **2 Feet**	**Transition to Crown Fire expected** Pre-Treatment **Yes** Post Treatment **No** **Surface Flame Length (feet)** *Intermediate/Regen Harvest* Pre-Treatment **8 Feet** Post Treatment **2 Feet**
Resistance to Control	Fires with low resistance to control near values is desired	**LOW**	**HIGH**	**MODERATE**

(*) 216 structures at high risk near Horse Butte Estates / Yellowstone Village / Rainbow Point Campground **the other values would be treated and have low risk.**

(**) Treated Acres near powerlines would be have low risk but the powerline south of Rainbow Point Campground along the NFS boundary would be untreated and remain high risk**.**

(*) 120 structures near** Horse Butte Estates / Yellowstone Village / Rainbow Point Campground have partial risk reduction other values would have low risk

Alternative 2 – Proposed Action

Direct, Indirect and Cumulative Effects

For fire and fuels, 2,898 acres of primary fuels treatments are proposed and an additional 2,249 acres of other fuel treatments would be accomplished. Table 7 displays the results of resource indicator and measures used to assess direct and indirect effects to the fire and fuels resource and Table 6 shows acreage treated by Alternative. In general, where intermediate silvicultural treatments are proposed, treatments are expected to be effective for 15-20 years. Regeneration harvest would be effective for slightly longer timeframes. The need for future treatments would be evaluated at that time, based on direction and priorities in place at that time.

WUI

Horse Butte sub-division, Rainbow Point Campground/homes and Duck Creek private lands would have a fuel condition that allows firefighters to perform direct attack on wildland fires that start on private land and burn onto national forest lands or vice versa. Flame length heights would change from 8 feet to 2 feet and crown fire potential would be reduced. As a result, treated areas **would have a <u>low</u> resistance to control.** Fuel reduction benefits would also be accomplished from the associated aspen enhancement and forest health treatments (Secondary) near these locations described in Table 2. Alternative 2 – Proposed Action and Preferred Alternative, Table 6 and shown in Figure 13. Alternative 2 (Proposed Action) South Half map.

Evacuation Routes

Fuels Treatments would **reduce crown fire to surface fire for a distance of 400 feet, providing a safe zone to perform public evacuation and firefighting operations.** Safety for access and egress of emergency responders would be increased. These evacuation routes would also serve as fuel breaks to aid in suppression efforts. More suppression personnel would be available to help control the fire instead of assisting with evacuations. Fuel reduction benefits would also be accomplished from the associated aspen enhancement and forest health treatments around the Whit's Lake and Red Canyon roads.

Critical Infrastructure (Powerlines)

All powerlines in timbered corridors would be treated 100 feet both sides from center line. This fuel reduction treatment removes all trees within 50 feet of the powerline corridor limiting any wind thrown tree from landing on energized lines and igniting a fire. The remaining 50 feet would be thinned to a 15 to 20 foot spacing that would change fire behavior from crown fire to a surface fire with less fire intensity. In some cases, this treatment is within and part of other treatment units. Firefighter guidelines do not allow for tactical operations within 100 feet of powerlines. The treatment would serve as a fuel break to aid suppression efforts. Wildland fires would burn through these areas at lower intensity inflicting less damage to power poles/lines with a less resistance to control. **These treatments address firefighter safety and provide protection to local critical infrastructure.**

Fuel Break (Tepee Road)

Implement fuel reduction treatments on both sides of Tepee Road (#986) to establish a fuel break between two distinct drainages with heavy continuous fuel loadings. The treatments would extend from either side of the road to the roadless boundary in most cases. Treatments begin at Highway 191 and end at the Tepee Creek Trailhead. A well-designed fuel break will alter the behavior of wildland fire entering the fuel-altered zone. Both surface and crown fire behavior may be reduced. Shaded fuel breaks must be created in the context of the landscape within which they are placed. No absolute standards for fuel break width or fuel reduction are possible, although recent proposals for forested fuel breaks suggest 400m wide bands where surface fuels are reduced and crown fuels are thinned. Wider fuel breaks appear more

effective than narrow ones. Effectiveness is also dependent on the psychology of firefighters regarding their safety. Narrow or unmaintained fuel breaks are less likely to be entered than wider, well-maintained ones. Compartmentalization of fires by fuel breaks, which may or may not be laid out in a connected network, can help to reduce fire size but generally will not reduce damage per unit areas burned outside of the fuel breaks themselves (Agee and others, 2000). These proactive fuel reduction treatments would help managers be able to compartmentalize a wildland fire on either side of the fuel break by modifying fire behavior from crown fire to surface fire. This would allow firefighters and public safer access and egress during wildland fire incidents. Treatments would benefit suppression and containment efforts that would help to limit the final fire size. Treated areas **would be changed from high resistance to control to low resistance within this fuel break corridor. Firefighter and public safety would be increased and allow for the full range of fire management strategies be considered.**

Cumulative Effects

The cumulative effects of past, present and foreseeable actions to the Fire and Fuels resource are minor and would have insignificant cumulative effects. Past actions were considered in the affected environment and future planned activity are limited in scale and do not modify fuel conditions. As a result there would be little to no combined effect with the direct and indirect effects of the North Hebgen project and the effects of reasonably foreseeable actions.

Conclusion

Alternative 2 – **best meets** the Fire and Fuels purpose and need of public and firefighter safety. Proposed treatments would reduce surface, crown and ladder fuels in the Wildland Urban Interface (WUI), along Evacuation Routes and Tepee Road (fuel break), and would protect Critical Infrastructure (powerlines).

Implementation of proposed fuel treatments in Alternative 2 would modify fire behavior characteristics to reduce wildfire risk near values, most effectively. Values include structures such as businesses and homes, powerlines and infrastructure like campgrounds and trailheads. Alternative 2 would provide the lowest resistance to control and least potential for fires spreading from private land to national forest and vice versa. There is a fuel reduction benefit associated with wildlife and forest health treatments. Alternative 2 would provide the most fuel reduction benefit overall. Alternative 2 BEST MEETS and SUPPORTS the Fire and Fuels purpose and need of public and firefighter safety.

Common among the alternatives is that the effects of the proposed activities will likely last between 15 and 100+ years. In general, where intermediate silvicultural treatments are proposed, an effects time frame of 15-20 years is estimated. Fuel treatments would help restore Fire Regime Condition Class in stands moderately altered from their historical range condition class 2 to vegetative conditions more represented to their historical range. The desired effects of the fuels treatments by modifying fire behavior characteristics would continue to meet purpose and need, until forest succession overtime creates stand growth similar to current conditions. The exact time period can be different for each treatment area. Fuel buildups, dense over-story canopy and understory is site and species specific so monitoring and follow up treatments could be implemented to maintain post treatment conditions if needed and desired. Future management would be considered as appropriate under future NEPA analysis.

Alternative 3

Direct, Indirect and Cumulative Effects

For Fire and Fuels, 2670 acres of primary fuels treatments are proposed and an additional 1919 acres of other fuel treatment benefit would be accomplished. Table 7 displays the results of resource indicator and measures used to assess direct and indirect effects to the fire and fuels resource and Table 6 shows acreage treated by Alternative.

WUI
The continuity of fuel reduction treatment would be fragmented. The elimination and reduction of treatment units (eliminate units 1-5, portions of units 6-10 and 77, 81, 84, 86, 87) on Horse Butte, near Horse Butte Estates, Yellowstone Village and Rainbow Point Campground would not reduce risk near homes, businesses and the infrastructure at the campground. The area would have the highest resistance to control. The least amount of aspen enhancement and forest health treatment (other fuel benefit) would be implemented, consequently, less fuel treatment overall would be accomplished. Fire starts in the area have the greatest potential of spreading from private land to national forest land and vice versa.

Evacuation Routes and Fuel Break (Tepee Road)
Treatments and effects would be similar to alternative 2.

Critical Infrastructure (Powerlines)
All treatments and effects would be similar to alternative 2; except for the elimination of unit 86 (south of Rainbow Point Campground) and removal of .75 miles of treatment in the powerline corridor in the northwest edge of private land in the Horse Butte area. Powerline protection would be reduced to low.

Cumulative Effects
The cumulative effects of past, present and foreseeable actions to the Fire and Fuels resource are minor and would have insignificant cumulative effects. Past actions were considered in the affected environment and future planned activity are limited in scale and do not modify fuel conditions. As a result there would be little to no combined effect with the direct and indirect effects of the North Hebgen project and the effects of reasonably foreseeable actions.

Conclusion
Alternative 3: as compared to Alternative 2 and 4.

- Fuel reduction continuity would be fragmented because 228 acres of primary fuels treatment near Horse Butte Estates, Yellowstone Village and Rainbow Point Campground would be eliminated. The .75 miles of powerline corridor would not be treated in Unit 86. As a result, treatment effectiveness near values and critical infrastructure is **LOW**. **Alternative 3 would be least effective in** protection of values and critical infrastructure.
- HIGH Resistance to Control near values as compared to High in Alt 2 and 4.
- HIGH potential for a wildfire to spread from private land to national forest or vice versa would be in Alternative 3 due to the fragmented fuel treatments adjacent to the Horse Butte private land boundary.

  In the units treated, Alternative 3 would reduce fuels and effectively change fire behavior in the Wildland Urban Interface (WUI), along Evacuation Routes and Tepee Road (fuel break), and protect Critical Infrastructure (powerlines) but it would be less effective than Alternatives 2 and 4.

Alternative 4

Direct, Indirect and Cumulative Effects
For Fire and Fuels, 2870 acres of primary fuels treatments are proposed and an additional 2042 acres of secondary fuel treatment would be accomplished. Table 7 displays the results of resource indicator and measures used to assess direct and indirect effects to the fire and fuels resource and Table 6 shows acreage treated by Alternative.

WUI
This alternative includes portions of proposed units that were dropped or reduced in Alternative 3 near Horse Butte Estates, Yellowstone Village and Rainbow Point Campground areas. Because of these

changes, this alternative effectively reduces fuels in all the high priority WUI areas except in unit 86 near Yellowstone Village. The powerline corridor within unit 86 near this boundary would be treated in full. As a result, treatment effectiveness would be moderate in reducing risk to values. There would be MODERATE to LOW resistance to control for the WUI area because of the treatment units that were added back in to the alternative. These units provide additional continuity and connectivity between treatment units compared to alternative 3. Fires spreading from private land on to the national forest and vice versa would also be at a low potential.

Evacuation Routes, Critical Infrastructure (Powerlines) and Fuel Break (Tepee Road)
All treatments and effects would be the same as alternative 2.

Cumulative Effects
The cumulative effects of past, present and foreseeable actions to the Fire and Fuels resource are minor and would have insignificant cumulative effects. Past actions were considered in the affected environment and future planned activity are limited in scale and do not modify fuel conditions. As a result there would be little to no combined effect with the direct and indirect effects of the North Hebgen project and the effects of reasonably foreseeable actions.

Conclusion
Alternative 2 and Alternative 4 are very similar with respect to fire and fuels. The following describes the minor differences between the two:

- Fuel reduction continuity in Alt 4 would be reduced by 28 acres (Unit 86) near Horse Butte private land and Rainbow Point Campground. Only the powerline corridor would be treated (within unit 86) which would effectively reduce risk to values and provide some protection for critical infrastructure.
    - Resistance to control would be LOW in both Alternatives 2 and 4 because of the reduced fuel and resulting fire behavior.
    - Potential for a wildfire to spread from private land to national forest or vice versa would be lowest in Alt 2 and 4.
    - Fewer acres of Aspen enhancement treatments would occur in Alt 4 than 2. These treatments would provide other fuel benefits that support the firefighter and public safety purpose and need near the Horse Butte / Rainbow Point Campground wildland urban interface area.

Alternative 4 is the second best alternative as compared to Alt 2 (best) and Alt 3 (least effective). IT would be similar to Alternative 2 in meeting the fire and fuels purpose and need of firefighter and public safety but not quite as effective.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans and Other Disclosures – Comparison of Alternatives
The proposed fuel reduction treatments in the action alternatives in the North Hebgen project would begin to address national, regional and local fire and fuels direction. Nationally, protection of human life, take positive action to ensure compliance with established safe firefighting practices and address hazardous fuel build-ups around communities at risk are key messages (1995 Federal Wildland Fire Management Policy / National Fire Plan). Local direction from the Gallatin County CWPP and Gallatin NF Plan and Fire Plan provide the following goals and objectives: protect life and human safety, prevent or limit loss of property and restore and preserve our ecology, provide safe working area and access for emergency responders, coordinate land and resource management efforts with other Federal, State, local agencies and private landowners, treatment of natural fuels accumulations to support hazard reduction and one or more fire management strategies within FMU1/2/3 may be considered for any unplanned wildland fire while minimizing negative effect to life, investment and valuable resources. The action alternatives move the project area toward these goals and objectives.

Summary
The scope of the potential effects to the fire/fuels environment is limited to the project area because fuels treatment are targeted to reduce fuels and subsequent fire behavior in specific areas. The treatments are not intended to alter fire behavior or fire occurrence on a landscape scale. *The duration of effectiveness is 15-20 years so the effects would not be long term and are local to specific areas identified.* There would be minimal cumulative effects because there are no known actions proposed that would have a combined effect with the direct and indirect effects from this project and the effects from past activities are reflected in the existing condition. The alternatives are consistent with national, regional and local direction. The direct and indirect effect of fuel reduction would provide a beneficial effect in terms of public health and safety by providing for firefighter and public safety and reducing the risk of fire damage near values. Fire managers would have more options to allow fire to have a role on the landscape due to fuel reduction in WUI and along Tepee Creek Road. There would a short term adverse effect associated with an increase in activity related fuel. Slash treatments identified in the treatment descriptions would *fully* mitigate this short term impact.

Forest Vegetation

This information is summarized from the North Hebgen Multiple Resource Project *Forest Vegetation Report (Konen 2015)* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific design features and resource protections related to Forest Vegetation are listed in Appendix A.

Affected Environment

Historic Conditions
Historical forest vegetation conditions provide us with an idea of what the area looked like at various points in time. However, it is important to remember they are limited by the availability and accuracy of historical information and do not necessarily identify desired conditions given today's ecological and social environment. In summary, the analysis of historic reference conditions (1998 East –side Analysis of the Management Situation (IRPS 2011)) compared to 1998[5] conditions suggests that the area is similar to historic conditions except that there are fewer areas with small trees and stands are more densely stocked:

- Less representation of the smallest size classes and a slightly higher representation of the largest size classes.
- More Douglas-fir, Engelmann spruce, and subalpine fir. Less lodgepole pine, subalpine shade intolerants. Similar amounts of aspen, cottonwood, limber pine, juniper, and whitebark pine.
- Only 16.7% of the dry forest types in the landscape have a basal area density ranging from 40-70 ft^2/ac compared to 40% historically. *Most of these stands have a higher basal area which means the stands have more trees in them.*

[5] During scoping some commenters were interested in the historic range of conditions. The referenced study was specifically intended to compare the historic range of variability. For the purposes of discussing historic trends this data is representative even though it is almost 20 years old. For this project, it is important to note that the treatments are not necessarily intended to replicate historic conditions.

Successional Stage Distribution

Three forested successional stages were identified in this analysis to illustrate distribution of successional development and hence tree size and age. Successional stages are another way of looking at forest resiliency. Age and size class heterogeneity on the landscape adds to resiliency to insect and disease. The Forest Plan has a standard to "use management tools to achieve size and age class diversity (II-21). In the North Hebgen landscape, mature and over mature forest dominate the landscape

Table 8: North Hebgen Successional Stages – Existing Condition

Successional Stage	General Description	Acres	% Conifer Forest Area
Seedling/Sapling	Dominant/Codominant <5" DBH	1,146	2.4
Pole	Dominant/Codominant 5"-9.9" DBH	8,990	18.9
Mature	Dominant/Codominant >= 10" DBH	**37,351**	**78.7**

Old Growth/Over Mature Forest Structure

Old growth is defined by Green et al, for the Eastern Montana Zone. Appendix B of Konen 2015 includes the minimum criteria and associate characteristics used to make old growth determinations. The Forest Plan contains direction relative to old growth and over-mature forest structure (FP as amended 2015 II-21, III-55). This direction frames the discussion of old growth and over mature Forest Structure in the analysis area. "Over-mature forest structure" is defined by forest type using minimum DBH values for Eastern Montana Zone old growth Type Characteristics in *Old-Growth Forest Types of the Northern Region* (Green et al., 2011) and translated into the most appropriate available size class in VMAP.

The distribution of old growth within the analysis areas was analyzed at multiple scales[6]. Estimates of the amount of old growth can be confidently made at large scales using Forest Inventory and Analysis (FIA) data. The appropriateness of this process is documented by Czaplewski (2004). Table 9 includes estimates of old growth using FIA data for the entire Gallatin National Forest, the western half of the Forest and the Madison and Henry's mountain ranges within which the project area falls

Determination of the existing condition of over mature forest structure relative to MA13 direction required multiple analysis steps and rule sets as described in the Forested Vegetation Report (Konen 2015, Appendix C). In general, the forested acres in MA13 within the appropriate compartments were evaluated by trees size class, then forest-type data was overlaid. This query[7] produced estimates displayed in the table below. MA13 exists in timber compartments 701, 702, and 703 within the analysis area. See Table 10.

Table 9: FIA Old Growth Estimates

Area of Interest	Old Growth Estimate	Lower 90% Confidence Interval	Upper 90% Confidence Interval
Gallatin National Forest	**24.8%**	21.1%	28.5%
Western Half Gallatin National Forest	**21.7%**	16.0%	27.2%
Madison Mountain Range	**33.9%**	23.6%	43.6%
Henry Mountain Range	**6.2%**	0%	14.3%

[6] For more information about the analysis and results refer to the specialist report (Konen 2015).
[7] This query used a combination of data sets, primarily VMAP and the Gallatin National Forest Stands Plus data layer.

Table 10: MA13 Over-mature Forest Structure Present

	Compartment 701	Compartment 702	Compartment 703
Compartment Acres	20,049 acres	5,041 acres	11,348 acres
MA13 Acres	10,327 acres	208 acres	6,218 acres
Emphasis 1 - Whitebark Pine (>= 10" DBH)	829 acres	0 acres	0 acres
Emphasis 2 - Mesic Sites (>=15" DBH AND Canopy Cover 40-60%)	199 acres	0 acres	0 acres
Over mature Forest by Forest Type (excludes emphasis areas)			
DF	296 acres	0 acres	0 acres
LP	3,219 acres	92 acres	2,106 acres
SAF	1,517 acres	0 acres	0 acres
Total Acres Over Mature Forest Structure	6,060 acres	92 acres	2,106 acres
Percent of MA13 Acres in Over Mature Forest Structure	**59%**	**44%**	**34%**

Forest Structure

Horizontal structure is often referred to in terms of density. In forestry, density can be measured in many ways but is most commonly expressed in terms of basal area, trees per acre, or canopy cover. Density is factor in fuel reduction and forest resiliency. Horizontal structure is also variable across the analysis area. Many of the Seedling/Sapling/Pole areas have extremely high tree densities, over 1,000 trees per acre. There are a few areas where regeneration following disturbance has been limited and only scattered trees are established; this is most likely due to drought. Density is also high in many of the mature areas. One measure of density is canopy cover, which is proportion of the forest floor covered by the vertical projection of tree crowns (Barber et al., 2011). An estimated 51% of the tree dominated areas in the project area has 60% or greater canopy cover and 33% has 40-59% canopy cover.

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

Similar to the estimates of Old growth mentioned earlier, estimates of the number of snags per acre and the amount of coarse down woody material per acre can be made analyzing FIA data at varying spatial extents. The confidence of estimates made using FIA data is higher as more data is incorporated. The Madison and Henry mountain ranges were used to characterize these attributes across the landscape within which this project falls. Although this area is broader than the analysis area boundary, it allowed for the incorporation of more data and thus better estimates of the existing condition for snags and coarse woody material. Table 11 summarizes the estimates of standing dead snags per acre (greater than 9" DBH) and coarse woody material (tons/acre greater than 3" diameter) by mountain range. It is important to note that this landscape attribute informs the reader of the extent of this component of stand structure, but there is not Forest Plan standard related to snags or coarse woody material. This is often a point of confusion, the applicable Forest Plan standard is an implementation standard tied specifically to harvest units and is incorporated in all action alternatives.

Table 11: FIA Snag and Coarse Down Woody Mountain Range Estimates

Mountain Range	Attribute	Estimate	Lower 90% Confidence Interval	Upper 90% Confidence Interval
Madison	Standing Dead Snags (trees per acre > 9“ DBH)	**13.9**	8.1	20.4
Madison	Coarse Down Woody (tons per acre > 3” diameter)	**8.0**	5.2	11.1
Henry	Standing Dead Snags (trees per acre > 9“ DBH)	**6.3**	0.2	17.2
Henry	Coarse Down Woody (tons per acre > 3” diameter)	**3.7**	1.8	5.8

Insects and Diseases

Forest insects and diseases are major disturbance processes in forests of the Northern Rocky Mountains. There effects can range from small scale disturbances, killing individual trees, to wide spread outbreaks causing extensive tree mortality. Native forest pests have been part of our forests for millennia and function as nutrient recyclers, agents of disturbance, members of food chains, and regulators of productivity, diversity, and density (Black, 2005). Numerous tools are available to help assess the existing insect and disease situation within the analysis area.

Insect hazard ratings measure the susceptibility of forest areas to particular insects by evaluating stand and host conditions. Susceptibility is the inherent characteristics or qualities of a stand of trees that affect its likelihood of attack and damage. Existing insect populations and climate combine to describe the risk of damage. In contrast, risk is the short term expectation of tree mortality in a stand as a result of an insect infestation. Risk is a function of susceptibility and insect pressure (Shore and Safranyik, 1992). Multiple hazard rating systems have been developed overtime for a variety of forest insect. Region 1 Forest Health and Protection staff has developed hazard ratings for important forest insects (Randall et al, 2011). Both hazard and risk assessments were completed for this landscape in order to validate the need for and effectiveness of the project. Detailed discussions are in the specialist report (Konen 2015).

Mountain Pine Beetle (MPB) is an aggressive bark beetle which feeds in the inner bark of host trees, often girdling and killing the tree. Hosts include most pine species with lodgepole pine (LPP), limber pine, and whitebark pine being of concern within the analysis areas. Infested trees fade within one year from yellow-green to red-brown. Large scale outbreaks are common, especially inLPP, when conditions are optimal and the beetles’ food supply is abundant. Currently, entomologists calculate stand hazard for LPP, limber, and whitebark pine utilizing the following criteria: quadratic mean diameter >5”, stand basal area, and the proportion of the stand basal area that is pine (Randall et al, 2011).

Regional entomologists have assigned MPB hazard (Very Low, Low, Moderate, High) using available VMAP metrics which provides a tool to assess relative insect conditions across the project area. The estimates indicate a MPB hazard of high for 46% of the area, moderate (11%), low (11%) and very low (11%) hazard in and 24% of the area is non-forest.

Douglas fir beetle (DFB) is a bark beetle which attacks primarily Douglas-fir. DFB has one generation per year, with a spring emergence typically between mid-April and early June. DFBs are not particularly aggressive. However, they are attracted to wind throw and trees weakened by fire, drought, defoliation, or root disease. Outbreaks typically last 2-4 years (Kegley, 2004). Stand susceptibility is related to the proportion, density, age, and size of Douglas-fir. High hazard stands are considered to have stocking

greater than 250 square feet basal area, greater than 50% Douglas-fir, average stand age greater than 120 years, and average diameter of Douglas-fir greater than 14 inches.

Western Spruce Budworm (WSB) - is a defoliating insect which eats the needles of Douglas-fir and true fir trees, though other species may be defoliated during epidemics. When populations of these insects reach epidemic proportions, they can cause a reduction in growth, top kill, reduced seed production, tree mortality, and mortality of regenerating trees. WSB outbreaks tend to last long and often cause limited direct tree mortality because budworms preferentially feed on current year foliage. Stand hazard is calculated by evaluating stand basal area, proportion of susceptible tree species, and the number of trees per acre.

Lodgepole Pine Dwarf Mistletoe (LPDMT) is a small parasitic plant whose principle host species is lodgepole pine. Ponderosa pine, whitebark pine, and Engelmann spruce are rare hosts. Dwarf mistletoes are obligate parasites depending on their host to survive, and are the most widely dispersed pathogen in the western United States. Effects include, witches brooms, top kill, reduced height and diameter growth, and occasionally mortality. Mistletoe inflicted mortality usually does not occur until trees are mature and begin to decrease in vigor. Spread and intensification is usually slow (FHP and SFO, 2004). Hawksworth (1977) developed a six-class dwarf mistletoe rating (DMR) system to quantify mistletoe infestations.

In addition to Aerial detection survey (ADS), a regional entomologist and pathologist were contacted to provide assistance with assessing insects and diseases within some proposed treatment areas. A field visit was made within the analysis area in July 2013 and the full report describing the visit is included in the project file for this analysis (Jackson and Egan, 2013). The trip was limited to the Rainbow Point and Horse Butte areas. General existing condition and forest health highlights include the following.

- LPDMT is a management issue (fuels and timber volume) across much of the analysis area.
- Many lodgepole pine stands on Rainbow Point, including within the campground, rate at either moderate or high hazard to MPB attack.
- Douglas-fir stands on Horse Butte rate at high susceptibility to DFB attack, contain root and butt rots affecting over mature and younger trees, and WSB defoliation has caused moderate to high levels of damage in over story (20-50% crown defoliation) mid-story (60-90% crown defoliation) and understory (up to 100% crown defoliation) vegetation.
- Observations indicate that Douglas-fir mortality on Kirkwood Face were the result of DFB

Climate Change

Projected changes in climate would impact forest vegetation in the Northern Rockies; both directly through vegetation growth, mortality, and regeneration and indirectly through changes in disturbances and ecosystem processes. Much uncertainty is involved with predicted climate changes and also uncertainty in how forest vegetation may respond to these climate changes. In this area climate changes are projected to reduce precipitation and increase temperatures, and this would reduce water available to trees. These changes would affect tree productivity (growth), establishment, and mortality. The indirect disturbances and processes (stressors) that may affect trees include wildland fire (potential shifts in fire regimes and larger, more intense fires in some areas), insects, diseases, and drought. Although these factors may be considered during project implementation and site specific monitoring, this analysis will rely on observed conditions and trends (which could include any existing responses to changes in climate).

Table 12: Resource indicators and measures represent components of the Purpose and Need for Action.

Resource Element	Resource Indicator	Measure
Insects and Diseases	Conditions and Stand Susceptibility	Hazard Ratings and Acres Treated
Successional Stages	Distribution	Acres Treated and % Old Growth and % Over-Mature Forest Structure
Tree Species	Representation/Resiliency	Acres Treated
Forest Structure	Resiliency	Acres Treated

Direct, Indirect and Cumulative Effects

This section describes the direct, indirect, and cumulative effects of the no action and the proposed action alternatives to forest vegetation. The potential effects described are based on research, modeling, experience, and professional judgment. The North Hebgen project proposes to conduct a series of actions to be implemented over an estimated 8-12 year timeframe within the analysis area. The Alternative descriptions include a listing of silvicultural actions and objectives by alternative. Treatments were grouped by harvest type, like intermediate, regeneration or specialized treatments. One silvicultural treatment could be used to achieve multiple objectives related to purpose and need. Descriptions of the proposed silvicultural treatments can be found in on the Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request, *Draft Description of Treatments November 2015 and in the specialist report (Konen 2015).*

Alternative 1 – No Action

By definition, direct and indirect effects (40 CFR 1508.8), and cumulative effects (40 CFR 1508.7) result from the proposed action, and thus are not germane to the No Action alternative. The following discussion focuses on expected trends and conditions associated with insects and disease, successional stages, tree species and forest structure.

None of the project proposed actions would occur under this alternative, allowing the processes of vegetation succession and disturbance to continue in a similar fashion as they currently are. In general insect and disease hazards would remain high and forest resilience would remain low. Firewood gathering, Christmas tree cutting, and continued wildfire suppression consistent with management direction is expected. In addition, some similar activities, would be expected to occur associated with other efforts or ongoing Forest programs and these activities will be discussed as reasonably foreseeable actions.

Action Alternatives 2, 3, and 4

This section will discuss the direct and indirect effects to forest vegetation from implementation of the three action alternatives. The actions are similar between alternatives, varying primarily by the number of acres treated, so the effects discussion is combined. Where possible, the effects will be quantified for each alternative to allow for comparison and will be discussed relative to the measurement indicators.

Successional Stages

Regeneration treatments will effect seral stage distribution more than intermediate treatments given that regeneration treatments are designed to establish a new cohort of tree. Note that successional stages for this analysis were defined by size classes outlined previously.

Intermediate treatments (commercial thinning, sanitation cutting, power line and highway corridor thinning, improvement cutting and non-commercial treatments) are not expected to affect the successional stage classification of treatment areas. However, these treatments will have effects on the average

residual stand DBH and on residual stand radial growth. It is likely that increases in average stand DBH coupled with expected increases in radial growth following treatment would accelerate the time interval for an area to shift from seedling/sapling to pole or from pole to mature successional stages.

Regeneration treatments (clearcut, seed tree, overstory removal, and group selection) would immediately effect an area's classification into successional stages, as existing pole and mature stage areas would be converted to the Seedling/Sapling stages. Proposed group selection treatment would only occur within the 20-30% of the area in group openings that are 1-3 acres in size. Also, the majority of areas proposed for regeneration are dominated by lodgepole pine and all of these areas are classified as Pole Successional Stage. Seedling sapling stage is least represented (2.4% of Forested area) in the landscape and as result these treatments would improve resiliency by increasing age and size class diversity.

Table 13: Acres Converted to Seedling/Sapling Stage Following Regeneration Harvest by Alternative

Pre-Treatment Successional Stage	Alternative 2 (Acres)	Alternative 3 (Acres)	Alternative 4 (Acres)
Pole	650	521	566
Mature	141	112	112
Total	791	633	678

Old Growth

Forest-wide old growth direction strives to maintain a minimum of 10% old growth (Green et al.) forest on lands classified as forested at the mountain range scale (FP 2015 II-21). Within the Madison Mountain Range the existing condition is 33.9% (91,751 acres) old growth of the 270,653 forested acres. Walkthrough surveys were completed for all proposed treatment areas. During these walkthroughs, the possibility of an area meeting old growth criteria was assessed by observing tree size (i.e. does the area currently contains trees that are near the minimum tree size). In addition, Forest Service activity database (FACTS) information was used to assess the possibility that an area could meet old growth minimum criteria (e.g. an area with a clearcut harvest would not contain trees old enough to meet minimum age criteria). Combining all of these data sources provides a sense of the current old growth status and the distribution of old growth and possible old growth within proposed treatment areas in the Madison Range, see Table 14.

Within the Henry Mountain Range the existing condition is 6.2% (6,125 acres) old growth of the 98,791 forested acres which is below the Forest Plan Standard of 10%. Proposed treatment areas were surveyed and do not meet old growth criteria. Therefore old growth will not be impacted. The Forest Plan standard relating to old growth does not include requirements for recruitment or replacement old growth; however successional stage estimates indicate the distribution of tree size within the analysis area and suggest dominance by trees in the mature successional stage (78.7%).

Table 14: Old Growth determinations for proposed treatment areas in the Madison Range by Alternative

Madison Range Old Growth Determination	Alternative 2 (Acres)[1]	Alternative 3 (Acres)[1]	Alternative 4 (Acres)[1]
Yes (currently meets minimum criteria)	269	269	269
No (does not currently meet minimum criteria)	1,938	1,808	1,923
Possible (currently contains trees that are near the minimum tree size but may or may not meet other criteria)	639	447	486

[1]Group selection acres only include 30% of unit acreage

Over-Mature Forest Structure

The effects of the action alternatives to over-mature forest structure will be discussed relative to the Forest Plan standard in the Regulatory Framework section for MA 13 (FP as amended 2015 III-55). *Vegetation management activities shall not reduce the proportion of over-mature forest structure in a timber compartment below 30% of the MA 13 acres within that compartment*. MA13 exists in timber compartments 701, 702, and 703 (see Table 15) within the analysis area and the existing condition of over-mature forest structure is 59%, 44%, and 34% respectively.

Table 15: Acres and percent MA13 of over-mature forest structure by alternative and timber compartment with mitigation.

Timber Compartment	Alternative 2 Acres[1]/% MA13	Alternative 3 Acres[1]/%MA13	Alternative 4 Acres[1]/%MA13
701 = 59%	630/6%	589/6%	592/6%
702= 44%	30/14%	30/14%	30/14%
703= 34%	382/4%	321/4%	346/4%

[1]Group selection acres only include 30% of unit acreage

Under all action alternatives, Compartments 701 and 702 remain at or above 30% over mature forest structure. In order to remain consistent with the MA13 Forest Plan, project design features would be incorporated for timber compartment 703. Without mitigation Alternatives 2 and 4 would reduce over-mature forest structure by 6% and Alternative 3 by 5% assuming all treatments were to eliminate over mature forest structure. In Alternatives 2 and 4, 2%, or 124 acres of proposed treatments would need to maintain or not effect over-mature forest structure post-treatment to maintain 30% of the MA13 acreage. Precommercial thinning accounts for 60 acres of proposed treatments but will not reduce over-mature forest structure. This leaves 64 acres where project design features would need to ensure retention of over-mature forest structure. In Alternative 3 to maintain 30% of the MA13 acreage 1%, or 62 acres of proposed treatments will need to maintain over-mature forest structure post-treatment. In this alternative precommercial thinning accounts for 50 acres; which leaves 12 acres where project design features will need to ensure retention of over-mature forest structure. This can be achieved in select commercial thin treatments where over-mature forest structure exists (Units 39, 49, 96) by limiting tree removal to trees less than 10” DBH on 64 acres of treatment in Alternatives 2 and 4 and 12 acres of treatment in Alternative 3 (see Design Features Common to Action Alternatives- Appendix A). Over-mature forest structure was also identified in Unit 100; however Unit 100 includes the Rainbow Point campground and will be excluded from the design feature to retain flexibility in managing this developed recreation site.

Tree Species

The proposed silvicultural and reforestation activities will result in varying effects to the tree species composition within the analysis area. Management direction includes emphasis on aspen, whitebark pine, and in some cases Douglas-fir where appropriate. The presence of these species suggests that site capabilities are adequate and they are appropriate areas to apply this direction. Therefore, these species will be preferred and favored for retention. Due to susceptibility to MPB and LPDMT of lodgepole pine, the relatively short longevity and fire-intolerance of lodgepole pine and subalpine fir, these species will be favored for removal in most situations.

Aspen

Aspen enhancements (improvement cuts) are expected to affect tree species composition directly by design. In these treatment areas aspen would be favored and all other species would be removed in the vicinity of aspen. Standard prescription practices would be incorporated that minimize browse pressure. However, browse pressure generally is not a limiting factor in these stand. As discussed, conifer competition was identified as the limiting factor. Aspen do not occur throughout all of the proposed

treatment areas, so it is not expected that these areas will be solely dominated by aspen post-treatment. Mixed conifer and aspen as a forest type would remain. This treatment is intended to release aspen that is being suppressed by conifer competition. Removal of conifer competition would increase aspen sprouts and improve growing conditions for this species.

Whitebark Pine

The proposed treatments would encourage whitebark pine (WBP) establishment and/or better growth to allow the forest stands to reach cone producing age sooner. There are two treatments proposed for WBP enhancement, daylighting and regeneration harvests. These types of treatment were identified as restoration opportunities in the Whitebark Pine Strategy (GYCCWBPS, 2011).

Several old harvest units are heavily stocked with LPP, spruce, WBP and alpine fir trees. These are the areas where "daylighting" is proposed. Whitebark pine saplings and pole sized trees (advanced regeneration) occupy 10-20 percent of the trees per acre on about 50-60% of the area in units identified. Whitebark pine trees are shade intolerant. By clearing around or "daylighting" the healthy WBP trees, select trees would be released from competition with the opportunity to mature more quickly and reach cone producing size more rapidly. Without treatment, shade tolerant tree species will suppress the WBP.

Overstory removal and seed tree treatments would affect tree species composition significantly by shifting to dominance by WBP pine through retention and regeneration. Currently, these areas contain a mix of WBP, LPP, subalpine fir, and Engelmann spruce. Proposed regeneration harvest treatments were designed to create openings that mimic mixed severity fires, as recommended in Keane et al. 2012 on pg. 74, creating opportunity for white bark pine establishment from existing seed sources and planted stock if needed. Openings would promote WBP by removing non-whitebark pine species and reserving the existing overstory WBP pine trees as a seed source. The intent would be to manage existing saplings and natural regeneration of WBP, combined with tree planting blister rust resistant seedlings. Rust resistant seedlings can be sown and grown from local proven rust resistant seeds. The end result would promote regeneration of this species and ultimately create a two-aged stand structure.

Aspen and WBP pine treatments would increase species diversity in a fairly uniform landscape resulting in increased resiliency on the landscape.

Table 16. Acres managed to favor desired tree species by Alternatives and

Species	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Aspen Enhancement	0	701 acres	192 acres	372 acres
Daylighting treatment to enhance WBP growth	0	843 acres	843 acres	843 acres
Regeneration harvest to regenerate WBP	0	286 acres	154 acres	154 acres

Douglas fir stands and regeneration are minimally represented in the area due to stand succession and limited potential habitat. Retention of Douglas fir forest is important because this species is more fire tolerant; and presence of Douglas fir, in a landscape dominated by LPP forest, adds to species diversity. A diversity of species increases landscape resiliency in the event of epidemic level attacks by insects or disease. Douglas fir is a shade intolerant species and has been under attack by Douglas fir beetle and western spruce budworm. Many stands in the project area are heavily stocked and the Douglas fir component is being outcompeted by more shade tolerant species. The proposed treatments are designed to favor Douglas fir forest furthering this goal. Douglas fir is present in forest stands in the vicinity of Horse Butte, Whits Lake, Red Canyon and Fir Ridge.

There is very little species diversity in the higher elevation reaches in the project area. A carpet of LPP tends to dominate the slopes allowing very little sun to reach the forest floor. The end result is little or no forage and a homogenous forest with little age or size diversity. Proposed treatments will create openings in homogenous forest conditions that will result in forage and age diversity moving the area toward conditions identified in the Forest Plan (II-21, 18).

Forest Structure

Forest structure (horizontal, vertical, snags, down woody material) will be affected by the proposed treatments. Intermediate harvests would modify existing forest structure primarily through density reduction. The treatment descriptions provide a range of the target residual stand density following treatment. Essentially, the number of trees that are currently growing within an area proposed for intermediate treatment will be reduced. By reducing the number of trees on a given area, the spacing between tree stems and crowns will be increased enhancing growth conditions.

Vertical structure will be affected through the selective removal of crown classes. When thinning from below lower crown classes (intermediate and suppressed) would be targeted for removal first. This will feature a more pronounced and defined single storied canopy comprised of dominant and codominant trees. Understory trees also appreciably add to the forest structure. In most situations some or all these trees will be cut to achieve fuel management and/or site preparation objectives. Often, these smaller understory trees act as ladder fuels which provide an opportunity for fire to move from the forest floor to the tree crowns. Understory trees or ladder fuels would be spaced between 10-15 feet apart or left in small clumps and then thinning or clumping would be spaced 10-20 feet apart to limit fire spread. As a result, some or all understory trees may be left in treatment areas to provide hiding cover and structural diversity if they are a desired species.

Some treatments (e.g. commercial thinning and precommercial thinning) are also expected to result in immediate larger average stand diameters. Typically, the suppressed and intermediate trees have smaller diameters than the dominant and codominant trees. By removing the smaller diameter trees, mathematical average stand diameters will increase. The exception to this would be in areas proposed for sanitation, improvement, corridor thinning, daylight, and some commercial thin treatments. This is because trees targeted for removal are not necessarily associated with any particular size or crown position. However, by removing a portion of the density, growing space will be made available to the remaining trees. Increased growing space and decreased competitive stress for nutrients, water, and sun light will result in improved, growth, vigor and resiliency to disturbance (Smith et al, 1997; Oliver and Larson, 1996). Much research has been conducted to explore this belief, considering variables such as species composition, age, and geographic location. When looking at the response of trees to partial cutting in western Montana, Schwalm and Milner (2002) found that height and diameter growth increased in residual trees of ponderosa pine, Douglas –fir, western larch, and LPP. Although sometimes small and negated by increased mortality following harvest, Dahms (1971) even saw positive growth responses in older LPP.

Regeneration treatments will replace the existing forest structure as opposed to intermediate modifications. Over time the seedlings will grow into saplings, then poles, then larger trees. These treatments would increase the diversity in age classes on the landscape which is heavily dominated by mature forest 78.7% see Table 8.

Standing dead trees (snags) and down woody material are important components of the overall forest structure. These elements are specifically important to wildlife habitat and nutrient cycling. The Forest Plan includes standards for retention of these elements in harvest units (FP, p. A-13). It should be noted that there is no landscape scale standard for this material. The discussion about existing mountain range

estimates is informational only but demonstrates that there is snag and coarse woody debris habitat across the landscape. The standard requires that approximately 30 snags per 10 acres plus replacement snags be left in harvest units if available. All proposed treatments would be designed to meet these standards (See Appendix A – Design Features common to Action Alternatives). Some snags may be felled to mitigate safety hazards during implementation in harvest units.

Insects and Diseases

The effects to forest insect and disease conditions associated with action alternatives will focus on the major insect and diseases observed within the analysis area. Tree damage (including windthrow, burn damage, and tree decay) associated with the proposed activities can affect the insect and disease conditions.

When stand density is reduced, residual trees can become more susceptible to windthrow. These effects can vary by tree species, tree size and age, residual stand density, and site. Some generalities can be made regarding the risk of damage associated with windthrow. Of the tree species likely to be reserved, Douglas-fir and WBP are considered to be more windfirm than Engelmann spruce, LPP, or subalpine fir primarily due to rooting habits (Burns and Honkala, 1990). Where high water tables or rocky soils exist, windthrow is more likely due to shallow rooting depths (Koch, 1996). As the intensity of tree removal increases stands often become more susceptible to wind damage.

Hamalainen (2010) found that on commercial thinning in larger sized LPP that 3.9% of the total number of trees inventoried in his study post treatment had damage resulting in mortality. He found that the higher risk for damage was found on wet soils than on dry soils and more damage was found in the taller trees. Larger trees grown under low densities or where their crowns have been exposed to winds are relatively windfirm.

The highest probability for windthrow associated with the action alternatives is with intermediate harvesting of LPP dominated stands and where regeneration harvests will create leeward edges where LPP dominates (Koch, 1996). Suggestions to mitigate windthrow associated with LPP have been offered by Koch (1996), Schmidt and Barger (1986), Gibson (2004) and Alexander (1975). This information will be considered and incorporated into detailed silvicultural prescriptions where feasible during implementation of this project (see Appendix A). However, based on the previous discussion wide spread wind throw is not expected.

Mountain Pine Beetle

The effects to MPB conditions associated with the action alternatives will primarily relate to susceptibility It should be noted that this project is not designed to attempt to alter MPB populations within or adjacent to the analysis area. Attempts at direct control of MPB numbers once an outbreak begins or over large spatial scales have proven largely ineffective (Amman and Logan, 1998; Black, 2005; Fettig et al., 2007 and 2014, and Egan et al., 2014). Population numbers appear to be dictated by the extent of suitable conditions, regardless of direct control efforts.

Susceptibility to attack from MPB will be affected by the action alternatives. Stand conditions which are ideal for MPB population growth include; large average pine diameters, high stand density (both basal area and trees per acre), the proportion of density that is susceptible pine, stand age, and elevation (Randall et al, 2011, Pederson, 2006 and Amman et al., 1977). Proposed silvicultural treatments will affect these attributes at varying levels. A substantial body of literature exists that supports silvicultural manipulation as an effective means of increasing resiliency, reducing stand susceptibility, and associated losses. Egan and others (2014), Fettig and others (2007 & 2014), Gibson (2004), Dix (2006), and Amman and Logan (1998) synthesize the literature which supports the effectiveness of silvicultural control of bark

beetles. Much of the research points to two silvicultural strategies which have shown promise, one at the landscape level and one at the stand level

At the landscape level, heterogeneity is thought to be more resistant and resilient to insect damage. Silvicultural treatments designed to create age, size, and species mosaics can increase landscape heterogeneity and disrupt the continuity of bark beetle food supply in time and space. Regeneration harvests promote landscape heterogeneity by creating new age classes and influencing species composition (Egan, 2014). All action alternatives include numerous types, amounts, and sizes of regeneration harvests as displayed in the following table.

Table 17: Regeneration type, acres, and patch sizes by alternative

Alternative	Clearcut		Seed Tree (Acres)		Overstory Removal (Acres)		Group Selection[1] (Acres)	
	Acres	# Openings (Patch Size Range)	Acres	# Openings (Patch Size Range)	Acres	# Openings (Patch Size Range)	Acres	# Openings (Patch Size Range)
No Action	0	N/A	0	N/A	0	N/A	0	N/A
Two	257	19(3-35ac)	149	8(5-34ac)	176	7(4-40ac)	209	105(1-3ac)
Three	200	14(3-35ac)	117	6(5-34ac)	176	7(4-40ac)	140	70(1-3ac)
Four	231	17(3-35ac)	117	6(5-34ac)	176	7(4-40ac)	154	77(1-3ac)

[1]Group selection acres only include 30% of unit acreage given that proposed activities will only convert ~30% of the unit to a new age class and also assumes an average opening size of 2 acres.

At the stand level, evidence suggests that partial harvesting (thinning) can be an effective deterrent to MPB infestation and associated losses. The specific reasons why these effects are seen in thinned stands is still uncertain but likely related to increased tree vigor and/or stand microenvironments less favorable to MPB.

Table 18: Stand level effects to MPB conditions by treatment.

Treatment Group	Stand Level Effects to MPB Conditions
Regeneration (Clearcut, Group Selection)	Regeneration treatments will inherently reduce stand susceptibility by removing all susceptible trees and establishing a new age class of trees. These areas would not exhibit conditions favorable to MPB for many years, even if host pines are the primary species regenerated.
Commercial Thin (Commercial Thinning)	Commercial thinning treatments will reduce stand susceptibility by affecting species composition, density, tree vigor, and stand microenvironments. Where MPB is a concern (e.g. presence of host species), proposed treatments will be designed to address stand hazard and create conditions less favorable for MPB. Commercial thinning treatments would reduce stand densities to 80 square feet of basal area or less and residual trees will be relatively evenly spaced. Egan (2014) summarizes multiple studies which suggest thinning in LP stands can be effective in reducing MPB- caused tree mortality. These studies indicate treatments that maintained 80-100 square feet or less per acre of basal area stocking or those that leave >=13 feet spacing between trees, can reduce MPB caused mortality. However, unthinned patches or leave strips within thinned areas can be colonized by MPB and contribute to tree mortality.

Sanitation (Sanitation Cut)	Although these treatments are primarily proposed to address LPDMT where MPB is of concern, they are expected to result in reduced MPB susceptibility by reducing host tree abundance and altering stand micro environments. The level of affected lodgepole pine removed will be determined by the intensity of LPDMT infections.
Corridor Thinning (Power line, Highway)	Corridor thinning treatments are designed to meet specific objectives; however they will have stand level effects relative to MPB. Where the first 50 feet of complete tree removal will have effects similar to Regeneration treatments and the remaining 50 feet would be similar to Commercial Thinning.
Non-Commercial Thin (Precommercial Thin, Post and Pole Thin)	Non-Commercial Thin treatments may have some direct stand level effects of reduced susceptibility as a result of density reduction; however these areas are dominated by trees less than commercial size (6" DBH) and younger, small-diameter trees <7" DBH are not quality hosts for MPB (Egan, 2014). Some longer term positive effects are possible if thinned stands maintain less favorable densities (80-100 ft^2 BA or less) as they grow to preferred size.
Aspen Enhancement (Improvement Cut)	Aspen Enhancements are not expected to result in effects to MPB conditions given that conifer removal to benefit aspen will almost exclusively involve Douglas-fir trees. In the event aspen is favored over host pine species, stand level susceptibility would be decreased.
WBP Enhancement (Overstory Removal, Seed Tree, Daylight)	Overstory removal and seed tree treatments will reduce stand susceptibility by removing nearly all non-WBP overstory trees and establishing a new age class of trees. Overstory WBP retained will have densities lower than those identified in commercial thinning treatments and thus reduced MPB susceptibility. These areas would not exhibit conditions favorable to MPB for many years, even if host pines (WBP and LP) are the primary species regenerated. Daylight treatments are a focused WBP enhancement that aims to increase resiliency (including to MPB) of WBP. Entomologists suggest this since any vegetation that provides shade or interferes with air movement through a stand increases the stands susceptibility (Sturdevant, 2010). A study of daylighting in Montana suggests that daylighted WBP trees had less MPB-caused tree mortality than no treatment (controls) (Sturdevant et al., 2015). Temporal effects are expected to be similar to Non-Commercial Thinning since proposed Daylight treatments are in stands dominated by trees less than 6" DBH.

Douglas-fir Beetle

Similar to MPB, the discussion of effects of the proposed actions to DFB will center on susceptibility. Much of the bark beetle literature and synthesis of current science regarding the effect of silvicultural manipulations cited previously also applies to DFB. Negron et al. (1999) found that stand basal area was the most significant indicator of mortality during a DFB outbreak. A report from the project area by Jackson and Egan (2013) states that thinning would increase growing space surrounding Douglas-fir and enhance resilience to DFB-attack especially where stocking levels can be reduced to less than 80 ft2/ac of basal area (Randall et al., 2011).

Proposed treatments would affect stand conditions that have been linked to susceptibility including; the proportion, density, age, and size of Douglas-fir. It is possible to qualitatively discuss the effects of the proposed treatments to susceptibility by treatment type. Proposed commercial thinning, sanitation

cutting, power line and highway corridor thinning, improvement cutting and non-commercial treatments would all reduce stand density and alter species composition to varying degrees. If Douglas –fir trees are present and DFB is a concern, treatments would include prescriptive parameters following suggestions in relevant literature aimed at reducing stand susceptibility. Regeneration harvests are not proposed in areas dominated by Douglas-fir however it is possible that Douglas-fir is a component of these areas. Regeneration harvests would lower stand susceptibility significantly since most/all trees would be removed. Although wide spread prescribed burning is not proposed, some burning of slash piles (landing and/or unit piles) may occur. If DFB population are present in the vicinity of burning it is possible that any fire injured Douglas-fir trees could attract DFB and create conditions favorable for population growth. Although this situation is possible, it is not expected to be an issue and would be evaluated on a unit by unit basis during the development detailed silvicultural prescriptions.

Western Spruce Budworm

Proposed activities associated with the three action alternatives will affect WSB conditions. Intermediate treatments (commercial thinning, sanitation cutting, power line and highway corridor thinning, improvement cutting and non-commercial treatments) are discussed below. Regeneration harvests are expected to significantly reduce WSB impacts as most/all host species would be removed.

In 2012 a forest entomologist and pathologist visited an area of the Custer Gallatin NF that is classified as a high budworm outbreak frequency area and was experiencing significant defoliation. In a report (Sturdevant and Jackson, 2012) from their visit they included potential effects to WSB from management actions. These effects are relevant to the North Hebgen action alternatives and include:

- Silvicultural recommendations for WSB have been to treat stands to promote tree vigor because fast growing vigorous trees do not provide favorable habitat for budworm as opposed to stressed trees and they are more likely to recover if defoliated. Also, thinning over time promotes individual tree vigor and increases mortality of budworm larvae during the dispersal period.
- Following severe defoliation on Flesher Pass near Helena Montana, private landowners within the drainage greatly reduced the stocking density of their stands through thinning and removing trees showing the greatest damage from budworm. Affected stands on forest service lands were not treated. In one area, average defoliation for trees in an un-thinned area was 83.5% compared to 41.9% for trees in a thinned area. Forty-two trees in the un-thinned unit had greater than 90% defoliation compared to 11 trees in the thinned unit. In general, trees in thinned units appeared greener and to be more vigorous than trees in un-thinned ones. (Bulaon and Sturdevant 2006).
- MacLauchlan and Brooks (2009) found that younger, thinned forests and those that were not selectively harvested in the past suffered the least damage from budworm over time. Intermediate-aged host stands can be thinned to improve stand vigor, reduce amount of host biomass, and increase mortality of dispersing larvae.
- Carlson and Wulf (1989) found that in an approximately 75 year old western Montana Douglas-fir stand, lowering density to about 200 to 300 trees per acre (leaving only the most vigorous trees) reduced percent defoliation and allowed affected trees to recover.
- Intraspecific genetic resistance to budworm feeding is evident in Douglas-fir stands across Montana and within a stand. Because of the heritability of resistance to feeding, improvement in stand conditions can be made by selecting trees for retention that show little damage from budworm feeding during an outbreak (Brooks *et al.* 1985).
- Thinning susceptible stands directly increases larval mortality as they disperse throughout the forest in search of suitable host material.

Further, during a visit to a stand within the project area on Horse Butte, Jackson and Egan (2013) note that thinning within the stand may enhance resilience to WSB and remove genetically susceptible Douglas-fir (Bauce and Fuentealba, 2013). They also suggest that the treatment is likely to retain unhealthy overstory vegetation in some locations that have a high degree of WSB-caused defoliation and are genetically susceptible to attack.

Lodgepole Pine Dwarf Mistletoe
The proposed actions would affect the spread, intensification, and impacts of LPDMT in both intermediate and regeneration treatments. The impacts of LPDMT can be effectively reduced through silvicultural treatments that emphasize the removal or killing of infected branches or trees (FHP, 2004). LPDMT is an obligate parasite and once host trees are killed (through cutting) the mistletoe will die. In general, all proposed treatments would prioritize the removal of infested lodgepole pine trees where LPDMT is present.

Regeneration harvests would reduce impacts most significantly due to intensity of tree removal. Clearcutting is suggested as the most effective means of controlling dwarf mistletoe (Hawksworth and Dooling, 1984) and is the primary proposed treatment in heavily infested stands within the project area. Group selection regeneration treatments are also proposed in areas of LPDMT infection. One to three acre group openings are proposed in these areas and studies suggest these smaller openings would result in ~30-35% volume reductions compared to uninfected stands (FHP, 2004). Dwarf mistletoe will generally spread and intensify more slowly in larger openings than smaller ones (Hoffman, 2004).

Intermediate treatments (commercial thinning, sanitation cutting, power line and highway corridor thinning, improvement cutting and non-commercial treatments) are proposed in areas where LPDMT exists and may have positive or negative effects to spread and intensification. Here again recommendations exist for reducing impacts and include removing trees in lower crown classes as they are more likely to be heavily infected, retaining trees with DMR<3, promoting single story stand structures, and favoring non-susceptible species (Dooling, 1976; Hawksworth and Dooling, 1984; Hawksworth et al., 1987; FHP, 2004). There are situations where retention of LPDMT infected trees are anticipated and which could result in increased spread and intensification; especially in portions of the project area where multi-story stand structures are common (lodgepole pine/bitterbrush habitat types). This is recognized and considered acceptable relative to other management objectives.

White Pine Blister Rust
The effects to white pine blister rust from the action alternatives will be somewhat limited; although some proposed treatments may have positive effects relative to impacts of white pine blister rust by retaining or planting genetically resistant trees.

Summary

Forest health and resiliency treatments are designed to maintain a diverse, vigorous, and adaptable forest landscape by providing for a mix of species composition, stand structures, and age distribution. For these stands, there are multiple objectives and the silvicultural prescriptions would be designed to integrate other primary project objectives while improving forest resiliency, stand health and to reduce long term loses. Consideration of forest health and resiliency improvements was focused in areas near other treatments where multiple project objectives could be met and areas that require limited investment for access.

Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis
Past, current, and reasonably foreseeable actions on all lands within the analysis area(s) were evaluated when considering the cumulative effects to forest vegetation associated with the action alternatives. The

activities which discernibly affect forest vegetation are identified in the cumulative effects worksheet (Konen 2015). Cumulative effects are discussed relative to the resource indicators and measures identified in Table 12 and will focus on present and reasonably foreseeable activities since past activities were incorporated and considered in the direct and indirect effects analysis as their effects established the baseline current conditions.

Aside for the proposed regeneration harvests, no current or reasonably foreseeable activities have been identified that would increase the youngest successional stage in the project area. As such there would be no combined effect.

Per the Forest Plan standard, the analysis area for old growth is the mountain range scale. The Forest Plan Standard and existing condition analysis are based on only old growth on Custer Gallatin National Forest Lands. Here again past actions and events have been considered in the existing condition analysis. Therefore, present and reasonably foreseeable activities on Custer Gallatin lands within the two previously discussed mountain ranges provide the opportunities for cumulative effects to old growth. Within the Madison Mountain range there are no currently or reasonably foreseeable vegetation management projects that would affect old growth on Custer Gallatin National Forest Lands. Some incidental tree removal is possible but is not expected to affect old growth at the stand level. Within the Henry Mountain Range there would be no direct or indirect effects associated with the North Hebgen Project (given project design features) thus no cumulative effects are possible.

Per the Forest Plan standard, the analysis area for over-mature forest structure is the MA13 lands within timber compartments. Aside for the proposed actions, no current or reasonably foreseeable activities have been identified that would further affect over-mature forest structure (at the stand level) within the timber compartments containing MA13. As such there would be no combined effect.

Aside for the proposed actions, the only current or reasonably foreseeable activities that have been identified that would affect the trees species within the analysis area is limited to willow enhancement work. This work is limited to 58 acres where conifer tree species would be removed from willow stands. These treatments are not expected to change the classification of an area from conifer to willow as they are currently willow dominated. As such the cumulative effects would be insignificant.

Aside for the proposed actions, the only current or reasonably foreseeable activities that have been identified that would affect forest structure within the analysis area is limited to firewood gathering. This activity would reduce snag numbers as dead trees are harvested for firewood and is expected to be minimal as it is restricted to areas accessible by open roads where firewood gathering has been ongoing and most dead trees have been available for removal. As such the cumulative effects would be insignificant. Aside for the proposed actions, no current or reasonably foreseeable activities have been identified that would further affect insect and disease conditions or successional stages within the analysis area. As such there are no additive cumulative effects.

Conclusion

The effects vary between alternative and indicators with both beneficial and non-beneficial effects. All effects, given identified design features, are consistent with Forest Plan standards and guidelines. In addition, the action alternatives are consistent with Forest Plan management direction both Forest-wide and for each Management Area and address the project purpose and need. In addition, each action alternative may vary relatively in the degree that some direction is met (i.e. based on the number of acres treated). All applicable standards are explicitly addressed in the specialist report. The findings of the cumulative effects analysis conclude that all past, current, and reasonably foreseeable activities within the analysis area(s) in conjunction with project activities would not have an additive cumulative effect beyond the direct and indirect effects discussed. Although some current and reasonably foreseeable

activities would affect forest vegetation; they were not of sufficient magnitude to create noticeable changes, negative trends, or threats to the overall forest vegetation resource.

Alternative 1 – No Action

In the absence of large scale disturbance, this alternative is expected to maintain current successional stage distribution where the mature successional stage dominates at ~79% of the analysis area. This alternative does little to promote vegetative diversity of age and trees size (Forest Plan and resiliency objectives). Old growth and over-mature forest structure levels are not affected.

Both vertical and horizontal structure is generally expected to reflect existing conditions under the no action alternative, with some incremental changes expected including increased densities and multiple canopy layers. In general these conditions are not consistent with project purpose and need of fuels reduction, resiliency, and insect and disease conditions.

The effects to species composition associated with this alternative include continued dominance by LPP and Douglas-fir, potential increases in shade tolerant species in some areas over time, potential decreases in shade intolerant species in some areas overtime, and impacts to species susceptible to observed insect and disease agents. No management emphasizing whitebark pine or aspen would occur.

Given calculated hazard ratings, loss predictions, observed insects and diseases, species composition, and suggested population dynamics; continued susceptibility and mortality is expected under the no action alternative. As a result, this alternative does not address the purpose and need related to forest health concerns and resiliency. The alternative also falls short of some forest plan direction related to managing insect and disease losses.

Alternative 2, 3, and 4

Insects and Diseases

Each action alternative addresses the major insect and diseases identified in the project area and are consistent with the project purpose and need and Forest Plan direction. Treatments have been designed to reduce susceptibility and/or modify stand and landscape conditions. When comparing the degree to which each alternative meets objectives, acres treated is the relative measure used. Alternative 2 best addresses insect and disease conditions with 5,894 acres treated, followed by Alternative 4 at 5,345 acres and Alternative 3 treats 4,832 acres

Successional Stages

Each action alternative effects the successional stage distribution, Old Growth, and Over-mature Forest Structure within the analysis area. Regeneration treatments increase vegetative diversity in age classes (Forest Plan direction). Alternative 2 regenerates 791 acres, followed by Alternative 4 at 678 acres, and Alternative 3 at 633 acres. The Forest Plan old growth standard is met in all alternatives when a design feature is applied in the Henry Mountain Range. The MA13 Over-mature Forest Structure is also met in all alternatives when a design feature is applied in Timber Compartment 703 that limits treatment on 64 acres in Alternatives 2 and 4 and 12 acres in Alternative 3.

Tree Species

Each action alternative affects the tree species in the analysis area and addresses favoring desired species through treatment design. Whitebark pine enhancement is included in all alternatives with Alternative 2 at 1,168 acres of treatment, followed by Alternatives 3 and 4 at 1,136 acres of treatment. Aspen enhancement is also included in all alternatives with Alternative 2 at 752 acres of treatment, followed by Alternatives 4 at 471 and Alternative 3 at 242 acres of treatment. In all treatments desired species would be favored through selection for retention, removal, and/or regeneration. As a result, when comparing the

degree to which each alternative meets this objectives, acres treated is the relative measure used. Alternative 2 treats 5,894 acres, followed by Alternative 4 at 5,345 acres of treatment, and Alternative 3 at 4,832 acres.

Forest Structure

Each action alternative affects forest structure within treatment units. Treatments are designed to create resilient stand conditions in the face of insects, diseases, and fire. Here again, acres treated is the measure used to compare alternatives in light of this objective. Alternative 2 treats 5,894 acres, followed by Alternative 4 at 5,345 acres of treatment, and Alternative 3 at 4,832 acres. *Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans and Other Disclosures*

National Forest Management Act (NFMA)

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

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

- Meet the definition of forestland
- Technological feasibility exists to protect soil productivity and watershed protection. Forest plan standards, project design criteria, and applicable Best Management practices will be used to protect these resource values.
- There is reasonable assurance that lands can be restocked within five years of final harvest.
- None of the areas considered for harvest have been withdrawn from timber production

Where timber harvesting is proposed in Management Areas not classified as suitable within the Forest Plan, all treatments are in response to protecting multiple-use values or meeting resource objectives identified in the project purpose and need and/or the Forest Plan.

Maintenance of the Diversity of Plant and Animal Communities
Forest Plan goals, objectives, standards, and guidelines address maintaining a diversity of vegetation and habitats across the forest to meet a variety of wildlife species and to provide for sustained yield of timber products. In addition to applying this forest plan direction, project designs prescribed by the project wildlife biologist and silviculturist address plant and animal community needs.

Appropriateness of Even-Aged Management and Optimality of Clearcutting.
NFMA directs that clearcutting be used only where “it is determined to be the optimum method”. Other even aged methods can be used where “determined to be appropriate”. Clearcutting is proposed on 200-257 acres depending on alternatives. All of these areas are dominated by lodgepole pine. Clearcutting was determined to be the optimum regeneration method for meeting management objectives for each of these areas by the project silviculturist. Criteria used to make this determination included; species composition relative to management direction and availability of desired species for seed sources, species susceptibility to observed insect agents, presence of disease infections which would be transmitted to the regenerated stand or where non-susceptible species conversion is necessary, and stands subject to wind throw if residual trees were retained. Other even aged methods are proposed as they are most compatible

with the disturbance regimes found in the analysis area and the adapted silvics and regeneration strategies of desired tree species. All regeneration harvest proposed create opening less than 40 acres in size.

NFMA Findings for Vegetation Manipulation
All proposals that involve vegetation manipulation of tree cover for any purpose must comply with the following requirements.

- Best suited to the multiple-use goals stated in the Forest Plan for the area with impact. All proposed treatments are consistent with multiple use Forest Plan direction and address the project purpose and need.
- Assure that the lands can be adequately restocked within 5 years. 3,352 acres of even-aged regeneration harvests have occurred since the 1960's in the analysis area. All of these acres have been certified in FACTS as stocked following harvest either through natural regeneration or planting. There are no indications that with appropriate planning proposed regeneration treatments could not be stocked within 5 years.
- Not chosen because they will give the greatest dollar return. Although timber harvest associated with this project will generate revenue, all treatments have been designed to meet project objectives not revenue generation.
- Be chosen after considering the effects on residual trees and adjacent stands.
- The effects to residual trees and adjacent stands were considered in the interdisciplinary development and the forest vegetation analysis of this project. Residual tree protection measures are included in the design features section of this report.
- Be selected to avoid permanent impairment of site productivity and to ensure conservation of soil and water resources. Appendix A includes design features common to action alternatives that ensure protection of soil and water resources. The Soils and Water resources section of the Environmental Assessment includes discussion related to potential impacts.
- Be selected to provide beneficial effects to water quality and quantity, wildlife and fish habitat, regeneration of desired tree species, forage production, recreation uses, aesthetic values, and other resource yields. Following Forest Plan and management area direction, an interdisciplinary team considered all of these resources in the context of the surrounding landscape and this project as documented in the Hebgen Duck Landscape Assessment (GNF 2013) and this Environmental Assessment.
- Be practical in terms of transportation and harvesting requirements and total costs of preparation, logging, and administration. Standard logging systems and log hauling is prescribed for this project and has been determined to be practical for this project and a sale feasibility analysis has been conducted.
- Prior to harvest, stands of trees throughout the National Forest System shall generally have reached the culmination of mean annual increment (MAI) of growth. This is the age at which average rate of annual tree growth stops increasing and begins to decline. Regeneration harvests included in my decision indicated serious declines in growth rate and were determined to have reached their culmination of MAI by the silviculturist. Iintermediate harvest also indicated that growth has slowed due to over stocking.

Summary
The alternatives move the vegetative condition in the project area toward the desired conditions identified in the purpose and need which achieve Forest Plan goals and standards. *Standards provide for vegetative*

*diversity in support of wildlife habitat needs and move the forest toward FP goals. T*he scope of potential impacts is limited to the treatment units and the surrounding area (project area) and as a result are fairly localized. There would be beneficial impacts of increasing forest resilience through increases in diversity of age, size and species composition, along with improved growing conditions for trees. There would be an increase in under-represented species including aspen, whitebark pine and Douglas fir. Old growth forest and over mature forest structure would be maintained at or above levels prescribed in the Gallatin Forest Plan (amended 2015) or unaffected. *From the stand point of successional stages, mature forest, which includes old growth and overmature forest structure, makes up about 78% of the Forest composition prior to treatment and about 76% post treatment. This shift begins to move the area closer to the historic conditions for the landsacape. At this time, the smallest size and youngest age class is underrepresented.* There would be incidental damage to individual trees and only a minimal amount of wind throw would be expected. There would be a reduction of snags and coarse woody debris (CWD) in harvest units but the Forest Plan standard for snag and CWD retention would be met ensuring adequate snags and CWD in the units where available *in the treatment units. On a landscape scale snag and corse woody debris remain plentiful.* The forest vegetation changes associated with the treatments represent changes that could occur naturally under natural disturbance conditions such as fire. The alternatives would improve forest vegetation conditions on a relatively local scale relative to the desired conditions identified in the purpose and need for action.

Grizzly Bear

This information is summarized from the North Hebgen *Wildlife Report* (Frost 2016, pp. 24-52). The Report is available on the Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific design features and resource protections related to Wildlife are listed in the description of alternatives and in Appendix A - Design Features Common to Action Alternatives.

Grizzly bear was listed as a threatened species under the ESA in 1975, mainly due to population declines caused by human activities resulting in mortality and displacement (Interagency Conservation Strategy Team 2007 pg. 39). Population recovery began in the 1980's, grew robustly in the 1990's, and has slowed since the early 2000's. The slowing of population growth is believed to be a density-dependent phenomenon, and may be indicating that grizzly bears are reaching some carrying capacity in the GYE (Interagency Grizzly Bear Study Team 2016 *and van Manen et al. 2015*). Grizzly bear was also identified in the Forest Plan (FP) Cleanup Amendment as a management indicator species (MIS) for threatened and endangered species (USDA Forest Service 2015a, pg. 31), MIS were identified in the FP as species groups whose habitat is most likely to be affected by Forest management activities and that will be monitored to determine population change. The Grizzly bear is proposed for delisting in the Greater Yellowstone Ecosystem. A decision is expected *in 2017*.

According to the GBCS, at minimum, grizzly bears need food, seasonal foraging habitat, denning habitat, and security in an area of sufficient size for survival. Because the project has the potential to affect the minimum survival requirements of grizzly bears (food, seasonal foraging habitat, denning habitat, and security), these were the resource indicators selected for this analysis.

The project is located within the Greater Yellowstone Ecosystem (GYE) Grizzly Bear Recovery Zone. The GYE Recovery Zone is divided into bear management units (BMUs) for habitat evaluation and population monitoring (USDI Fish and Wildlife Service 1993 pg. 17). BMUs are further subdivided into Bear Management Subunits (BMS) to allow better resolution of habitat measurement (Interagency Conservation Strategy Team 2007 pg. 17). BMUs approximate the lifetime size of a female's home range, while subunits approximate the annual home range of adult females (USDI Fish and Wildlife Service 2007c pg. 14870). Subunits provide the optimal scale for evaluation of seasonal feeding opportunities and

landscape patterns of food availability for grizzly bears (Weaver et al. 1986), as cited in (USDI Fish and Wildlife Service 2007c pg. 14870). The bear management units and subunits were identified to ensure that habitat for grizzly bears is well distributed across the recovery area (Interagency Conservation Strategy Team 2007 pg. 38). The project area lies within both the Madison #1 (145,847 acres) and Madison #2 (100,377 acres) BMSs, which, together, make up the Madison BMU (See Figure below). Because BMSs provide the optimal scale for evaluating seasonal feeding opportunities and landscape patterns of food availability, the spatial boundary for analyzing the effects to grizzly bear is the area that consists of the two BMSs that are intersected by the project area: the Madison 1 and Madison 2 BMSs. See Figure 18.

The term “project area” is used in a variety of documents relevant to the NHMRP. For the purposes of this Wildlife Specialist report, the “project area” refers to the largest area that has the potential to be directly affected by proposed treatments. Alternative 2 treatments encompass those proposed under Alternatives 3 and 4. For this reason, the “project area” refers to the area encompassed by the Alternative 2 unit boundaries, which then covers all areas affected by the other two action alternatives. See Alternative 2 Maps, Figure 12 and Figure 13 showing Alternative 2 treatment boundaries, which defines the “project area” for this analysis.

Affected Environment

In general, the entire analysis area provides suitable habitat for and is occupied by grizzly bears. The IGBST ran an analysis to estimate the presence of grizzly bears with home ranges that potentially overlap the project area (Landenburger et al. 2015). They concluded that the area is well-used by grizzly bears. Specifically, they stated that:

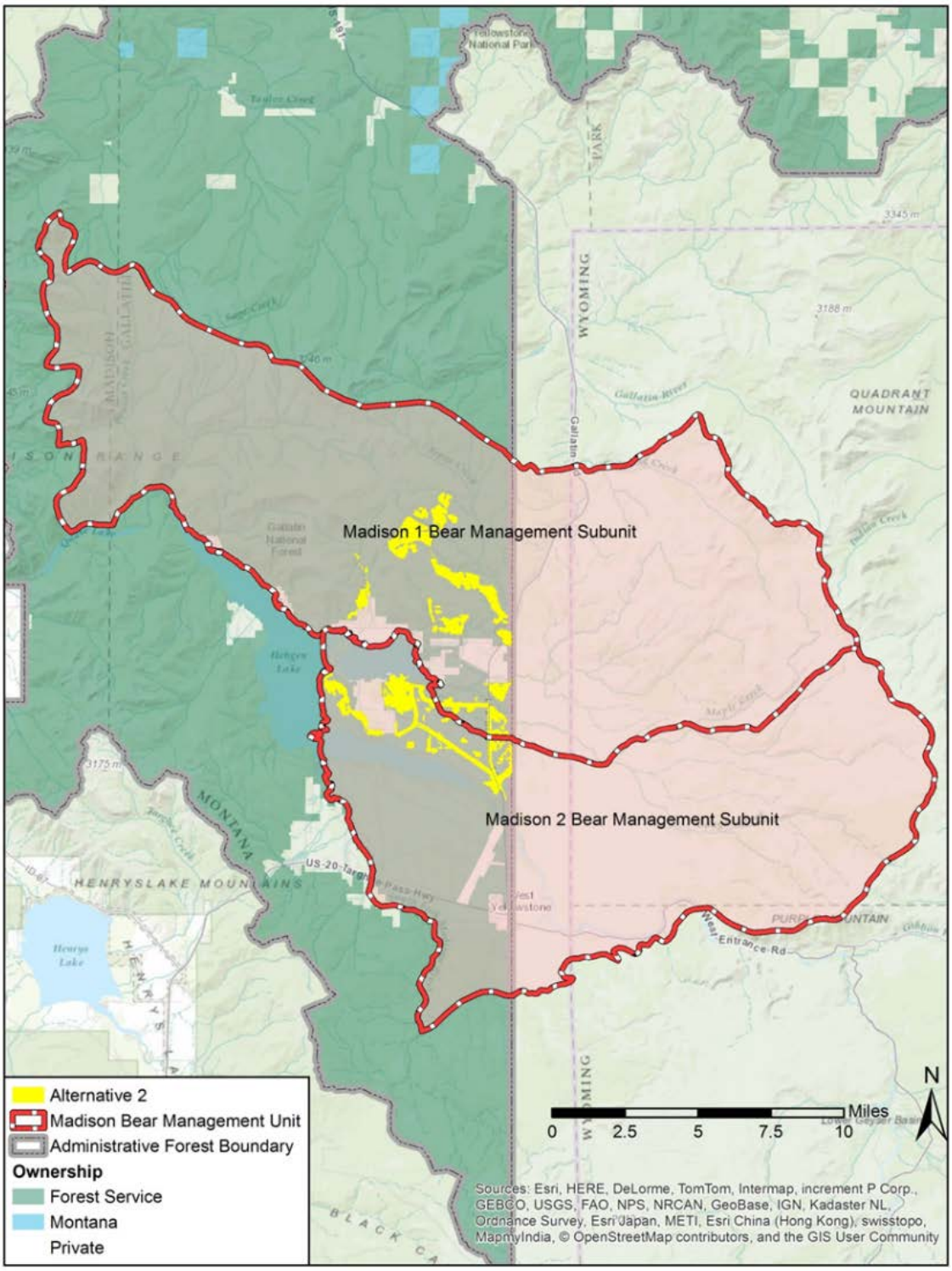
Viewed collectively, our combined locational data pertaining to grizzly bear occurrence in the vicinity of the proposed timber harvest units located on the Hebgen Ranger District indicate frequent, consistent, and long-term use of the area by all cohorts of grizzly bears.

Food and Seasonal Foraging Habitat Quality

Grizzly bears are opportunistic omnivores and will feed on almost any food available, which includes a wide variety of animals and plants (Schwartz et al. 2003 as cited in Van Manen et al. 2013 pg. 3; USDI Fish and Wildlife Service 2007c pg. 14867). Four food sources in the GYA have long been considered important to grizzly bear survival in the GYE (USDI Fish and Wildlife Service 2007c pg. 14867). These foods include army cutworm moths, native cutthroat trout, winter-killed ungulates, and whitebark pine (WBP) nuts. Army cutworm moths are utilized by bears primarily in the eastern portion of the GYE, and cutthroat trout are important primarily around Yellowstone Lake in Yellowstone National Park. Neither of these food items are, therefore, major food items for grizzly bears in the project area. Winter-killed ungulates and WBP nuts are important to grizzly bears in the northwestern portion of the ecosystem, where this project is located.

Despite the importance of meat and WBP to grizzly bears in the affected subunits, grizzly bears are omnivores that can utilize a wide variety of plants. Gunther et al. (2014) documented use of greater than 266 animal and plant species consumed by grizzly bears in the GYE. Areas that support a wide diversity of plant and animals species are likely to be preferred foraging areas for bears. Aspen and riparian areas are considered the most biologically diverse communities in the West. These areas, therefore, likely provide some of the most important foraging areas on the landscape for grizzly bears.

Figure 18. Madison grizzly bear management unit and subunit boundaries in relation to unit boundaries for Alternative 2.



Ungulate Displacement
Almost all of the project area lies within elk and moose winter range (Montana Department of Fish, Wildlife and Parks 2008a, Montana Department of Fish, Wildlife and Parks 2008b), with the exception of units on Tepee Creek Road that are only in elk winter range, units in the Flats that are only in moose winter range, and units at the end of Tepee Creek Road that are outside of both winter ranges. Grizzly bears rely on winter-killed ungulates throughout the project area for forage early in the spring when they emerge from their dens. Moose and elk are important food items across the project area, while bison are important prey items on the calving grounds on Horse Butte and the Flats and lower elevations across Hebgen Basin, especially in the spring.

Whitebark Pine
Whitebark pine (WBP) is present in the northern portion of Madison Subunit #1 at elevations above 8,000 feet. Whitebark pine nuts provide an important fall food source for grizzly bears during years of high cone production. As stated in Konen (2015), within the GYE, WBP communities have suffered large scale mortality due to a recent mountain pine beetle outbreak, wildfire, and, to a lesser extent, blister rust. Whitebark pine seeds (nuts) are high-energy foods rich in fats, carbohydrates, and protein, and are, thus, highly sought-after by grizzly bears *whose home ranges include this habitat* in the fall when bears are fattening up for the winter denning season. Grizzly bears are unable to obtain WBP nuts from the tree canopies in an efficient manner, however, and must rely on red squirrels to collect the nuts, split them open, and then concentrate them in ground middens. Grizzly bears can then efficiently "harvest" sufficient quantities of WBP nuts by raiding these red squirrel middens. Red squirrels do not inhabit pure WBP pine stands. This is because WBP cone production does not occur on a reliable or predictable basis. Red squirrels, instead, forage in mixed forest stands that include WBP pine, where forage opportunities are more reliable. Grizzly bears, therefore, also tend to forage in mixed stands because of their reliance upon red squirrels to obtain and concentrate the WBP pine nuts.

Aspen
Aspen stands are important to grizzly bears, because they provide increased foraging opportunities for both grizzly bears and their prey species. These communities are rich in insect and plant diversity, both of which contribute directly to the diet of grizzly bears. Ungulate species such as moose and elk rely heavily on young aspen shoots for forage, and aspen, therefore, contributes to the diet of important prey species. Aspen is scattered throughout the project area but is most notable on Horse Butte, in Red Canyon, along Whit's Lake Road, on Fir Ridge, and at the base of Tepee Creek Road. Field observations indicate that aspen sustainability in the project area is threatened by competition with encroaching conifers, primarily Douglas fir. This is true for all aspen stands, with the exception of at least two small stands on Fir Ridge. In that location, these stands appear to be limited by a combination of conifer encroachment and heavy browse, likely due to the importance of this area as a migration corridor for elk. These areas also tend to be heavily shaded by conifer trees, which suggests that these aspen may be unable to overcome limitations from the combination of shade and browse pressure. Stands in more open areas appear to be characterized by higher stem densities, taller plants, and less evidence of browse pressure.

Riparian Areas
Riparian areas, as with aspen stands, provide important food sources for grizzly bears due to their high diversity of plant and insect populations and the fact that prey species tend to rely on these areas as well. Riparian areas are often favored by bears as travel routes across the landscape, because they provide good forage opportunities in areas characterized by higher levels of hiding cover. Riparian areas in the vicinity of the project area are abundant and include ponds and wetlands in the upper Tepee Creek area; smaller, high-gradient alpine streams that connect with the larger tributaries of Hebgen Lake; and the shores and sloughs around Hebgen Lake, itself.

Forest Understory Vegetation
Berry producing shrubs such as grouse whortleberry, huckleberry, buffalo berry, and snowberry are scattered in the understory across most of the project area, with the exception of the lodgepole pine-dominated stands in the obsidian-sand flats between Horse Butte and Yellowstone National Park. Grizzly bears rely on the berries produced by these shrubs as an important food source. The obsidian sand flats support sagebrush and bitterbrush in the understory, which are not berry-producing and are not major food sources.

Denning Habitat
According to the IGBST suitable grizzly bear denning habitat model, the Madison #1 Subunit contains large portions of suitable denning habitat that overlap portions of the project area, while suitable denning habitat in the Madison #2 Subunit is limited almost entirely to portions of the Subunit in Yellowstone National Park (Podruzny 2002).

Grizzly Bear Security and Displacement/Mortality Risk
Grizzly bears avoid human activities and developments, preferring to forage in remote, undisturbed areas, less impacted by the influence of humans. Displacement is often associated with avoidance of roads, but grizzly bears are disturbed by the activities associated with those roads, not just the roads themselves. Roads, therefore, serve as a suitable metric for avoidance, but disturbance from human activities is also an important consideration, even when those activities take place in areas that are not roaded.

Research has shown that grizzly bears select habitat adjacent to motorized routes less frequently than areas farther from those routes, even when the motorized use on those routes is relatively low (Mattson et al. 1987, McLellan and Shackleton 1988, Aune and Kasworm 1989, Kasworm and Manley 1990, Mace and Manley 1993, and Mace et al. 1996, all as cited in USDI Fish and Wildlife Service 2007c pg. 33) or when the habitat quality along these routes is high (Aune and Stivers 1982 as cited in USDI Fish and Wildlife Service 2007c pg. 33). *Research also shows that while grizzly bear avoid open roads, they do not avoid roads used intermittently solely for forestry access (Wielgus and Vernier 2003, Wielgus et al. 2002).* If human-related disturbance is prolonged, grizzly bear use of an area may be lost for several generations, because females pass on the avoidance behavior to their cubs (Aune and Kasworm 1989 as cited in USDI Fish and Wildlife Service 2007c pg. 34).

Helicopter logging also has the potential to displace grizzly bears. In their *Guide to Effects Analysis of Helicopter Use in Grizzly Bear Habitat* (Montana/Northern Idaho Level I Terrestrial Biologists Team 2009), the authors reviewed key literature with respect to effects of aircraft on bears. They concluded that aircraft flying at low altitudes can elicit a response from grizzly bears. Effects may range from a simple awareness of the aircraft (i.e., raising the head but otherwise continuing uninhibited) to short-term disturbance of flight response (resulting in physiological changes such as increased stress and energetic demands) to temporary displacement from an area.

The importance of cover to grizzly bears has been documented in the scientific literature (USDI Fish and Wildlife Service 1993 pg. 7). Cover can influence selection of foraging habitats and bed locations (USDI Fish and Wildlife Service 1993 pg. 7, Serrouya et al. 2011) and can even increase foraging in areas that would otherwise be avoided because of their proximity to roads (Gibeau et al. 2002). The scientific literature does not provide specific definitions or thresholds for suitable or adequate amounts of cover for grizzly bears, but it is understood that timber management has the potential for reducing thermal, resting, and security cover for bears (USDI Fish and Wildlife Service 1993, pp. 7-8).

Roads negatively affect grizzly bears through displacement and increased mortality risk (Claar et al. 1999 pp. 7.24-7.25, USDI Fish and Wildlife Service 2007a pp. 31-36, Mace et al. 1996, Schwartz et al. 2010, Interagency Conservation Strategy Team 2007, Interagency Grizzly Bear Committee 1987). USFWS

provided an extensive review of the effects of motorized access on grizzly bears in the Biological Opinion (BO) on the GNF Travel Plan (USDI Fish and Wildlife Service 2007a pp. 31-36). Much of the pertinent information is summarized here, but, for the full analysis, please refer to that document, which is contained in the project record.

Roads have been shown to increase mortality risk to *individual* grizzly bears, either directly, through motor vehicle collisions and illegal shooting, or, indirectly, through habituation to human presence, which increases the potential for conflicts between humans and grizzly bears (USDI Fish and Wildlife Service 2007a pg. 31). Habituated grizzly bears tend to experience higher mortality rates, as they generally get removed from the population through management actions or are more vulnerable to illegal shootings because of their higher exposure to people (USDI Fish and Wildlife Service 2007a pg. 32). Schwartz et al. (2010) found that grizzly bear mortality was best explained by the level of human development of the landscape within the home ranges of bears. Survival improved as secure habitat and elevation increased but declined as road density, number of homes, and site developments increased. Their research strongly supported findings that roads and developed sites present hazards to grizzly bear survival. Amount of secure habitat and density of roads in non-secure habitat were determined to have the greatest effect on grizzly bear survival. Ungulate hunting was also found to negatively affect survival, with increased mortality associated with hunters defending a camp, carcass, or themselves when charged by a grizzly bear. An additional concern was increased mortality risk for grizzly bears in poor whitebark pine seed years, because grizzly bears tend to move to lower elevations in these years in search of forage, where the presence of human-related hazards increase. Due to the general scientific consensus regarding the effects of motorized access on grizzly bear survival, management of roads is considered to be one of the most important factors in grizzly bear habitat conservation (USDI Fish and Wildlife Service 2007a pg. 31; Interagency Conservation Strategy Team 2007 pp. 39, 43).

Access management guidance for grizzly bears was first produced in 1994 by the Interagency Grizzly Bear Committee (IGBC) Taskforce (Interagency Grizzly Bear Committee 1994). This guidance referred to management of core (now referred to as “secure”) habitat and road density measures (OMARD and TMARD). Secure habitat is defined in the GBCS as areas more than 500 meters from an open or gated motorized access route or reoccurring helicopter flight line that are greater than or equal to 10 acres in size (Interagency Conservation Strategy Team 2007 pg. 7). Secure habitat is reported as the proportion of a given BMS that meets this definition. OMARD was defined in the Taskforce Report as a measurement that includes open roads and open motorized trails where density is displayed as a percentage of an analysis area in a defined density category (Interagency Grizzly Bear Committee 1998 pg. 5, USDA Forest Service 1996 pg. 2). TMARD was defined as a measurement that includes open and restricted roads and motorized trails where density is displayed as a percentage of an analysis area in a defined density category. Specific guidance from this iteration of management direction has been updated.

The GBCS was finalized in 2003 and updated in 2007 *and 2016* (USDI Fish and Wildlife Service 2007c pg. 14873, ICST 2007, *ICST 2016 (Draft)*). This document was designed to provide adequate regulatory mechanisms after delisting and ensure long-term maintenance of the recovered population (USDI Fish and Wildlife Service 2007c pg. 14873). The GBCS *incorporates the best and most current scientific information* with respect to grizzly bear management. Upon its finalization, the Forest Service signed an MOU agreeing to implement all aspects of the GBCS to maintain and enhance the recovered status of the grizzly bear (Interagency Conservation Strategy Team 2007 pp. 12-13). The GBCS acknowledged that grizzly bear researchers and managers now generally agree that secure habitat is especially important to the survival and reproductive success of grizzly bears, especially adult female grizzly bears (Interagency Conservation Strategy Team 2007 pg. 43). In recognition of this, the GBCS contains recommended standards for threshold values of secure habitat but not for OMARD and TMARD. Rather, it

recommended that these access management values be monitored and reported annually (Interagency Conservation Strategy Team 2007 pg. 44).

In response to the updated science and management recommendations included in the GBCS, the GNF amended its FP in 2015 to replace the outdated language for grizzly bear management with this most current guidance as standards. FP standards now refer to nondiscretionary thresholds for secure habitat within BMSs, but there is no reference to thresholds for OMARD and/or TMARD. OMARD and TMARD can be useful in providing context for the analysis of effects to grizzly bears, but there are no requirements in the FP that refer to these measures. Because no public routes would be constructed, OMARD would not be affected, and this measure is not discussed any further in this document. *The access standard and application rules were maintained under the most recent GBCS revision (Draft, 2016).*

The GBCS recommended that habitat conditions for grizzly bears be managed at or above levels that existed in 1998 (Interagency Conservation Strategy Team 2007 pp. 7, 21), for all but three BMSs. This year was selected as a baseline for habitat management because all demographic recovery criteria for grizzly bear had been met by 1998 (Interagency Conservation Strategy Team 2007 pg. 39). In addition, the grizzly bear population had been increasing throughout the 1990's, and levels of secure habitat and the number and capacity of developed sites had changed little from 1988 to 1998 (Boyce, et al. 2001 as cited in Interagency Conservation Strategy Team 2007 pg. 21; USDI Fish and Wildlife Service 2007c pg. 14870, USDA Forest Service 2007 pg. 30). The GBCS recognized that three BMSs had the potential for improvement in the amount of grizzly bear secure habitat above 1998 levels, and it stated that the quantity and timing of improvement for these BMSs would be determined by the GNF Travel Plan, which would be followed by an amendment to the FP that would set a baseline for these BMSs (Interagency Conservation Strategy Team 2007, pg. 44). The Travel Plan did identify improvements required in these BMSs, and the Cleanup Amendment ensured that the levels of secure habitat according to full Travel Plan implementation in these BMSs are now the new baseline. One of these BMSs was the Madison #2, which would be affected by this project. For the Madison #2 BMS, baseline level of secure habitat is the level calculated for when the travel plan is fully implemented within that BMS. It is important to note that the concept of a "baseline" level is only true for secure habitat.

Table 19 shows baseline levels of secure habitat, 2014 levels (the most current year available), and the difference between these values for each of the BMSs affected by the project. Baseline for the Madison #1 BMS is the 1998 level, while baseline for the Madison #2 BMS is the level at full GNF Travel Plan implementation, as explained above. Secure habitat is reported as the proportion of the BMS that is secure. The amount of secure habitat in the Madison #1 BMS has increased 9.2% since 1998. The amount of secure habitat in the Madison #2 BMS is currently at baseline, which is the same as what is expected with full travel plan implementation and where "current" refers to the most recently available data which is for the year 2014. Under the travel plan a small number of road closures still need to occur but all of these pending closures are in areas that are already affected by other roads. As a result, the amount of secure habitat will not increase upon their closure.

Table 19: Baseline levels, 2014 levels, and the difference between these levels of secure habitat in each BMS affected by the project. 2014 levels are the most recent data available and were reported in the most recent Access Model run provided by the IGBST (Landenburger 2015).

BMS	Secure Habitat Baseline	Secure Habitat 2014 level	Difference Between Baseline and 2014
Madison #1	71.5%	80.7%	+9.2%
Madison #2	67.5%	67.5%	No change

Table 20 shows 1998 levels of TMARD, 2014 levels (the most current year available), and the difference between these values for each of the BMSs affected by the project. TMARD is defined and reported as the proportion of the subunit that exceeds 2 mi/mi^2. In both BMSs, TMARD has been reduced below 1998 levels.

Table 20: 1998 levels, 2014 levels, and the difference between these levels of TMARD in each BMS affected by the project. 2014 levels are the most recent data available and were reported in the most recent Access Model run provided by the IGBST (Landenburger 2015).

BMS	TMARD 1998 level	TMARD 2014 level	Difference Between 1998 and 2014
Madison #1	12.5%	7.5%	-5.0%
Madison #2	24.0%	21.6%	-2.4%

Direct and Indirect Effects and Cumulative Effects for Action Alternatives

Food and Seasonal Foraging Habitat Quality

Alternatives 2, 3, and 4

The project has the potential to affect grizzly bear food and seasonal foraging habitat quality. Resource indicators used to evaluate this potential consist of how the project will affect ungulate displacement, whitebark pine, aspen, riparian areas, and understory vegetation. This section discloses effects of the Alternatives 2, 3, and 4

Ungulate Displacement

Project activities would not lessen the presence or abundance of ungulate prey species across the analysis area, but the proposed activities could alter their distribution in the vicinity of the project area. Project activities would be expected to cause some disturbance and displacement of big game, but these effects would be limited to areas where treatments take place, and, because grizzly bears operate at such a large scale, bears would be able to adjust to alterations in big game distribution, and effects on grizzly bears would be minor. These effects would be expected with all action alternatives, with the greatest effect being associated with Alternative 2 and the least being associated with Alternative 3. Effects of Alternative 4 would be intermediate between the two.

Bison exhibit strong fidelity to their calving grounds in the spring. Bison may alter their travel patterns as the travel out of Yellowstone National Park and work their way to the calving grounds to avoid project activities, but they are still likely to travel along Horse Butte in order to get to the calving grounds. *Project design criteria would be implemented to reduce impacts to bison during migration out of the park,*

particularly during their spring migration to the calving grounds. Displacement would, therefore, be minimal, and any effect on grizzly bears would be minimal, as any resulting shift in foraging patterns would be temporary and at such a small scale for bears that it would be discountable.

Whitebark Pine

Treatment activities would be consistent with measures for protecting and restoring whitebark pine described by Keane and others (2012) and the Whitebark Pine Strategy for the Greater Yellowstone Area (GYCC 2011). Because grizzly bears forage for whitebark pine (WBP) nuts in mixed stands where red squirrels create their middens, treatments in mixed forest stands that are designed to enhance WBP pine have the potential to reduce the quality of grizzly bear foraging habitat in the short term. Overstory removal and seed tree treatments are designed to shift tree species dominance in these stands to WBP pine by removing competing conifer species. These treatments implement part of the WBP enhancement purpose identified for the project and in the long term improve grizzly bear foraging habitat. Overstory removal is intended to create a two-aged stand by removing the large trees (overstory) (except for cone-producing whitebark pine trees) and managing the understory. The understory would continue to be a mixed-species stand, so red squirrels may continue to forage in these stands, which would mean that there would be no effect on foraging quality for grizzly bears. As long as the mixed-species understory continues to produce cones on a reliable basis, red squirrels would continue to use the stand, and grizzly bears would be unaffected. The seed tree treatments could temporarily displace red squirrels to adjacent forest in eight different units (149 acres) ranging in size from 5 acres to 35 acres. The units are small and adjacent forest cover is extensive. These treatments would have little effect on squirrels and bears feeding on squirrels due to the fact that this is a relatively small portion of the area. Alternatives 3 and 4 would have two fewer seed tree units (32 acres). Daylight treatments would favor WBP pine, but these treatments would only occur in the vicinity of WBP pine trees, so, overall, residual stand composition would remain the same, and red squirrel use would not be affected.

Removing overstory competition and releasing small diameter whitebark pine, which do not grow well under full shade, will allow trees to add volume to their crowns and ultimately become good seed producers (Keane et al. 2012). Removal of competing overstory would also create conditions that would promote larger trees that produce more cones. This would enhance the potential for WBP to continue to persist as a component of the ecological communities in the analysis area, and, ultimately, this would present a long-term benefit to grizzly bears *utilizing this food resource.* Whitebark pine would be enhanced with all action alternatives. Table 16 lists the number of acres of WBP pine proposed for enhancement under each alternative. Alternative 2 would result in 1,129 acres enhanced, while Alternative 3 and 4 would result in 1,002 acres enhanced.

Aspen

Aspen enhancements would benefit grizzly bears by enhancing foraging opportunities for individual bears and their prey species, such as moose and elk. *The proposed treatments would reverse past declines in this habitat type resulting from competition with conifers and other factors, provide for a mosaic of habitat types and species compositions that promote high quality grizzly bear habitat, and provide for the persistence of this species in treated stands.* As shown in Table 16, Alternative 2 would result in the 701 acres of aspen enhanced and, therefore, have the biggest benefit to grizzly bears, whereas Alternative 3 would result in the least acres(192) aspen enhanced, thus, still benefitting grizzly bears but to a lesser amount. Alternative 4 would result in the enhancement of 372 acres of aspen.

Riparian Areas

Riparian areas would be protected through project design and development of mitigation measures that would be applied during implementation. Treatments were reduced, altered, or eliminated, in Alternatives 2-4 from the Scoping alternative, to avoid impacts to riparian areas. Riparian areas that fall within

treatment boundaries would be protected with the application of streamside protections, which restrict the types of activities within a designated distance from streams, lakes, and wetlands. See Appendix A for water quality, riparian, and aquatic habitat design features and mitigation measures. These design features and mitigation measures would protect riparian habitats for grizzly bear, and the project would have no direct or indirect effects on grizzly bear foraging opportunities around riparian areas.

Forest Understory Vegetation

Research indicates that tree removal for thinning or timber harvest and prescribed burning can result in localized increases in bear foods through increased growth of grasses, forbs, and berry-producing shrubs (Zager et al. 1983). Increased grass, forb, and shrub production would occur under all action alternatives in areas where the forest canopy is opened enough to stimulate growth of understory production. The proposed activities would damage individual plants and shrubs, but there would be an overall net gain of understory vegetation. The amount and diversity of understory production would vary depending on the site potential. Alternative 2 would have the greatest effect, because it would result in treatment of the largest area across the landscape. It follows that Alternative 3 would have the least effect, and Alternative 4 would be intermediate between the two.

Denning Habitat for Alternatives 2, 3, and 4

Most of the suitable denning habitat affected by the action alternatives would be north of Hebgen Lake, where more secure denning habitat is available across the Madison #1 BMS. Although not all treatments are expected to temporarily convert suitable denning habitat to unsuitable denning habitat, some treatments would have more of an effect than others. The forested stands suitable for denning and proposed for regeneration harvest (some of the whitebark pine enhancement treatments) would temporarily no longer provide denning habitat due to loss of cover. Some units proposed for intermediate treatments (Commercial thin and improvement cuts) would temporarily not be considered suitable for denning, also due to loss of cover. Alternative 2 would affect the most denning habitat across the analysis area by loss of cover from harvest. This alternative would result in 2,445 acres (2%) of the available denning habitat in the Madison #1 BMS being treated and 107 (less than 1%) of the available acres in the Madison #2 BMS being treated. Alternative 3 would affect the least amount of denning habitat. Under this alternative, a total of 2,211 acres (2%) in the Madison #1 BMS and 42 acres (less than 1%) in the Madison #2 BMS would be affected. Alternative 4 would affect 2,352 acres (2%) in the Madison #1 BMS and 91 acres (less than 1%) in the Madison #2 BMS. Any temporary reduction in denning habitat would be negligible when considered relative to the scale of the subunit and availability of suitable denning habitat in the immediate vicinity of proposed treatments.

Regular human use of an area in the winter time in areas otherwise suitable for denning may cause bears to avoid or abandon den sites (Linnell et al. 2000). Winter logging has some risk, then, of reducing denning opportunities even where habitat is suitable, if activities occur early enough in the season, when grizzly bears are selecting a den location. *These potential impacts would be limited in time and space, as the majority of denning habitat that would be affected lies in the Tepee Creek area, which would not be harvested in the winter. The remainder of affected denning habitat is situated at lower elevations. Given the amount of denning habitat available in the BMSs and design measures that would restrict winter activities in certain areas, these impacts would be unlikely to occur.*

Grizzly Bear Security and Displacement/Mortality Risk

Resource indicators used to evaluate effects of the project on grizzly bear security and displacement/mortality risk consist of change in grizzly bear secure habitat below baseline levels and change in TMARD as compared to 1998 levels.

Alternatives 2, 3, and 4

Approximately 21 miles of temporary roads would be constructed under Alternative 2. Some project routes would be constructed in areas that are already considered non-secure, while others would temporarily create additional areas of non-secure habitat.

During implementation, Alternative 2 would temporarily affect 1.3% of the secure habitat currently present within the Madison #1 Subunit. The amount of unaffected secure habitat would still be 7.9% higher than baseline level of secure habitat for the subunit. Therefore, the current level of secure habitat would decrease, but levels would still be above baseline. In the Madison #2 subunit, Alternative 2 would temporarily affect 0.9% of the secure habitat within the subunit. Because the Madison #2 BMS is currently at baseline, that means this would also temporarily affect 0.9% secure habitat within the subunit below the baseline level.

Approximately 12 miles of temporary roads would be constructed under Alternative 3. Alternative 3 would affect 0.7% of the secure habitat currently present within the Madison #1 Subunit. This amount would be 8.5% higher than baseline level of secure habitat for the subunit. The effect of project routes on secure habitat in the Madison #2 BMS is so small that it does not change the proportion of the BMS that is secure, so, quantitatively, there is no change in secure habitat..

Approximately 17 miles of temporary roads would be constructed under Alternative 4. Alternative 4 would result in a temporary reduction of 0.8% of the secure habitat currently present within the Madison #1 Subunit. This amount would be 8.4% higher than baseline level of secure habitat for the subunit. In the Madison #2 Subunit, Alternative 4 would temporarily affect 0.3% of the secure habitat within the subunit and below baseline. Effects of Alternative 4 on secure habitat are intermediate between the other two action alternatives.

In order to minimize the effects on grizzly bears that could occur by affecting secure habitat below baseline, the GBCS included a standard and associated application rules for habitat management with respect to secure habitat. The GBCS standard allows for temporary reductions in secure habitat below baseline for individual BMSs, as long as a series of application rules are followed. This standard and associated application rules were incorporated into the GNF FP as part of the 2015 Cleanup Amendment (USDA Forest Service 2015a). This language requires that only one project affecting secure habitat below baseline may be active within any BMS at any one time. Under Alternative 2 and 4, secure habitat would be temporarily affected below baseline in Subunit #2. No other projects would affect secure habitat below baseline in this BMS for the length of the project. In addition, as required by the application rules, all roads associated with the project that would impact secure habitat in Subunit #2 would be in place, collectively, for no more than three consecutive years, and roads would be decommissioned such that secure habitat would be restored within one year after road closure. Finally, the application rules require that the total acreage of affected secure habitat below baseline must not exceed 1% of the acreage in the largest subunit within the BMU. The largest subunit in the Madison BMU is Subunit #1, which is 145,847 acres in size. For alternative 2, the amount of secure habitat affected in Subunit #2 below baseline would total 862 acres, which is 0.6% of Subunit #1. Under Alternative 4, the amount of affected secure habitat in Subunit #2 below baseline would total 271 acres, which is 0.2% of Subunit #1. The amount of affected secure habitat in Subunit #2 below baseline is, therefore, less than 1% and within the tolerance allowed by the GBCS and FP standard in both Alternatives.

In both subunits, effects on secure habitat would be in compliance with the FP and the GCBS. Such small changes in secure habitat may have localized effects on individual grizzly bears but grizzly bears would be expected to easily adapt to those changes, and effects on grizzly bears are likely to be minor, especially at the scale of the BMS.

Because secure habitat would not be affected below baseline in either subunit under Alternative 3, the GBCS standard would be met and the application rules used as mitigation in Alternative 2 would not apply.

For all alternatives, public motorized use of project routes would be effectively restricted during project implementation, and project routes would be effectively closed to all motorized use after project completion. As a result, all alternatives would temporarily increase the density of administrative routes but would not affect the density of routes open to the public. All action alternatives would, therefore, have the potential to increase TMARD. Most project routes, regardless of alternative, would be constructed in areas where TMARD already exceeds 2 mi/mi^2, and would, therefore, in most cases, not affect the measure. See Table 21 for changes to TMARD by Alternative.

Table 21. Effects of the action alternatives on TMARD in the Madison Subunits during implementation and comparison of these values with 1998 levels for each subunit, and current conditions (as of 2014) for each subunit. 1998 and current values were reported in the most recent Access Model run provided to the CGNF (Landenburger 2015). Results for the model runs for project alternatives are in the project record.

Sub-unit	Measure[1]	1998	2014[2]	Alternative 2		
				Implementation[3]	Difference from 1998	Difference from 2014
1	TMARD	12.5%	7.5%	9.6%	-2.9%	+2.1%
2	TMARD	24.0%	21.6%	22.4%	-1.6%	+0.8%
				Alternative 3		
				9.1%	-3.4%	+1.6%
				21.8%	-2.2%	0.2%
				Alternative 4		
				9.3%	-3.2%	+1.8%
				22.1%	-1.9%	+0.5%

Notes:
1. TMARD is reported as the proportion of the subunit that exceeds a total road density of 2 mi/mi2.
2. 2014 is the most recent year for which data are available.
3. Values refer to those during implementation. Values would return to current condition at project completion.

To summarize, the project would have no effect on OMARD and would result in small increases in TMARD. In all cases, TMARD would still be below 1998 levels. These small increases in TMARD may result in displacement of grizzly bears from areas where road densities increase, and bears may retreat to less disturbed areas across the subunits during project implementation. Effects would be greatest with Alternative 2 and least with Alternative 3. Effects of Alternative 4 would be intermediate between the two. In all cases, these small changes in TMARD may have localized effects on individual grizzly bears but grizzly bears would be expected to easily adapt to those changes, and effects on grizzly bears are likely to be minor, especially at the scale of the BMS. *This conclusion is based on input of experts (van Manen, personnel communication 2016) and the scale at which disturbance is expected to occur.*

Disturbance associated with project activities throughout the proposed treatment areas *could result in bears moving to adjacent areas in the subunits with less disturbance while implementation is occurring.* The IGBST has established that the project area is located within the home range of a substantial number of grizzly bears and that the project area has long been used frequently and consistently by all cohorts of grizzly bears (Landenburger et al. 2015). Because grizzly bears inhabit the entire project area, and the

area proposed for treatment under Alternative 2 is the largest in size, Alternative 2 has the potential to cause the greatest amount of displacement among the alternatives. Alternative 2 would require construction of more temporary roads than the other action alternatives and would be associated with the highest amount of project activities and likely take the longest to implement. Alternative 3 has the potential to cause the least amount of *disturbance* among the action alternatives, because it would involve the least amount of treatments and associated roads, while the effects of Alternative 4 would be intermediate between the two. The amount of displacement would vary across the project area, depending on the timing, extent, and type of treatment. Based on typical operations, it is not likely that commercial operations would be conducted over large areas all at once, and operations would, therefore, likely to be conducted in isolated portions of the project area in the shortest timeframe possible, before operations would be moved on to other areas. Displacement would, therefore, be limited in extent at any one time. *It would also be temporary; once activities were completed and associated disturbance ends, bears would utilize these areas.*

Commercial harvest requires more machinery, equipment, and personnel than hand crews and is likely to cause bears to leave the area more quickly, travel further, and stay away longer while it is taking place because of the increased noise and number of people. Hand treatments involve less machinery, equipment, and noise, which would reduce their effect on displacement in comparison to commercial harvest. Alternative 2, which would have the greatest amount of commercial treatment and least amount of hand treatments would have the greatest effect on grizzly bears in this regard, while Alternative 3 would reduce this impact. Alternative 4 would have an intermediate effect.

Under Alternative 2, helicopter logging would occur in Units 127, 201, 218, and 219. This activity has the potential to displace grizzly bears and would affect 433 acres of secure habitat in the Madison #1 BMS. Effects from helicopter use in Units 127, 218, and 219 on bears might be fairly minimal, as these units are close to Highway 287, and grizzly bears that occupy those units may already be accustomed to some level of loud noise and more frequent exposure to human activities. Grizzly bears that occupy the area within Unit 201 would likely be more surprised by and less tolerant of helicopter use, as that area is more remote. Helicopter logging would take about 4-6 days to complete, so effects would be very temporary in nature. Secure habitat is directly adjacent to Unit 201 so displaced bears would have secure areas to retreat to.

While displacement may occur as a result of proposed treatments, grizzly bears operate at a landscape level in the GYE. *Given the temporary nature of silvicultural projects, bears can accommodate this at the project level, even at higher densities, by adjusting their spatial and/or temporal use patterns within their home range (van Manen 2016, personnel communication). Grizzly space use is very fluid and dynamic; there is a high degree of overlap among home ranges.The dietary plasticity of the grizzly bear allows it to occupy diverse habitats over large spatial scales and to cope with perturbations in the abundance of food (Gunther et al. 2014 pg. 69). Research suggests that in response to food availability grizzly bear will shift their use to other available forage items within their home range (Costello et al. 2014).* Suitable alternate habitats are widely available in the immediate vicinity of treatment units located in the Madison #1 Subunit and effects of all action alternatives on grizzly bears in the Madison #1 Subunit are likely to be minor.

In the Madison Subunit #2, however, alternate foraging habitat in the immediate vicinity of proposed treatments is more limited than in Subunit #1. Bears displaced by treatments in the Flats and on Horse Butte would be forced to relocate further to avoid project activities and find secure habitat. The closest areas providing secure habitat include areas to the South in the Madison Arm Flats, areas to the East in Yellowstone National Park, and areas to the North beyond Whits Lakes. Some of the proposed activities around the Rainbow Point Campground and on Horse Butte could occur in the winter months (as required

or encouraged by project design features for Units 94, 100 and encouraged for units that are accessed from Rainbow Point Road and FSR 695 to the campground), when grizzly bears are denning at higher elevations in more remote locations, and this would minimize impacts on grizzly bears. Den emergence can begin in February in the GYE, however, with most males out of dens by the fourth week of April. Winter logging can, therefore, minimize effects but not eliminate them, especially if it continues into April. In addition, Horse Butte is an important spring feeding ground for grizzly bears in the Hebgen Basin, so logging in the area during the spring months may displace them from a reliable foraging area during an important time of the year. Mitigation measures for bald eagle nests on Horse Butte will limit the amount of logging activity that could occur in this area in the winter and spring and would, thus, minimize effects on grizzly bears.

Winter logging in other areas would also reduce *disturbance* of grizzly bears by maximizing activities when bears are likely to be denning. For Alternatives 2 and 4, logging on Fir Ridge (Units 147-149) could occur in the winter. (Under Alternative 3, no harvest would occur in Unit 147 on Fir Ridge). Winter logging would be encouraged in the Whits Lake Road and Trailhead parking area and in the Red Canyon area, which would minimize displacement of grizzly bears from those areas, if it were to occur.

To reduce displacement of grizzly bears from important riparian areas along Cougar and Duck Creeks and the south shore of the Grayling Arm of Hebgen Lake, treatments in all action alternatives were either eliminated, reduced, or designed to specifically retain cover in these areas. In some cases, several treatment units were dropped altogether from all alternatives in order to leave a protective buffer along these areas. Some units were retained, but treatments within those units were designed to retain hiding cover (as defined for elk in the FP) *for potential prey.* Some treatment units along the riparian area would be treated using group selection, meaning that treatment would occur in no more than 30% of the unit, and existing forested vegetation would be retained in about 70% of the unit. *While short-term disturbance of grizzly bear would occur during implementation to some degree (dependent on site factors such as screening vegetation, distance to roads, and type of treatment that occurs), these areas would be used immediately once the sights and sounds of implementation cease.*

In many cases, treatments in the project were designed to alter existing forest structure and species composition. Forested cover would be reduced with all action alternatives in both subunits, but forested cover is also abundant in both subunits. Because grizzly bears operate at the landscape level, changes in forested cover at the stand level would not be expected to have a notable effect on their behavior when considered across the subunits. On a local level, however, changes in cover are likely to have an effect on individual grizzly bears in some portions of the project area. Grizzly bears that have traditionally used Horse Butte and/or the area south of Rainbow Point Campground to take refuge between foraging attempts at the bison calving grounds may be displaced to areas on the peninsula further to the East, due to reductions in cover. Effects would be slightly more in Alternative 2 and least with Alternative 3, due to the more expansive treatments proposed with Alternative 2. Alternative 4 would be intermediate between the two alternatives. Across the subunits, effects of these changes in cover would be negligible, because these reductions in cover would be at such a small scale, and bears would be able to alter their habitat use with respect to available habitats across the BMSs.

Because increased access has been shown to increase mortality risk to grizzly bears, the reduction in secure habitat and increase in TMARD under all action alternatives indicates that the project has the potential to increase mortality risk to *individual* grizzly bears. Increased human presence in the project area increases the potential for conflicts between humans and grizzly bears. Alternative 2 has the greatest potential for increasing mortality risk among all alternatives because it is the most widespread of the alternatives, would result in the highest number of temporary roads on the landscape, and would create the highest likelihood of incidents between bears and humans. Alternative 3 would affect the least amount

of secure habitat and would result in the smallest changes in TMARD. It is the least widespread of the alternatives and would result in the least number of temporary roads on the landscape. Alternative 3, thus, has the least potential for increasing mortality risk from increased access among the action alternatives. Alternative 4 is intermediate in effects between the other two action alternatives. Use of project roads would be restricted to administrative access, only, and the food storage order would be implemented and enforced, so the risk of *conflicts* would be minimized. In addition, disturbance from project activities would move bears away from the area, so the risk of a surprise encounter would also be reduced.

Treatments around Rainbow Point Campground in Unit 100 were designed to reduce the likelihood of negative grizzly bear encounters with humans. By thinning the vegetation around the campground and reducing cover in the understory, hiding cover for grizzly bears would be reduced and sight distances from the campground would be increased, which will, in turn, reduce the likelihood of a surprise encounter between bears and humans. This effect would be common to all alternatives.

Ongoing recreational use of decommissioned roads, especially by ungulate hunters, could have a longer-term effect on increased mortality risk for grizzly bears. This use would be non-motorized. Because ungulate hunting has been found to negatively affect grizzly bear survival (Schwartz et al. 2010), this longer-term increased access for hunters may result in more negative encounters with grizzly bears over time. This would be true for all action alternatives. Alternative 2 would have the greatest effect of the action alternatives, because the highest amount of project roads would be constructed under this alternative. Alternative 3 would have the least effect, and Alternative 4 would be intermediate in effect.

For all alternatives, a 25 mph speed limit on Tepee Creek road would reduce the potential for vehicle collisions between logging traffic and grizzly bears in that area. The CGNF food storage order would also be implemented and enforced with all alternatives to minimize the likelihood that bears would get conditioned to human foods as a result of project activities and increased human presence.

Cumulative Effects of the Action Alternatives

Food and Seasonal Foraging Habitat Quality

Past and current actions that have affected grizzly bear food and seasonal foraging habitat include timber harvest on public land, willow enhancement treatments to improve riparian areas, wildfires *(including the 2016 Maple and Boundary Fires)*, prescribed burns, noxious weed control, and bison management. Whitebark pine stands have been reduced due to the combined effects of insect and disease and fire suppression, which has reduced forage opportunities across the subunits. *The Maple Fire burned portions of both affected subunits in Yellowstone National Park in 2016. The fire created or enhanced habitat heterogeneity and will improve forage for potential prey.*

Within the analysis area, the Forest Service anticipates implementing another timber harvest in 2016 in the Rendezvous Trails area south of the town of West Yellowstone. Wildfires are expected to also occur into the future. Past and future timber harvest, wildfires, and prescribed burns activities have had and will continue to have mixed effects on food and seasonal foraging habitat at the local level for grizzly bears and their prey. In some cases, these events have created conditions favorable for stimulating understory vegetation, which increases food and foraging opportunities. In some cases, however, where ground disturbance has been more severe or where fires have burned at extreme temperatures, the return of understory vegetation has been prolonged or inhibited. These types of events will continue to have similar effects into the future across the landscape

Ongoing treatments in riparian areas have enhanced conditions for willow by reducing competition with incoming conifers. These treatments have improved riparian habitats. Ongoing noxious weed control has

protected native understory vegetation, which enhances biodiversity and broadens foraging opportunities for grizzly bears and their prey.

Grizzly bear demographic recovery occurred across the recovery zone and within the Madison BMU in the context of all these actions (Interagency Conservation Strategy Team 2007 pg. 39).

Cumulatively, the past, ongoing and foreseeable actions in addition to implementation of any of the action alternatives, would result in mixed effects on grizzly bear food and seasonal foraging habitat quality. In general, this project would benefit grizzly bear food and seasonal habitat quality so it would serve to counteract actions in the analysis area that would reduce these factors for grizzly bear.

Ungulate Displacement
A variety of factors affect how ungulates use the landscape within the BMSs in space and time. Food availability, human presence, predator cycles, time of year, and climate all play a role in determining the presence of ungulates in a given place or at a given time. Cumulatively, this project would add to any factors that currently displace or are likely to displace ungulates in the future. Mule deer and elk already avoid roaded areas and human activities, especially during hunting season, so this project would further displace animals from treatment units, which are all adjacent to already roaded areas. These effects would be limited to the duration and extent of project activities. At the scale of the BMS, the effects of this project would have a relatively minor effect on the overall landscape distribution of big game herds. Grizzly bears would be able to adjust to these small-scale changes and alter their foraging patterns to match any shifts in ungulate distribution resulting from project implementation.

Whitebark Pine
The current condition for whitebark pine (WBP) described earlier took into account the past and current activities affecting this valuable food resource for grizzly bears. As also discussed in that section, WBP pine in the GYE is declining due to the combined effects of white pine blister rust, mountain pine beetle, and lack of fire. Whitebark pine stands in the BMSs are generally located in the higher elevations north of Highway 287 in the Madison #1 Subunit. Whitebark pine presence in the Madison #2 Subunit is very limited. The beneficial effects of the proposed treatments on WBP pine will slightly diminish the overall decline of WBP in the Madison #1 Subunit. The scale at which treatments will take place is very small when compared to the entire subunit. However, given that the species is in sharp decline and is warranted for listing under the ESA, the small benefit to WBP pine expected with this project is prudent. Effects of Alternative 2 would have the greatest cumulative benefit to WBP, and, therefore, grizzly bears, because the greatest amount of acres (1,168 acres) would be treated to enhance WBP. Alternatives 3 and 4 would treat slightly less, 32 fewer acres.

Aspen
Lack of wildfire has resulted in conifer encroachment in aspen stands where they occur in the BMSs. Cumulatively, the proposed treatments would slightly diminish the overall decline of aspen on the landscape. The scale at which treatments will affect aspen is very small when considered in the context of the entire analysis area. Individual grizzly bears that use these aspen stands would benefit, due to increased foraging opportunities associated with these stands. Alternative 2 would have the greatest cumulative benefit for aspen, and, therefore, grizzly bears, because it would result in the greatest number of aspen acres treated (amounting to a total of 752 acres). Alternative 3 would have the least cumulative benefit for aspen and grizzly bears, because it would result in the least amount of aspen treated (a total of 242 acres). Alternative 4 would treat 471 acres of aspen and would have an intermediate effect on aspen.

Riparian Areas
Because the project would have no direct or indirect effects on foraging opportunities for grizzly bear in riparian areas, there would be no cumulative effects.

Forest Understory Vegetation
Cumulatively, the project would add to grizzly bear foraging opportunities in the forest understory. Effects would be small in relation to the scale of the entire analysis area. Grizzly bears that use affected areas would experience increases in forage, due to reduction in forest canopy. Alternative 2 would result in the greatest increase in forage, because it would result in treatment of the largest area. Conversely, Alternative 3 would result in the least increase in forage, because the least amount of area would be treated. Alternative 4 would be intermediate between the two.

Denning Habitat
Past and current actions that have affected denning habitat include timber harvest on public land, wildfires, and prescribed burns that have occurred in the Madison #1 Subunit. Snowmobiling is a popular winter recreation activity in both subunits. The number of participants has grown over time, as well as the extent of the areas that can be accessed, due to improvements in machine capability and technology. While it was determined that snowmobile activity was not appreciably reducing the likelihood of survival or recovery of grizzly bears across the GYE forests, localized effects may reduce suitability of certain areas for denning across the analysis area.

Suitable denning habitat in the Madison #2 Subunit was reduced by the 1988 wildfires, and insect and disease outbreaks in the Madison #1 Subunit may have also affected the availability of denning habitat, due to losses in cover. *Effects of the Maple Fire on denning habitat have not been quanitified; it likely caused the temporary loss of suitable grizzly bear denning habitat to a small degree. As the fire burned in a heterogeneous pattern across the landscape, it is likely that patches of denning habitat continue to be available in the burn area.* Denning habitat in the Madison #2 Subunit has been relatively unaffected by any additional actions in the past and is not expected to be affected by any scheduled actions in the future, because denning habitat in that subunit is located almost entirely within the portion that is located within Yellowstone National Park. Within the Madison #1 subunit, past actions have had a minor effect on denning habitat availability for grizzly bears in the analysis area, because suitable habitat is available across the Madison #1 subunit and grizzly bears would be able to locate desirable denning locations adjacent to affected areas. Wildfires are expected to continue to occur in suitable denning habitat in the BMU. In all cases, the additive impact of the alternatives is small. Denning habitat is abundant at the subunit scale, *denning habitat would be available in close proximity to affected units as well as in more remote areas at higher elevations post-treatment. throughout the analysis area. For these reasons the* effect on denning habitat would be negligible.

Grizzly Bear Security and Displacement/Mortality Risk
Past actions that have caused temporary displacement and increased mortality risk include past timber harvests *(extensive thinning, sanitation, salvage and regeneration harvests)* and other vegetation management activities, such as willow treatments. These activities no longer have direct effects on displacement and increased mortality risk once they are completed. Some old logging roads continue to be used for non-motorized access by hunters and other recreationists; this use increases the risk of mortality due to negative encounters. *The grizzly bear population grew robustly and met recovery goals during this period.* One timber harvest is scheduled to occur in the BMU in 2016 in the vicinity of the Rendezvous Trails system just south of the town of West Yellowstone.

Road and trail use and maintenance have impacted and will continue to impact grizzly bears through displacement and mortality risk. Travel plan implementation has improved conditions for grizzly bears,

with reduced road densities and increased levels of secure habitat in the BMU. Activities on public lands such as recreational use, outfitter and guide trips, dispersed camping, hunting, and a variety of other activities likely have increased displacement of bears from certain areas and increased mortality risk for bears where they occur, due to the higher likelihood of negative human/bear interactions.

Some actions are more permanent in nature and have likely displaced grizzly bears on a longer term basis. These include developed recreation sites; state, county, and private roads; commercial and residential developments on both public and private lands. Grizzly bear demographic recovery (Interagency Conservation Strategy Team 2007 pg. 39) took place after much of this development was already in place in the BMUs, and these actions have likely had a minimal impact on grizzly bears, which occupied locations around these locations where more suitable habitat is available.

Grizzly bear-human conflict is the major source of known grizzly bear mortality, with self-defense and management removals of bears involved in bear-human conflicts being the two primary causes of human induced bear mortality. Other sources are illegal kills, electrocution by downed power lines, mistaken identification by black bear hunters, and vehicle strikes. A primary focus of the grizzly bear recovery effort has been the management of mortality levels. Studies have shown a direct correlation between road access and bear mortalities attributed to illegal killing and management removals of food conditioned and/or habituated bears from developed areas (Mace et al 1996). A Forest-wide Food Storage Order is now in effect, and proper storage of food/attractants has been regulated in the grizzly bear recovery zone for many years. Management of human related attractants has had a notable effect in reducing the number of bear-human conflicts in the GYE.

Because secure habitat is discussed in context of the BMS, the discussion of direct and indirect effects on secure habitat was based on the effects of this project in addition to all other activities that already affect secure habitat. *These past activities combined to create the existing condition of secure habitat in the analysis area. The grizzly bear population grew robustly and met recovery goals during this period despite numerous activities that had temporary and permanent impacts to secure habitat. The FS does not know of any reasonably foreseeable future activities that would affect secure habitat in the future. Ongoing activities on private lands in the Madison 1 and 2 Subunits that may continue in the future include residential development and occupancy, firewood gathering, and recreational activities. It is unlikely that bears would avoid these areas to a greater degree than is currently occurring due to current levels of human disturbance.* For this reason, the cumulative effects of the proposed activities on secure habitat are the same as the direct and indirect effects already discussed earlier in this report.

Effects of the project on TMARD were also discussed in the context of the BMS and also already included all past activities in the BMSs that have affected these measures. The FS has almost completed all road closures expected under full travel plan implementation in the Madison BMU, with a few exceptions. The areas where road closures have not yet occurred will take place in areas that are already have high road densities, and the additional closures will actually not reduce TMARD when they are fully implemented because their closure will not reduce road densities in those areas below the thresholds for these measures. The FS does not have any future projects planned that would affect these measures, nor does the FS know of any projects that will occur on non-FS lands that would have an effect on these measures. For this reason, there are no cumulative effects of the proposed activities on TMARD.

In addition to the past, present, and foreseeable actions that have displaced and are expected to continue to displace grizzly bears, activities associated with this project would likely further temporarily displace grizzly bears into less developed areas in secure habitat in the BMSs. Proposed treatments would occur directly adjacent to areas that are already non-secure, so the project would, in general, enlarge areas that grizzly bears are already likely to avoid. Effects would be limited to the duration of project activities and the extent of areas where operations are occurring. The spatial scale at which project activities would take

place is very small in relation to the scale at which grizzly bears operate across the landscape, and displaced individual bears would be able to seek out more secure areas for breeding, foraging, and sheltering within their home ranges.

Cumulatively, the project would add to overall mortality risk to bears across the BMSs, because it would add to the overall potential for bears to interact with humans. Temporary project access routes would be effectively closed to public motorized use throughout project implementation, and permanently closed upon project completion, minimizing potential for added mortality risk associated with motorized public access on temporary project routes. Alternative 2 would cause the greatest amount of mortality risk, cumulatively, because it would result in treatment of the largest area across the landscape and would, therefore, be associated with the highest amount of activities and human presence on the landscape. Alternative 3 would cause the least amount of mortality risk of the action alternatives, cumulatively, because it would result in treatment of the smallest area across the landscape and would, therefore, be associated with the least amount of activities and human presence on the landscape. Alternative 4 would have an intermediate effect on grizzly bear mortality risk.

Cumulative Effects Summary

For all aspects of grizzly bear habitat discussed, there could be combined impacts from project related activities and other past and ongoing activities. However disturbance impacts would be temporary and limited to the duration of project activities and the extent of areas where operations are occurring. The spatial scale at which project activities would take place is very small in relation to the scale at which grizzly bears operate across the landscape. In all cases, combined effects to habitat would have localized effects on individual grizzly bears but grizzly bears would be expected to easily adapt to those changes, and effects on grizzly bears are likely to be minor, especially at the scale of the BMS. *By meeting the secure habitat standard and the application rules in individual bear management subunits, there would be no substantial impacts at either the BMS or larger scales (e.g. adjacent Bear Management Units). Meeting the secure habitat standard at the subunit level is key to maintaining carrying capacity for bears at the ecosystem level (van Manen, 2016, personal communication).* Grizzly bear population recovery began in the 1980's, grew robustly in the 1990's, and has slowed since the early 2000's. The slowing of population growth is believed to be a density-dependent phenomenon, and may be indicating that grizzly bears are reaching some carrying capacity in the GYE (Interagency Grizzly Bear Study Team 2015b). Grizzly bear demographic recovery occurred across the recovery zone and within the Madison BMU in the context of all these [past and ongoing] actions (Interagency Conservation Strategy Team 2007 pg. 39), including extensive thinning, sanitation, salvage, and regeneration harvests in the North Hebgen project area. The North Hebgen project would comply with direction in the Conservation Strategy, which is recognized as incorporating the best and most current science with respect to grizzly bear management. For these reasons the limited cumulative impacts that are anticipated would be minor.

Consistency with FP direction specific to grizzly bear

Table 22 lists the FP standards that are specific to grizzly bear habitat management. It also shows how the action alternatives would be in compliance with those standards. When standards were used as design features, as they were with respect to managing for grizzly bear secure habitat, further detail is provided in the effects analysis, which also describes how those design features minimized effects on the resource.

The Endangered Species Act of 1973 as amended

The ESA requires the Forest Service to insure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. It also requires the Forest Service to confer on any agency action which is likely to jeopardize the continued existence of any

species proposed to be listed or result in the destruction or adverse modification of critical habitat proposed to be designated for such species (USDI Fish and Wildlife Service 1973, pg. 15). Effects of the proposed alternatives on federally listed species are analyzed in this document, and consultation with USFWS will be completed once an alternative has been selected. Summary of Effects of Proposed Action Alternatives on Grizzly Bear.

Table 22: FP standards specific to grizzly bear habitat management and how the project complies with those standards

Standard	Compliance
The Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area (Interagency Conservation Strategy Team 2007), will be followed in maintaining or improving habitat, minimizing human/grizzly bear conflict potential, and guiding resource management activities.	GBCS standards were amended to the FP with the 2015 Cleanup Amendment. All relevant standards are included in this table and compliance with each is described. All proposed alternatives are in compliance with the GBCS.
The GYA Grizzly Bear Conservation Strategy will be followed to evaluate grizzly bear habitat and mortality risk.	All relevant standards are included in this table and compliance with each is described. All proposed alternatives are in compliance with the GBCS.
Inside the PCA or RZ, maintain the percent of secure habitat in each Bear Management Subunit at or above 1998 baseline levels (see Application Rules below). For those subunits identified in the Conservation Strategy as needing improvement from 1998 levels (Gallatin #3, Madison #2, and Henry's Lake #2), secure habitat levels at full implementation of the 2006 Gallatin National Forest Travel Management Plan become the new baseline, and these subunits must be maintained at or above this new baseline. Projects that result in reductions to secure habitat below the applicable baseline (1998 or Travel Plan) must follow the Application Rules.	The project would take place in the Madison #1 and #2 subunits. Alternatives 2 and 4 would result in temporary changes to secure habitat below baseline levels in the Madison #2 subunit. See application rules below for compliance.
Only one project affecting secure habitat [below baseline levels] may be active within any Bear Management Subunit at any one time.	Secure habitat would temporarily be reduced below baseline in the Madison #2 subunit *(Alt 2 and 4)*. No other projects affecting secure habitat below baseline will be implemented in the subunit until this project has reached completions. This was included as a project design feature.
The total acreage of [the reduction of secure habitat below baseline levels] within a given Bear Management Unit will not exceed 1 percent of the acreage in the largest subunit within that Bear Management Unit. The acreage of a project that counts against the 1% limit (i.e., the secure habitat affected) is the acreage within the 500-meter buffer around any temporary motorized route or recurring	The largest subunit is Madison #1, which is 145,847 acres in size. One percent of the subunit is 1,458 acres. Alternative 2 would result in the greatest amount of acres being treated and would cause a temporary reduction in secure habitat below baseline in the Madison #2 subunit of 862 acres. This accounts for 0.6% of the Madison #1 subunit. The

Standard	Compliance
low level helicopter flight line that extends into existing secure habitat.	total acreage of the reduction does not exceed 1% *for the Madison BMU.*
Use of project roads will be limited to administrative purposes associated with project activities. Project implementation shall not reduce secure habitat below baseline levels for more than 4 consecutive years. The collective set of project roads that affect secure habitat below baseline levels shall be closed to all motorized travel after 3 years. Project roads shall be decommissioned such that secure habitat is restored within 1 year after road closure.	Compliance will be ensured with design features common to all action alternatives. *All of the action alternatives would meet this application rule with regard to project roads.*
MA7 (Riparian): "Inside the grizzly bear Recovery Zone or Primary Conservation Area, follow the GYA Grizzly Bear Conservation Strategy direction for monitoring grizzly bear food items and managing human access for secure habitat." See Appendix 1 (of the Decision Notice for the Gallatin Forest Plan Clean-up Amendment 11/2/2015) for application rules associated with access management and monitoring protocols."	This affects treatments in MA7 along Duck Creek, Cougar Creek, and unnamed riparian areas in the Flats to the southwest and west of Cougar Creek. The alternatives would have no effect on monitoring of grizzly bear food items. All alternatives are in compliance with management guidance for grizzly bear secure habitat. All proposed alternatives are in compliance with the GBCS.
MA13 (Forest within grizzly bear RZ) and MA15 (open grasslands): The GYA Grizzly Bear Conservation Strategy will provide the basis for managing other resource uses.	This affects treatments in MA13 along Tepee Creek Road, around the Whits/Johnson Lakes area, and in the Flats. It also affects treatments in MA15 on the south side of Mount Hebgen, in the Whits Lakes area, at the bottom of Tepee Creek Road and on Horse Butte. See Management Area Map on the Gallatin Webpage at http://www.fs.usda.gov/project/?project=45491. GBCS standards were amended to the FP with the 2015 Cleanup Amendment. All proposed alternatives are in compliance with the GBCS.
MA13: All vegetative management activities will consider: 1. Maintaining or enhancing security for the grizzly bear. 2. Vegetative treatment (i.e., fire or timber harvest) to enhance forest habitat components for the grizzly bear where security will not be jeopardized and where there is a demonstrated need to:	These factors were considered in project design. GBCS guidance was followed for management of grizzly bear secure habitat. Project activities were designed, in part, to enhance big game forage opportunities (aspen enhancements or creation of forest openings) and improve whitebark pine nut availability.

Standard	Compliance
a. Provide openings in Forest cover to increase production of browse species for ungulate prey species. b. Improve white bark pine nut availability. 3. Enhancing cover where regeneration timber harvest would provide the quickest results for the grizzly bear and its prey.	
MA13: Select site preparation methods that will increase food production for the grizzly bear.	Compliance will be ensured through project design. Site preparation would support natural regeneration of seedlings and forage such as grasses and an herbaceous understory.
MA15: Grizzly bear habitat improvement, such as prescribed fire, may be scheduled where the need is identified.	This affects aspen enhancements proposed on Horse Butte, Whits Lakes, the bottom of Tepee Creek Road, Fir Ridge, and the south side of Mount Hebgen, which will improve habitat for grizzly bear.

Conclusion

The proposed action alternatives are in compliance with all FP standards. The action alternatives would affect food and seasonal foraging habitat quality. Ungulates would likely be displaced by project activities, causing bears to follow suit, but shifts would be local and at a small scale in relation to the size of the BMSs and the scale at which grizzly bears operate across the landscape. Effects on grizzly bears would, therefore, be minor. Whitebark pine and aspen would be enhanced, which would benefit grizzly bears. Riparian areas would be protected through project design, so there would be no effect on grizzly bear use of these areas. Increased understory vegetation production would benefit grizzly bears. The action alternatives would result in minor reductions in the amount of available denning habitat or denning habitat quality but denning habitat is plentiful. The action alternatives would also affect grizzly bear security by causing disturbance of bears during project implementation, reducing cover, temporarily increasing TMARD above current levels and temporarily affecting the amount of grizzly bear secure habitat. *Use of system and temporary project routes may cause individual bears to move to to adjacent areas in their home range with less disturbance while implementation and road use are occurring. Temporary* reductions in security would be localized and grizzly bears operate at such large scales that they would be able to adjust their use of the landscape to find areas *in their home ranges away from project roads that provide secure habitat. For the above reasons, and due to the fact that secure habitat would be temporarily reduced below the already degraded secure habitat baseline in the Madison #2 BMS, Alternatives 2 and 4 may affect, and are likely to adversely affect the grizzly bear. As Alternative 3 would not reduce secure habitat below the baseline in either of the affected BMSs, it may affect, but is not likely to adversely affect grizzly bear.*

Invasive Weeds

Introduction

This information is summarized from the *North Hebgen Invasive Weeds Report* (Lamont 2015) which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific resource protection measures for Invasive Weeds is in Appendix A - Design Features Common to Action Alternatives.

Resource Indicators and Measures

Key issues and indicators used to measure the magnitude of the issues are shown in Table 23. The determination of effects is based on a combined evaluation of current weed infestations in the project area and the likelihood that weeds would spread into new areas given the proposed disturbance and vehicle traffic. The risk of weed spread is greater if a seed source is close to or within the treatment units. Risk is also higher if the vegetation type is more suitable to the weed species. Most invasive weeds prefer sunny, drier sites, and not areas with full shade. Indicators used in the present evaluation were selected based on literature reviews and professional judgment. The following general indicators were used to compare alternatives:

Table 23. Issue Attributes, Indicators, and Measures for Assessing Effects

Attributes	Indicators	Measure (Quantify if possible)
Risk of Weed Spread	Weed Risk Assessment – Susceptible Vegetation types.	Treatment acreage by potential natural vegetation type, and acreage of habitat at high risk of weed invasion
	Present extent of weed occurrence	Weed occurrence within 100 feet of unit
	Effectiveness of mitigation measures	Effectiveness and feasibility of implementation
Impact on biodiversity and site productivity	Weed density at which impacts on biodiversity and site productivity are measurable	Current weed density in the project area based on field observations. Estimated density of weeds within the next 10 years (project and follow-up weed surveys may last 10 years), based on professional judgment and effectiveness of mitigation measures. Comparisons to levels cited in the literature where impacts to the ecosystem are documented.

Using a GIS (Geographic Information System) mapping program, the 2014 and 2015 weed inventories were overlaid on the proposed treatment units (including a 100 foot buffer) to calculate the gross acreage of weeds in and near the units for each action alternatives.

Based on the 2015 inventory there are 925 acres of weeds (not including private land) within the 68,662 acres entire project area (Forest Service land only); or one percent of the total area. A subset of this total is in the high risk lodge pole pine obsidian flats area there are 373 acres of weeds within 10,908 acres (Forest Service land only); or three percent. While the inventory is not a complete census and there are likely some weeds that were not included. Most of the inventoried weeds occur within 50 feet of roads, although it is recognized that many of the non-roaded areas have not been as thoroughly surveyed. The

most common weeds are hoary alyssum, spotted knapweed, Canada thistle and yellow toadflax. See the Invasive Weeds Report (Lamont 2015) for a list of weed species and acreages in the project area.

The current weed infestation in the project area is very low, one percent of the total area. At these population levels the weeds are not causing a measurable impact to biodiversity or site productivity. However, the concern is that when the weed population increases, both native plants and site productivity will decrease. Native plants are valuable for wildlife forage and for aesthetic reasons.

The effects of climate change and global warming on invasive weeds are uncertain at this time. Some researchers have predicted that the increase in temperature and moisture may cause a shift in suitable habitat for some species. Most weeds of concern thrive in hot dry sites. If climate change is severe enough to turn moist areas into dry areas, then weeds may thrive. Most likely the changes in climate in the analysis area would be more subtle, with only slight changes in moisture and temperature so that impacts to vegetation would be minor. At this time there are no scientific data available that show how invasive plants would respond to changing climate conditions.

Direct, Indirect and Cumulative Effects

Alternative 1 – No Action

Since the No Action alternative would not harvest or thin forests, there would be very little change in the current weeds condition. Invasive weeds next to roads would continue to be treated based on available funding. Most areas are treated only once every 3 to 5 years. The management strategy is to eradicate high risk weed species (for example the orange hawkweed and leafy spurge) and then to control the density of the other weed species. The eradication strategy requires multiple treatments per year. The control strategy involves occasional treatments to reduce density.

The No Action alternative would not cause site disturbance, would not open the forest canopy, and would not introduce new weeds with mechanized equipment. Many of the weed patches occur in the lodgepole pine potential natural vegetation type and in areas that were previously disturbed by past logging, forest fires, or roads. Over time the conifer seedlings are growing taller, providing more shade and out competing the weeds (LaMont, 2015 (a)). Without disturbance the weeds will be confined to smaller areas but will not be eliminated because the vegetation is naturally sparse due to dry soils.

Weeds would continue to be spread by vehicles, wind, streams and animals. This area is heavily used by people and most of the existing weeds are likely associated with human activity, for example, near existing roads, campgrounds, snowmobile trails, lake access points, power lines, communication sites, firewood gathering two-tracks, private lands, the bison trap location and transfer station. Even wildlife spreads weeds: routes frequently used by bison have spotted knapweed and hoary alyssum. Rivers and lake shores have yellow toadflax and Canada thistle, likely started by seeds floating in the water. With time, new infestations may occur due to these vectors. It is difficult to estimate the rate of new weed infestation due to these vectors.

Direct, Indirect and Cumulative Effects for Alternatives 2, 3 and 4

Risk Assessment

The Forest Service Manual 2080 lists activities for the prevention and control of weeds. Completing a weed risk assessment in the environmental analysis is a required activity (FSM 2081.2(6.a (1)(a)). The following risk assessment fulfills that requirement. The *Invasive Weeds Report (Lamont 2015)* includes two risk assessments: first, the Mantas risk assessment which estimates the amount of habitat with high

and low risk acres; second, the Northern Region Risk Assessment which defines the appropriate level of mitigation measure based on the level of risk.

The first risk assessment was based on a process and database developed by Maria Mantas in 2003, "Evaluation Risk to Native Plant Communities from Selected Exotic Plant Species". This process was selected because it is the best available data for National Forest lands in Montana. Further, the model was adaptable to this specific site project-level analysis. As determined using the Mantas Risk Assessment method, about half of the project is at high risk to weeds due to the lodgepole pine, Douglas-fir and quaking aspen potential natural vegetation types, which are very vulnerable to yellow toadflax, spotted knapweed and sulfur cinquefoil. About half of the project is at low risk to weeds due to the subalpine fir potential natural vegetation type that can produce vegetation relatively quickly and out-compete most weed species over time.

The Northern Region Risk Assessment Rating combines the findings from the Mantas risk assessment to evaluate the risk of weed spread under the action alternatives in order to help design mitigation measures. Following the Northern Region protocol, the "likelihood" of weeds spreading has a rating of 7.5, which when multiplied by the "consequences" rating of 7.5 gives an overall numeric risk rating of 56. The project is on the lower end of high risk. These findings, along with direction found in FSM 2080, indicate that mitigation measures should be implemented to reduce the potential for introduction or spread of weeds. In keeping with the outcome of this assessment, mitigation and monitoring is incorporated in all action alternatives see Appendix A - Design Features Common to Action Alternatives.

Mitigation Monitoring and Effectiveness

Each mitigation measure was reviewed to assess its feasibility and effectiveness. Feasibility is determined by considering whether or not the mitigation measure can be implemented. For example, the availability of a work force, economic viability, and potential for incorporation into a contract is considered in the feasibility assessment. For determining effectiveness, scientific literature was reviewed, and previous field experience is considered.

Starting in 2011, the Custer Gallatin National Forest west zone weeds program monitored the effectiveness of treatments using ocular estimates of weed mortality. This type of monitoring considered the effectiveness of the herbicide application, specifically attempting to determine if the chemical was applied in a manner that killed the targeted weeds. The monitoring does not account for weeds regenerating from dormant seeds in the soil or re-growth from roots. Most of the areas need repeat treatment for multiple years to exhaust the dormant seeds or to deplete the root reserve. A single herbicide application would reduce the density of weeds but rarely would it eradicate a patch. If the site can be treated only occasionally, it should be sprayed before the native plants have declined below 50 percent of the canopy cover so enough native propagules will be present to repopulate the site. Most weed patches are being managed for "control" and these patches have experienced a significant reduction in density.

The 2011 monitoring report found herbicide application effectiveness ranging from 50 to 95 percent; in 2012 effectiveness ranged from 90 to 92 percent, in 2013 it ranged from 90 to 99 %, and in 2014 it ranged from 90 to 100 percent (LaMont, 2015(b)). Although the treatments appear to be highly effective at killing most of the plants, some plants survive or are missed, and still produce seed.

A direct effect of thinning and logging is that the activities may introduce weeds into the project area while working. The off-road logging equipment may spread invasive weeds within the units by dragging seeds or root stock while skidding trees to the road. The mitigation measure to power wash and inspect off-road equipment would help to reduce the spread of weeds. Also the mitigation measure to leave a 30-foot buffer around existing weed patches within a given unit would preclude ground-disturbing activities

that could spread weeds. Equipment that stays on roads and temporary roads (such as log trucks, trailers, pickup trucks and other vehicles) are not power washed or inspected. It is possible that weeds could be introduced by vehicles that stay on temporary roads. However design features in the alternatives direct implementers to avoid temporary road locations and landing locations where weeds exist. This would limit disturbance and spread from existing weeds. After the temporary roads are decommissioned, access for follow-up weed treatment is reduced and the cost of weed treatments increases but is still feasible. The mitigation measure that requires five years of survey and treatment following reclamation would help to reduce the risk of weeds spreading in the units.

Units exempt from the 30 foot buffer (units 16, 33, 34, 35, 52, 59, 100, and 106) currently have weeds mainly along the edges of the units. Putting buffers along the edge of the unit would compromise the purpose for treating the area to the point of not being practical. Although the area's weeds will be pre-treated prior to disturbance, dormant seed will still be in the soil. Off-road equipment working in these units may become contaminated with weeds while working in the units and so could spread weeds throughout the unit. The following mitigation measures would reduce the risk of weed spread: pretreatment of weeds (at least one year prior to disturbance), survey and treatment of weeds for five years following disturbance, and power washing of equipment prior to moving to other units.

An indirect effect or latent effect of thinning is that it opens the forest canopy and allows more sunlight to reach the forest floor, thus creating more area suitable for growing weeds. If weeds are present in the area and the forest canopy is opened, the weeds may spread into the new habitat. Based on the risk assessment, the lodgepole pine potential natural vegetation type on the obsidian flats (areas around Duck Creek and Rainbow Point) is at high risk for infestations of yellow toadflax and sulfur cinquefoil. Even if the area is not disturbed, the yellow toadflax can colonize the natural open areas in this habitat type. This means that if introduced into the area, weeds would continue to spread throughout the area into undisturbed areas if enough sunlight is available. However, the follow-up weed survey and treatment would reduce this risk.

The Douglas-fir potential natural vegetation sites are at high risk to spotted knapweed, houndstongue, leafy spurge, St. Johnswort, Dalmatian toadflax, and sulfur cinquefoil, even if not disturbed. Currently there are small patches of spotted knapweed along roads adjacent to the Douglas-fir harvest units. Mitigation measures require that weeds be treated prior to disturbance, and then for five years following reclamation, the area would be surveyed and the weeds treated. These mitigation measures would reduce the risk of spreading weeds in the Douglas-fir areas, so the effects are expected to be minimal.

The quaking aspen potential natural vegetation sites are at high risk to Canada thistle, spotted knapweed, leafy spurge, and orange hawkweed. Currently there is Canada thistle and spotted knapweed adjacent to roads. Mitigation measures require that weeds be treated prior to disturbance, and that for five years following reclamation the area would be surveyed and the weeds treated. These mitigation measures would reduce the risk of spreading weeds in these areas, so the effects are expected to be minimal.

The subalpine fir potential natural vegetation sites are susceptible to weeds only if disturbed (except for orange hawkweed, which is not in the treatment units and is being managed for eradication). If weeds do establish in a subalpine vegetation type they are not likely to spread to other non-disturbed areas. Mitigation measures require weed treatments prior to and following ground disturbance to help reduce the risk of spreading weeds. The subalpine fir vegetation type tends to have vegetation that will out-compete weeds. As a result the impacts of weeds to the subalpine fir areas are expected to be minimal.

All action alternatives would treat scattered weeds along roadside before and after the project. Due to effective mitigation measures the total acreage needing herbicide treatment is not expected to increase substantially from current level, however there could be many small patches scattered over a large area. Additionally, for five years following final reclamation (grass seeding of burned landing piles) surveys of

the high risk habitat acres would be needed to identify new infestation of weeds and treat all new and existing weeds within the units. The number of new weed patches is not known at this point in time. However, the sizes of the patches are expected to be small because of the short time span between disturbance and follow-up survey. Table 24 shows an estimate of labor costs to implement the pretreatment, monitoring and post treatment. Actual costs are likely to be slightly higher and would include fix costs such as equipment and supervision. This amount of work is feasible with funding. It is anticipated that funding would be available from a variety of sources, but primarily from stewardship receipts.

Monitoring has shown that application of the design features identified for the action alternatives is effective. As a result, risk of weed spread would be effectively mitigated in all action alternatives.

Impacts of Weeds on Biodiversity and Site Productivity

The current weed infestation in the project area is very low, one percent of the total area. At these population levels the weeds are not causing a measurable impact to biodiversity or site productivity. However, the concern is that when the weed population increases, both native plants and site productivity will decrease. Native plants are valuable for wildlife forage and for aesthetic reasons.

For a detailed description of how weeds can impact the ecosystem see Bret Olsen's article, The Impacts of Noxious Weeds on Ecological and Economic Systems (Sheley and Petroff, 1999, pages 4-11). Areas for which most research studies document impacts to soil characteristics and site productivity are located in places with very high weed densities. For example, changes in phosphorus were detected when spotted knapweed canopy cover was at 60 to 80% (Thorpe, et al. 2006). Likewise, research studies found an increase in surface runoff and sediment in sites of heavy knapweed infestation (90 %) compared to sites in which native grasses dominate (Lacey et al. 1989). The runoff was 56 percent higher and the stream sediment yield was 196 percent higher on sites dominated by spotted knapweed compared to sites dominated by native bunchgrasses. Water infiltration was greater on sites with grasses than on sites with spotted knapweed.

Weeds are often cited as having a detrimental impact on wildlife forage. Research has indicated that elk will use knapweed and cheatgrass but native grasses make up the majority of the diet (Kohl et al. 2012). Herbicide treatment of spotted knapweed increased perennial grass biomass from 173 kilogram/hectare to 1,309 kilogram/hectare (knapweed density averaged 36 mature plants per square meter – more than 60 % canopy cover) (Sheley et al 2015). This is an indication of the amount of native grasses that are lost with high density levels of spotted knapweed.

From monitoring observations, the rate of weed spread, the number of new sites and the size of weed patches tend to be small immediately after ground disturbance. Long term monitoring plots that measured the growth rate of yellow toadflax in the obsidian sand flats without any herbicide treatment found that the area of patches increased 10 percent per year on average (LaMont 2015(a)). For example, over a 13 year time span, one patch increased from 2333 to 8527 square feet. Also, there was only one new patch within the larger 200 X 200 feet plot during that time. During that same time period the canopy cover of the yellow toadflax within the patch was between 1 percent and 75 percent. After 13 years the center of the patch was at 10 to 25 % canopy cover. Although the monitoring plot only represents one data point, it supports the idea that the rate of spread is slow at the initial phase of invasion. While it is true that the rate of spread can change depending on the weed species, the vegetation type, and the stage of infestation (initial versus latent), the mitigation measure that requires follow-up survey and treatment for five years after reclamation would help keep new weed patches small. At small and isolated patches, the weeds are not causing a measurable impact to biodiversity and site productivity.

Most of the current weed densities in the project area are at very low levels, about one to twenty-five percent canopy cover within a given patch (LaMont2015(a)). A few weed patches have density levels at 50 to 75 % canopy cover. Currently these patches are less than a quarter-acre in size and isolated (more than 500 feet from the next patch). None of these high density patches are near proposed thinning units. At this population level, the weeds have not caused much displacement of native plants over a large area so have not caused a significant impact to biodiversity or site productivity. Given that current levels are not a threat to biodiversity and site productivity and the fact that mitigation is included to limit spread of new weeds, potential impacts would be minimal to biodiversity and site productivity.

Table 24 displays estimated cost of implementing survey and control work identified for all action alternatives. Regardless of the alternative selected, the District has the capacity to treat a greater acreage if funding is available. It is expected that funding from multiple sources would be obtained to mitigate the risk of weed spread.

Table 24. Comparison of Invasive Weed indicators by Alternative

Indicator	**Alternative 2**	**Alternative 3**	**Alternative 4**
Weed Risk Assessment Proposed treatment acreage in vegetation types at high risk to invasive weeds (PICO, PSME and POTR)	**3,110 acres**	**2,590 acres**	**2724 acres**
Existing weeds within 100 feet of units and within high risk vegetation types	**211 acres** **177 acres**	**201 acres** **168 acres**	**210 acres** **176 acres**
Effectiveness of Mitigation Measures	The mitigation measures are the same for all action alternatives and are reasonably effective at minimizing spread of new weeds into the area.		
Biodiversity and site productivity	The current levels and densities of weeds are low enough to not have a measurable impact on biodiversity and site productivity. One percent of area has existing weeds with low to moderate weed density within patches. Mitigation measure would keep weeds near current level, thus maintaining current biodiversity and site productivity. Pretreatment and persistent monitoring and treatment as a result of this project could reduce weed presence.		
Capacity to treat weeds – estimate of labor costs to pretreat, monitor and treat after implementation. Can the District complete this work?	$135/person day X 2 people X 26 days = $7020 annually YES.	$135/person day X 2 people X 22 days = $5940 annually YES	$135/person day X 2 people X 23 days = $6210 annually YES

Gallatin National Forest Noxious and Invasive Weed Treatment Project EIS 2005, disclosed the effects of weed control treatments, such as effects of herbicide on the environment and human health. The effects of herbicide (on human health and the environment) associated with this project were addressed in the 2005 EIS, refer to that document for the effects analysis.

Cumulative effects analysis acknowledged that noxious weeds are wide-spread and weed infestation occur within the treatment units. The spread of weeds is from many different past activities and would possibly occur from this project. It is anticipated that new weeds will continue to invade public land even with the No-Action alternative. Existing infestations would continue to be treated with herbicides until they are controlled or eradicated. With the mitigation measures, none of the action alternatives would appreciably accelerate the spread of weeds over the existing trend. Because the current condition reflects all past and ongoing actions and the direct and indirect effects of this project would be mitigated the combined effect would be minimal. The cumulative effects analysis is the same for each action alternative because the alternatives involves the same activities, the same spatial and temporal time frames, a similar number of acres at high risk and the proximity of existing weeds to proposed treatment units is virtually the same for all action alternatives. A list of activities considered in this analysis is included in the *North Hebgen Invasive Weeds Report (Lamont 2015)*.

With required mitigations outlined above, all alternatives are consistent with Executive Order 13112, The Federal Noxious Weed Act, the Montana County Noxious Weed Control Law; Forest Service Manual (FSM) 2080- Noxious Weed Management Policy; Forest Service Northern Region Weed Risk Assessment protocol and the 2005 Gallatin National Forest Noxious and Invasive Weeds Management Plan EIS. The mitigation measures in this project would minimize the spread of weeds by avoiding and treating weeds.

Summary

Existing weed infestation would be avoided and buffered for most of the project area which would limit potential spread from existing weeds. New weed patches might occur; however, it is expected that they would be isolated and would impact small areas (patches less than a quarter of an acre) because effective mitigation measures are included in all action alternatives. The current weed infestation is the result of many vectors in the area (people, animals, water and wind). *While the presence of weeds is undesirable, the current infestation is contained and very limited.* For the entire project area (68,662 acres of FS land) there are 925 acres of mapped weeds or 1.3% infested area. For the obsidian flats (10,908 ac of FS land) there are 373 acres of mapped weeds or 3.4 % infested *in the Flats* area. The existing weed patches are very small, *most are* less than a quarter of an acre in size. Only a few patches are larger than an acre and they are not adjacent to the proposed thinning/harvest units. The concern about weeds impacting biodiversity and site productivity occurs when the weed density level becomes high (e.g., more than 50 % canopy cover) and the area impacted becomes large enough that weed control becomes very difficult (e.g., more than a few acres per patch). *At current levels, weeds have not caused a measurable displacement of native plants over a large area so have not caused a significant impact to biodiversity or site productivity.* Given that the current level of infestation is not causing detrimental impacts to biodiversity or site productivity, and that the mitigation measures would be effective at reducing the risk of weeds increasing in density *and risk of introduction*; the potential effects of the North Hebgen project would be limited in scope to the vicinity of treatments and in magnitude. Therefore, the project would not have a significant impact on concerns related to invasive weeds.

Overall, the increased emphasis on weed control in this area could decrease the existing weed population (e.g. treating weeds prior to disturbance and follow-up weed survey /treatments for five years). There would be more program work related to weeds on the District. It is anticipated that timber receipts would be available to help fund mitigation because of the extensive logging associated with the alternatives. Other funding sources would also be expected to be available to fund mitigation because of the multi-purpose nature, extensive interest and ongoing collaboration for this proposal. This funding would be expected to mitigate the additive impact of this work.

Response to scoping concerns or requests
This section describes mitigation measures that were identified during scoping, but then dismissed because they were either not feasible or were incorporated into another mitigation measure.

- Use helicopter logging or winter logging to reduce the number of temporary roads, thus reducing the number of weeds being spread.

Feasibility and effectiveness: This is not an economically feasible option because helicopter logging is very expensive and is only used with high value trees in areas where ground-based equipment cannot be used. Using an expensive logging method such as helicopters reduces the available funding for other treatments (such as weed spraying). Since this is not an economically feasible mitigation measure it would not be carried forward. Further, weed spread would be mitigated so that there would be no need for this mitigation.

Winter logging does help to reduce ground disturbance but does not alleviate the need for temporary roads or the latent risk of highly invasive weeds colonizing suitable habitat created from the thinning. Yellow toadflax has colonized areas in full sunlight on the obsidian flats; it does not need ground disturbance to become established.

- Log weed-free areas first, and use resulting revenue to fund treatment of weeds in infested areas. Log infested areas only after weeds have been treated.

Feasibility and effectiveness: The intent of this mitigation measure is to help fund weed spraying. Since all roads in the project area have weeds, there are no weed-free areas to log first. Even Tepee Creek road has weeds that need to be treated prior to logging.

- Control kochia before implementing the project.

Feasibility and effectiveness: Kochia is an annual weed species commonly found along roadsides or disturbed areas. Historically the Forest has not treated kochia as an invasive species because it has not left disturbed road side areas and moved into undisturbed areas. However, for this project kochia can be treated when the roadsides are sprayed, so there is no need for a separate mitigation measure. Since crews would be in the area looking for other weed species, treating kochia would not increase operating costs substantially.

- Leave the temporary roads open for weed treatments after the harvest is complete. Keep the roads closed to other motorized vehicles during this time. After the weeds are eradicated, decommission the roads.

Feasibility and effectiveness: Eradicating weeds can be a lengthy process, sometimes involving many years of repeated treatments (estimated at five or more years). Keeping the roads closed to other motorized vehicles but still accessible for weed treatment vehicles would be difficult on the obsidian flats since vehicles can (and do) simply drive around most barriers. Most weeds and high risk habitats are on the obsidian flats and not in the other areas. Since the ability to keep unauthorized vehicles off the roads on the flats is difficult without additional enforcement activity, this mitigation measure was not carried forward in the analysis.

Another concern raised by the public is that logging would promote the spread of weeds which would in turn increase fire frequency. Cheatgrass has been found to increase fire frequency in area where it is abundant (Penn State 2012, Balch et al 2012). The more frequent fires are causing populations of native plants to decrease and the cheatgrass to increase. Cheatgrass is present in the project area, though it is neither inventoried nor treated by the Forest Service. In the Hebgen Basin, cheatgrass is usually found

along roadsides and on south slopes, but not often in old clearcuts (based on field observations in 2015). The wildfire history of the Hebgen Basin suggests that logging has not increased fire frequency; rather logging has lowered the intensity of fires (Jones, F. personal communication 2015). Based on this history, the presence of weeds does not seem to be increasing fire frequency in the area.

Scenery

This information is summarized from the North Hebgen Multiple Resource Project Scenery Report (Stiles and Seth 2016), which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Resource protections related to scenery are listed in Appendix A - Design Features Common to Action Alternatives.

Certain elements of the proposed vegetation management activities could lower the quality of scenery from key observation points and areas, as well as from some private land. These elements include slash piles, skid corridors and temporary roads, stumps, unnatural vegetation patterns, and increased exposure of constructed features formerly hidden by vegetation

The Gallatin National Forest (As amended 2015) developed the Forest Plan Visual Quality Objectives (VQOs) to provide guidance for all landscape-altering activities (Forest Plan II-15), based upon procedures set out in the National Forest Landscape Management, Volume 2, Chapter 1, The Visual Management System, FS, USDA, Agriculture Handbook No. 462, 1974 The Forest Plan glossary defines the term Visual Quality Objective as "A desired level of scenic quality and diversity of natural features based on physical and sociological characteristics of an area. [VQO] Refers to the degree of acceptable alterations of the "characteristic landscape."

It is important to note that the VQO's are geared toward the "casual" forest visitor. People who are frequent visitors or who own property and thus know the landscape intimately would be able to recognize where forest management activities take place, more readily. It is also important to reiterate that the VQO's refer to the degree of acceptable alterations from the characteristic landscape and not from the existing condition. In many forest areas today, fire suppression has allowed or encouraged densities to become much higher than what would otherwise be more open in character. Further, visual objectives are applied from key observation points in the project area. *The description of visual effects are based upon how the project area would look at the end of one yar after project activities are complete.*

The Forest Plan in the management area (MA) descriptions provides general scenery guidance that is clarified for all areas within this project in the VQO maps (July 1987) that specify the VQOs for this project as being:

- ***Retention*** for those units, or portions of units, proposed on Horse Butte Peninsula from the lookout northwest along the summit of the butte toward Narrows Peninsula that are visible from the Hebgen Lake or Highway 287 corridor. In addition to Horse Butte, Fir Ridge as viewed from Highway 191 corridor, and Whits Lake units south of Whits Lake Road #971 viewed from Highway 287 corridor, are also Retention. Retention is defined by the Forest Plan Glossary as "Human activities are not evident to the casual Forest visitor."

- ***Partial Retention*** for the area immediately along both sides of Rainbow Point County and FS Roads (FSR 695), Horse Butte Road (FSR 610 up to its junction with FSR 6106), portions of Cougar Creek Road (FSR 1781), Highway 191 corridor, and for those units along Red Canyon Road (FSR 681). Partial Retention is defined as "Human activities may be evident but must remain subordinate to the characteristic landscape."

- ***Partial Retention*** for the immediate views from the designated recreation sites within the project area, such as Rainbow Point Campground and the recreation residence tracts (all within Management Area 1: Developed Recreation Sites).

- ***Modified*** for the Tepee Creek area, Whits Lake area north of Whits Lake Road (*FSR 971) and areas south of the road from the junction with the Johnson Lake Trailhead*, and interior area of the "flats" described as north of Madison Arm, east of Rainbow Point Road (FSR 695) and south of Cougar Creek, and the land not within view of Highway 191 that abuts Yellowstone National Park. Modified is defined as "Human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in middle ground or background".

Direct, Indirect and Cumulative Effects

Effects Common to Action Alternatives
Reducing fuel in the project area could have the indirect effect of decreasing the probability of a large scale immediate and long lasting change in scenery character due to stand replacing fire. However, the fuels reduction work proposed in the action alternatives would not eliminate all risk to scenery from crown fires. Aspen is considered a desirable scenery component, especially where conifers are the dominant tree type. This project is designed to increase aspen near Fir Ridge, Whits Lake, Red Canyon, on Horse Butte *and on Tepee Road near highway 191*.

Timber harvest activities would have direct effects on scenery. How those effects are considered depends upon the specific type of treatment proposed, the geography and location of treatment (on a visible slope versus in the flats), and where units are in relationship to view corridors such the Highways, Forest Roads, and recreation sites.

General considerations
Current tree densities would be reduced with all treatments. Intermediate harvest treatments generally create 15-30' spacing between trees or small openings around aspen closes combined with thinning or a combination of removal of overstory trees and thinning in trees less than six inches in diameter. Pre-commercial thinning would create 12-20' spacing. In group selections, 20-30% of the overall unit is actually treated with 1-3 acre openings scattered throughout that bigger group selection unit polygon. Regeneration harvests would remove nearly all trees in a unit, creating the largest visual change of any treatment prescription. The highway and power line treatments are similar in that they clear all vegetation in a straight right of way, and would create visually straight lines when viewed directly down them. Where trees are over 6" in diameter, they would most likely be logged using ground based equipment. Trees smaller than 6" in diameter would either be hand thinned or machine thinned.

In all areas where there would be harvest operations, there would be skid corridors, landings, and temporary roads visible in the short term in the foreground. In all treatments, landings would be necessary to remove harvested material and treat residual fuels, and would be ½ to 1 acre in size, with generally one landing per 20 acres of treatment as an average. Landings are areas where equipment, log decks and slash are temporarily placed during harvest operations. The landings would be very noticeable in the short term during logging operations and prior to burning of the landing piles. Where possible, landings for temporary decks, equipment or possibly some slash piles, would be located away from main travel corridor roads, further minimizing visual dominance to viewers.

The effects analysis relies heavily on the application and effectiveness of design features common to action alternatives. The practices identified address mid and background views associated with changes in vegetation patterns and impacts mostly visible in the foreground, for example, next to the road. The

intent of scenery design features is to create transitions between a unit and adjacent forest or opening and vegetative patterns that appear natural when viewed from a distance, from along main roads, recreation sites and Hebgen Lake and to maintain screening where needed. For the most part these outcomes would be achieved through tree marking guidelines. The landscape architect would work closely with the silviculturist and presale foreman to ensure objectives are met. As long as the end result of the project meets these goals, the quality of the scenery would be maintained whether these or similar practices are incorporated. It is important to note that while these design features are meant to focus on view corridors from NFS lands as specified in the Forest Plan, these design features/mitigations would also benefit scenery as viewed from adjacent private lands such as homes in the Horse Butte vicinity. These design features are also proposed to address foreground impacts in view corridors. These practices apply to all temporary roads, skid corridors, burn piles if needed and landings, so timely restoration from key observation points in retention and partial retention areas would be assured. These practices focus on minimizing exposure in the foreground or next to main roads. Some examples include using screening when possible, designing road approaches so they are no perpendicular to the main road.

Views from Highways 191

The effect to scenery from harvest work depends on current visual characteristics of a unit, and whether a given unit is visible from a view corridor. After harvest, all treated areas in the immediate foreground of Highway 191 as one drives the highway would appear more open. One would be able to see farther into the forest, particularly where existing lodgepole pine stands are dense. Highway clearing treatments between Cougar Creek and the transfer station road (Ecology Lane), would open up the highway corridor straight line visual, though in some areas it is already essentially clear 50' from the highway edge so that treatments would not widen the cleared area by much or at all. Further north toward Cougar Creek, there would be more clearing to reach 50' width off the road edge, making the corridor appear more open. The power line which parallels Highway 191 several hundred yards in from the highway, would remain out of view from the highway corridor due to leave trees between the highway and power line itself. Given the current Highway clearing, the additional clearing would not appear substantially different. The visual result would meet the VQO of Partial Retention along Highway 191 due to incorporation of scenery design features for treatment of the edges and leave trees, and the fact that flat ground would prevent any visual dominance of lines other than the forest edge simply paralleling Highway 191 itself, as is basically already the case.

Views from forest access roads and recreation sites in the project area

Compared with the affects to viewers near and along Highway 287, the visual result of the thinning would be more visible to viewers in the foreground, along main access roads including Rainbow Point, Horse Butte, Cougar Creek, Whits Lake, Red Canyon, and Tepee Creek Roads, and in recreation sites. This would be true especially in the immediately after harvest operations conclude due to the impacts such as landings. Much of the forested areas along project area roads and recreation sites appear fairly dense, with leaning and down deadfall. Since these areas currently are so dense, they would look very different to viewers who are familiar with the area. These areas would appear more open post-harvest including more visibility of grass and understory shrubs and forbs. There are also areas along these routes that are meadows, providing occasional "break outs" from the dense lodgepole forest. By implementing the scenery design features for leaving the largest or healthiest trees, grouping trees, transitioning into un-thinned or naturally open areas, the thinning treatments would not become visually dominant for casual observers. See Figures 19 and 20 below. Where tall spindly lodgepole trees form walls or are adjacent to younger fuller trees, they accentuate old harvests. Since some of those old lodgepole trees would be thinned or removed, along with some of the younger trees, the visual effect of that contrast would be reduced or eliminated.

In the case of the units in view of Highway 191 on Tepee Road (155 and 210), these units would meet Retention with scenery design features as well due to the transitions. The stands are fairly open now because they are a transition area from open aspen stands to conifer forest. As a result, changes in tree density would not be very evident from the Highway. Foreground views would not be apparent from the highway *because of the topographic separation from the highway to the area where activity would occur.*

Figure 19 Example of small groups or clumps.

Figure 20. Example of feathered thinning shortly after harvest. For the North Hebgen project the transitions would be more gradual making the change in stand density less apparent.

Dense Douglas fir and mixed conifer stands common in Whits Lake, Horse Butte, and Red Canyon vicinities that generally have crowns that are fuller than lodgepole pine, would become more open and park-like, and viewers would be able to see more of the trunks and farther into the forest than now. Aspen would become more visible, accentuating color differences with its white bark, bright green leaves in spring/summer, and golden leaves in fall. These forest types are often more open, so this change would be characteristic of Douglas fir, aspen and mixed conifer transition areas. The visual result would meet the VQO of Partial Retention (or Modified as in the case of the units north of Whits Lake Road) due to incorporation of scenery design features for treatment of the edges and leave trees because visual lines between treated and un-treated stands would not be dominant *within a year*.

From Rainbow Point Campground/Boat Launch and Horse Butte Lookout Picnic Site, VQO's and Management Area 1 standards for developed recreation sites would be maintained due to a wide variety of project design and mitigation measures to maintain and protect "the campground". These impacts are addressed in the recreation section. Similarly, project design would also prevent the recreation sites and other private improvements/structures from becoming visually dominant to boaters on Hebgen Lake.

The standard for areas with a "modification" VQO is that the treatment should appear as a natural occurrence when viewed in the middle or back ground. The areas with a "modification" VQO are Tepee, not in view of Highway 191, above the Witts Lake Road and the areas in the Flats not visible from the roads or the lake. Due to topography or lack of key observation points these treatments would not be apparent as a mid or background view from any key observation points.

The section detailing applicable design features identifies several practices to revegetate skid trails, landings, burn piles and temporary roads, in particular the approaches. Approaches are the locations where these features meet the main road. The impacts associated with these activities would be minimized through placement and effective and timely revegetation. Landings tend to be the most impacted area. In all areas where there would be harvest operations, there would be some skid trails and temporary roads visible in the short term in the foreground. Landings for temporary decks, equipment or possibly some slash piles, in most areas, would be located away from main travel corridor roads, thus minimizing visual dominance to viewers. In some areas the only locations to have landing would be by

the main access roads. Temporary landings adjacent to roads would not be visually dominant in the long term for a few reasons: 1) placement of landings would avoid steep areas so no cutting, filling or grading would be necessary; 2) the adjacent thinning and edge treatment would reduce the visual dominance of the openness of the landing; 3) after all hauling and piling is completed, the landings would be scarified and seeded; 4) the area directly underneath landing piles that would eventually be burned, would be monitored to ensure that no large unburned materials remain visually dominant and that the area is re-vegetating properly. These areas would be monitored closely to ensure timely restoration.

The foreground is typically not visible from key observation areas in the areas with the highest visual standard because of the distance from the key observation point to the activity, such as from the Highway 287 or the Lake. Regardless, in the foreground project related activities would not be evident to the casual observer within one year of project completion due to design features that ensure placement that minimizes impact and timely restoration of skid trails, landings and temporary roads as described above. Restoration would begin immediately in treatment areas allowing multiple seasons for the restoration to take effect while the project progresses.

Cumulative impacts result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. The direct and indirect impacts of the proposed action would be mitigated. The existing condition takes into account past activities that have impacted the scenery. There are no known foreseeable activities that would alter landscape character or scenery. There are ongoing activities such as recreation use and small scale habitat projects occurring but they do not impact landscape character. The visual quality of the area as it stands, meets the desired visual quality objectives, the impacts of the project would be mitigated and there are no known foreseeable landscape altering activities, as a result, potential cumulative impacts would be minimal or nondiscernable.

Alternative 2 – Summary

Alternative 2 is most proactive at maintaining desired species on the landscape (aspen and Douglas Fir) and reducing the risk of spread of large stand replacing fire which is often perceived as undesirable to forest users. Longer term impacts such as changes in forest stand density would be characteristic of this forest type in more vigorous forest communities. There would be short term effects on scenery from the described view corridors to the casual visitor as a result of harvest operations, temporary roads, landing/burn piles. Alternatives 2 would impact the most view corridors in retention and partial retention areas but impacts would be very similar in all action alternatives. Since the proposal would incorporate design features to mitigate potential negative effects to scenery throughout the project area, Alternative 2 would meet Forest Plan standards for scenery within a year of project completion. Alternative 2 has the most treatment close to the Forest boundary near private land near Horse Butte altering the current condition. Some homeowners would like the area next to their property to remain as is, but forests are dynamic and forest management is a compatible and emphasized activity in this area. Restoration measures are planned to minimize effects. The visual quality objectives would be met or exceeded in this area along the forest boundary.

Alternative 3 - Summary

Alternative 3 is least proactive at maintaining desired species (Aspen and Douglas fir) on the landscape and reducing the risk of large stand replacing fire which is often perceived as undesirable to forest users. The vegetative changes and short term impacts from landings, temporary roads and landing piles are similar to alternative 2 except that there would considerably less treatment on Horse Butte and near Fir Ridge. See Table 25 for more specifics. The proposal would incorporate design features to mitigate potential negative effects to scenery throughout the project area, as a result, Alternative 3 would meet Forest Plan standards for scenery within a year of completion. Alternative 3 has the least treatment adjacent to private land south of Rainbow Point Campground leaving the current condition, as desired by

some homeowners. Restoration measures are planned to minimize effects. The visual quality objectives would be met or exceeded in this area along the forest boundary.

Alternative 4 - Summary

Alternative 4 is less proactive than 2 at maintaining desired species on the landscape and reducing the risk of large stand replacing fire which is often perceived as undesirable to forest users but more effective than Alternative 3. The vegetative changes and short term impacts from landings, temporary roads and landing piles are similar to alternative 2 except Alternatives 4 would treat fewer acres on Horse Butte and Fir Ridge. See Table 25 for more specifics. The proposal would incorporate design features to mitigate potential negative effects to scenery throughout the project area, as a result, Alternative 4 would meet Forest Plan standards for scenery. Compared to alternative 2, activity would be reduced adjacent to private land south of Rainbow Point Campground addressing concerns by some homeowners that their sense of place would change. The treatment is limited to powerline clearing along this private boundary for this alternative which is more activity than in alternative 3 but less than 2. Restoration measures are planned to minimize effects. The visual quality objectives would be met or exceeded in this area along the forest boundary.

Table 25. Differences between the Action Alternatives for Scenery in areas that are in View Corridors

Geographic Area	VQO / View corridor	Alternative 2	Alternative 3	Alternative 4
Fir Ridge	Retention / View from Hwy 191	Units 147 (99 acres), 148 and 149 included.	No treatment at Fir Ridge	Unit 147 (50 acres), 148 and 149 treated
Whit's Lake Road	Retention / View from 287 (below FSR 971)	Unit 144 included	144 not included	144 not included
Horse Butte	Retention / View from US 287 and the Lake	Includes units 1-10	Includes part of units 6-10	Includes all or part of units 1-4, 6-10
Red Canyon	Partial retention / View from US 287	Unit 127 included	Unit 127 excluded	Unit 127 excluded
Highway 191	Partial retention / View from 191	Unit 36 and 41 included	Unit 36 and 41 excluded	Unit 36 and 41 excluded

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans and Other Disclosures

Forest Plan Standard (II-17) - Environmental analysis and project designs for landscape altering activities would be evaluated to determine if they are compatible with the assigned VQOs. Landscape altering projects shall meet the assigned VQOs, or in locations where the existing situation does not meet the VQO, shall not further degrade the visual condition. (GFP amended 2015) A visual quality objective is "A desired level of scenic quality and diversity of natural features based on physical and sociological

characteristics of an area." [VQO] Refers to the degree of acceptable alterations of the "characteristic landscape." All three action alternatives would be compatible with Forest Plan Visual Quality Objectives (VQO's) by implementing the prescribed design features and mitigations common to all action alternatives. It is important to note that the VQO's are geared toward the "casual" forest visitor. People who are frequent visitors or who own property and thus know the landscape intimately would be able to recognize where forest management activities take place more readily. It is also important to reiterate that the VQO's refer to the degree of acceptable alterations from the characteristic landscape and not from the existing condition. Forest VQO's are applicable from major view corridors described earlier. They are not intended to be applied to every dispersed acre of National Forest System lands where there could be a treatment unit, from private land, nor are they applicable from Forest System trails.

Conclusion

As described in this analysis, the alternatives would result in change to the look of the vegetation but the change is compatible with the characteristic landscape, in part because of the design features, and in part due to the fact that many of the stands are overly dense. The measure for impacts to scenery is focused on landscape character rather than the existing condition, recognizing that vegetation is a dynamic resource and does not remain unchanged over time, under any circumstance.

The action alternatives would help to reduce (though not eliminate entirely) risk of large portions of the view shed in the project area being affected by a crown fire by affecting fire spread which is often perceived as undesirable. They would increase aspen presence which is visually desirable. A number of design features would be incorporated into all action alternatives to ensure that human activities remain subordinate or not evident **from key viewpoints** within a year after project completion. These locations include areas that are in view of the Lake, Highways 191 and 287, Rainbow Point County Road and primary forest access roads. The design features include forest cover transitions, retaining cover to avoid making structure and improvements more visible from the lake and winter logging in sensitive areas to minimize surface disturbance. Placement of landings, skid trails and landing piles would take advantage of natural features and includes practices that minimize visual exposure in view corridors. Soils and water best management practices and invasive weed mitigation would provide for effective and timely revegetation of skid corridors, slash piles, landings and temporary roads, as well as closure. As a result, restoration from key observation points in retention and partial retention areas would be assured.

Monitoring of the mitigation is included and would be important to help evaluate whether additional restoration measures would be needed, especially in the areas with a higher visual standard. Earlier photos show application of some of the mitigation. The proposed mitigation has been successfully incorporated in many projects on the forest. The Forest continues to learn from implementing other projects and as a result, has modified some practices such as increased clumping in lodgepole pine stands. Soil and weed mitigation has been refined for this project to improve reclamation success based on past monitoring.

The scope of impacts extends no further than the background view of the proposed treatment area. In the mid-ground and background, there would be changes to the vegetative character as it relates to scenery but those impacts would represent the characteristic landscape after implementation. More noticeable impacts, such as disturbance associated with skid corridors and temporary roads would be the short term and not eveident to the casual forest observer wthin a year after project completion. For these reasons scenery impacts would be limited in magnitude and duration, and would therefore be insignificant.

Other Issues Considered

Air Quality

This information is summarized from the North Hebgen Multiple Resource Project *Air Quality Report (Dzomba 2015)* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific resource protections related to Air Quality are listed in Appendix A - Design Features Common to Action Alternatives.

The Smoke Impact Spreadsheet model was used to assess potential smoke impacts from pile burning activities associated with the North Hebgen Project. Model results predict that no significant impacts to human health are anticipated from burning activities associates with this project. $PM_{2.5}$ concentrations would fall below the 35 $\mu g/m^3$ 24-hour National Ambient Air Quality Standard (NAAQS) within 0.5 miles of the burn location for all pile burning activities anticipated for this project. Short term impacts would likely be to residents living near burn locations and nuisance impacts such as reduced visibility across highways. There is potential for smoke to intrude into Yellowstone National Park but significant visibility impacts are not expected due to the short-term duration of any smoke intrusions. Other sensitive receptors within 50 miles of a burn are not likely to be impacted by smoke.

The greatest potential for cumulative effects would be smoke from pile burning mixing with residential wood smoke. Any impacts due to these potential cumulative impacts would likely be localized in nature and insignificant.

As disclosed, the context for potential impacts is local and the duration is short term (generally less than 24 hours). Anticipated emission would be consistent with Clean Air Act (CAA) standards and visibility impacts would be limited to nuisance levels within .5 miles. The Custer Gallatin National Forest would cooperate with the Montana Department of Environmental Quality (MTDEQ) Air Quality Bureau and meet the requirements of the Montana State Implementation Plan. The Environmental Protection Agency (EPA) has delegated CAA compliance authority to the state of Montana, under the auspices of MTDEQ. Thus, compliance with state environmental laws and regulations also satisfies compliance with the federal CAA and local Forest Plan requirements tied to the SIP and CAA. The CAA and associated regulations were developed to ensure protection of public health and safety. For these reasons all applicable requirements/direction would be met and there would be no significant impacts to air quality from the action alternatives.

Aquatic Species

This information is summarized from the *North Hebgen Multiple Resource Project Aquatics Report* (Roberts 2015) which includes information related to Fish, Amphibians and Mussels. The full report is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific resource protections related to Aquatic Species are listed in Appendix A - Design Features Common to Action Alternatives.

Affected Environment

Effects analysis will focus on Red Canyon, Little Tepee and Tepee Creek for fisheries and the Flats for amphibians for the reasons disclosed in Table 26. The analysis areas include: Red Canyon, Johnson Canyon, Lower Grayling, Tepee Creek, Little Tepee, Closed Basin, and The Flats.

Figure 21. North Hebgen Multiple Resource project area and seven analysis areas for fisheries, amphibians western pearlshell mussel and Water Quality.

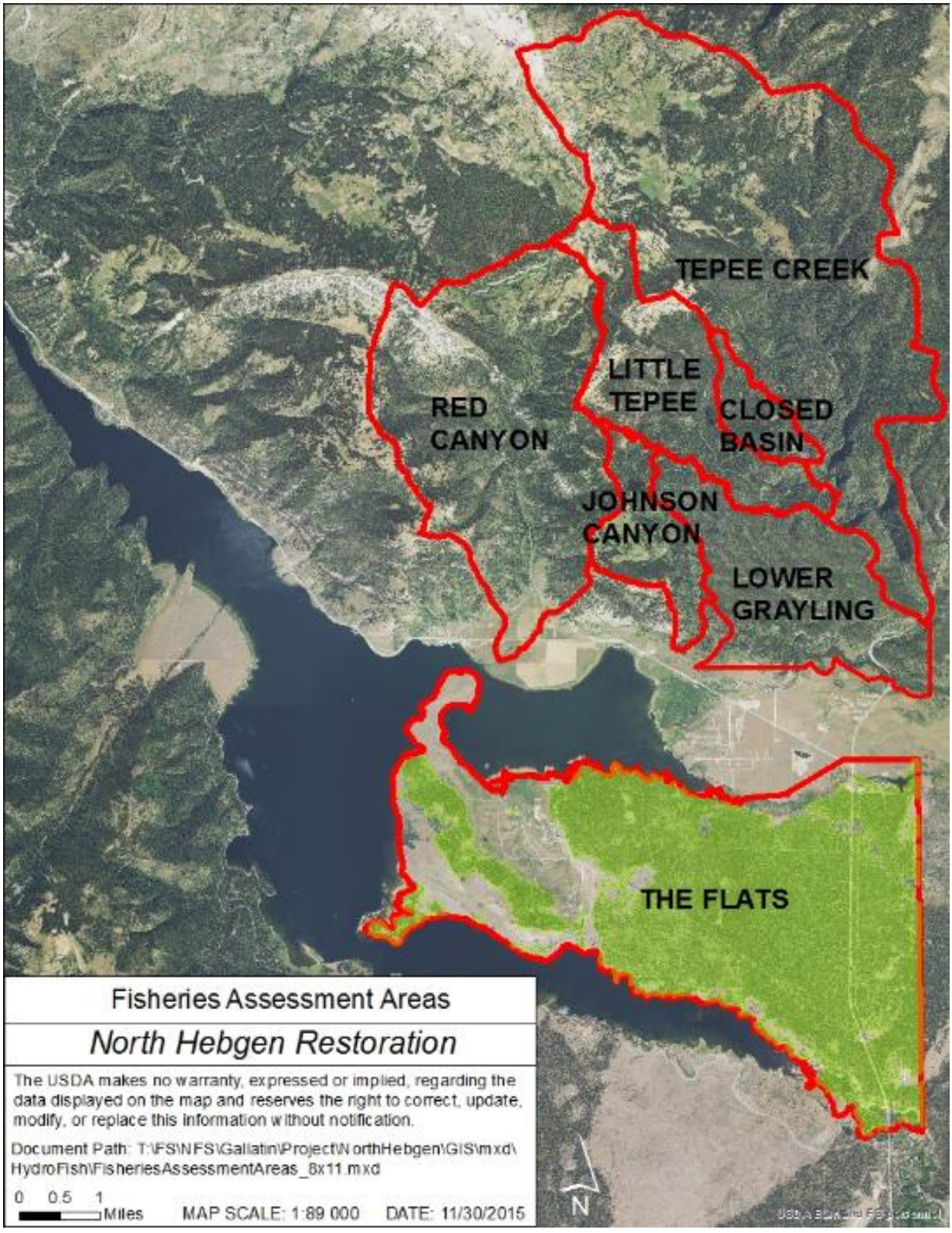


Table 26. Summary of analysis areas dropped from further discussion.

Analysis Area	Resource Area	
	Fisheries	**Amphibians and Mussels**
Red Canyon	See report for analysis	Because of the more varied and steeper terrain, generally less vehicle traffic, protected, wetlands, and no proposed complete overstory removal treatment units, no specific mitigation measures were proposed to protect western toads within any of these six analysis areas. It is believe that direct, indirect and cumulative effects to western toads would be minimal and similar between alternatives and analysis areas.
Johnson Canyon	There are no fish occupying any streams within the analysis area until you reach Hebgen Lake.	
Little Tepee Creek	See report for analysis	
Closed Basin	There is no surface outlet connecting the Closed Basin analysis area to other downstream analysis areas.	
Tepee Creek	See report for analysis	
Lower Grayling	The impacts from proposed upstream activities are already captured at the mouth of Little Tepee Creek and Tepee Creek. Impacts would not be measureable along Grayling Creek. All treatment units within the Lower Grayling analysis area are along dry draws and swales with no surface water connection to fish bearing streams.	
The Flats	There are no flowing streams within the analysis area with the exception of lower Duck Cr and lower Cougar Cr. The soils are very porous. Terrain is flat. Creeks are well buffered through design features.	See report for analysis

Direct and Indirect Effects

Fisheries

Alternative 1 – No Action

Sediment delivery and instream spawning sediment would be expected to remain constant. The baseline condition is what disclosed in Table 27.

Hebgen Lake should continue to be a mecca for all amphibian species. Loose soils, healthy riparian zone, protected bays, isolated oxbow ponds and slow and controlled reservoir drawdowns make for stable habitat conditions for all amphibians. The operation and maintenance of Hebgen Dam and other Madison Rivers hydro-electric facilities have been managed under FERC License 2188 since 2000 (FERC 2000). There are no proposed amendments to this license that would alter habitat quality for amphibians using the shores of Hebgen Lake for breeding purposes. Current management of Hebgen Lake is expected to continuously provide for a stable environment for western toads, plains spadefoots and other amphibians.

Overstory vegetation removal could result from natural disturbance such as wildfire or insect or disease related mortality. Vehicle traffic would be expected to remain constant. Incidental amounts of slash burning would continue from other ongoing activities.

Generally speaking, climate change presents a threat to aquatic habitat with projected effects on water temperature and quantity. Recent warming has already driven significant changes in the hydroclimate, with a shift towards more rainfall and less snow in the western U.S. (Knowles et al. 2006). Likewise, the peak of spring snowmelt is two weeks earlier in recent years, and this trend is anticipated to continue (Stewart et al. 2004). Probable effects of climate change in the western U.S. will be increased water shortages and warmer water temperatures. These conditions may further restrict distribution of cold water dependent species such cutthroat trout (Williams et al. 2009) while increasing distribution of

species more tolerant of warmer temperatures such as brook trout and brown trout (Rahel et al. 2008). In addition, changes in timing of spring runoff and temperature may alter spawning cues that have maintained temporal segregation of native and nonnative species. However, in areas of topographic variability such as those within the project area, local responses are highly variable (based on flow regimes, topography, and geology), and current climate models cannot reasonably predict responses at a practical scale. The past and present effects of climate change on project area fish habitat and populations are reflected in the existing condition. Within the 8-12 year timeframe for projected implementation for this project, ongoing effects of climate change are not expected to significantly alter baseline habitat conditions or conditions under the no action or the action alternatives.

Alternative 2 – 4

Because of treatment unit layout and design (See Appendix A - Aquatic Design Criteria and Mitigation Measures), it is expected that the proposed project would not have any negative effects to local fish populations from changes to water temperature, stream bank stability, riparian cover and large woody debris recruitment. As a result, the entire effects analysis for fisheries will be based on sediment delivery. All stream channels (both perennial and intermittent) would be buffered by at least 50 feet with the exception of those stream channels within the Little Tepee Creek analysis area which would be buffered by at least 150 feet. As a result, these listed effects will not be discussed any further. A discussion on water yield augmentation is included in the water report.

Typically within mountainous landscapes, drainage networks are dendritic in nature, meaning that smaller tributaries flow together to form larger tributaries which flow together with other tributaries of similar size. Dendritic drainage networks are often well connected with surface flow. Because of volcanic activities within the larger Yellowstone area, much of the drainage network within the various analysis areas throughout the North Hebgen Multiple Resource project area do not express this typical dendritic pattern. Adding in the very porous natural of the soils (or increased infiltration), many of the smaller dry drainages or swales do not have defined stream channels or surface flow connection with tributaries. Several of the smaller drainages have surface flow but they are often truncated at terminal ponds with only ground water connection to the larger tributaries. The majority of the analysis areas, with the exception of the Red Canyon and Johnson Canyon, are characterized by poorly connected drainages.

WATSED model (Cline et al. 1981), Fish/Sediment model (Stowell et al. 1982), and Sediment/Survival curves (Irving & Bjornn, 1984) were used to assess the relative magnitude and direction of incremental change between alternatives. It is assumed that a lack of a dendritic drainage network and surface water connectivity that the model results are elevated within a portion of the analysis areas. White (2015) estimated that 30% of the drainage paths in the vicinity of Little Tepee Creek consist of vegetative swales with debris and lacking the structure or materials that characterize stream channels likely providing an extremely effective filter for water entrained sediment. Both the magnitude and direction of the model results will be displayed, but the results will be qualified based on local knowledge of specific drainages to better predict environment consequences related to sediment delivery.

Both the R1/R4 sediment delivery and Fish/Sed model (Stowell et al. 1983) are very simplified approximations of complex natural processes that affect sediment production and fish embryo survival, due to the models inability to predict all aspects of natural variation associated with sediment delivery and routing. Because of this, resulting values are not considered definitive or absolute; rather they are used only to evaluate the relative magnitude and direction of incremental change in spawning habitat and as a means to make relative comparisons between alternatives and indicate consistency with standards.

Table 27. Baseline conditions for Alternative 1 and projected changes from Alternative 2-4 for instream fine substrate sediment for Red Canyon, Little Tepee and Tepee Creek analysis areas

Parameter		Red Canyon	Little Tepee Creek	Tepee Creek
Reference Sediment Yield (tons/yr.) (White 2015)		309.9	93.4	322.3
Existing Sediment Yield (tons/yr.) (White 2015)		313.5	98.7	328.1
Alternative 1	Percent above Reference (White 2015)	1.2%	5.7%	1.8%
	Instream fine substrate sediment (% > 6.3mm)	28.5%	34.1%	21.3% /[a]
Alternative 2	Percent above Reference (White 2015)	3.3%	25.0%	7.4%
	Instream fine substrate sediment (% > 6.3mm)	29.0%	38.7%	22.6%
Alternative 3	Percent above Reference (White 2015)	2.9%	24.3%	7.3%
	Instream fine substrate sediment (% > 6.3mm)	29.0%	38.6%	22.6%
Alternative 4	Percent above Reference (White 2015)	3.3%	24.3%	7.3%
	Instream fine substrate sediment (% > 6.3mm)	29.0%	38.6%	22.6%

Red Canyon

Red Canyon Creek is a more typical mountainous drainage network with a dendritic pattern of connected streams. As a result, the WATSED model (Cline et al. 1981) most likely projects changes to sediment yield more accurately, as compared to the less connected drainage networks described for Little Tepee Creek and Tepee Creek analysis areas. Expected fine substrate sediment levels in all alternatives would slightly exceed the Travel Management Plan Standard (E-4). Alternative 2 and 4 levels would be the same and alternative 3 would be similar. High reference sediment levels are attributable to sediment from the fault reach from the 1959 earthquake.

Little Tepee Creek

The WATSED model projects a 19.3% increase in sediment yield from 5.7% to 24.7% within the Little Tepee Creek analysis area, see Figure 21. The model doesn't allow turning off disconnected sub-drainages or swales with high infiltrating or porous soils. Based on this condition, a large portion of projected sediment yield increase would be trapped and stored before sediment reaches Little Tepee Creek. The small draws draining treatment units 200, 201, 202, western edge of 203 and northern edge of 198 are of such shape that sediment would not be transported downslope to perennial waters. The same is true for a large portion of the treatment units located adjacent to the FS Road #2527. These drainages are characterized as dry swales, very porous soils, no identifiable stream channel, and abundance of under story vegetation and large woody debris. The lower treatment units including 180, 181, 177, 176, 174, 172, and 173 have wide untreated green buffers by design, between the lower edge of each of the treatment units and Little Tepee Creek. Treatment unit 185 by design was converted from a ground base treatment unit to a hand treatment unit to avoid disturbance to the road cut and fill slopes along FS Road #

986. This leaves treatment units 199, the northern portion of 196, and 197. To mitigate project generated sediment from these three treatment units and associated hauling along FS Road # 986, all alternatives would include spot graveling four sediment contributing reaches of road. Based on very specific on-the-ground knowledge, design features, and mitigation measures, it is believed that sediment delivery would be negligible to Little Tepee Creek and would protect the downstream westslope cutthroat trout fisheries. High reference levels of fine sediment are attributable to natural erosive geology, even so, the conditions remain suitable for fish.

The effects of Alternative 3 and Alternative 4 would be similar to Alternative 2 with the exclusion of treatment units 201 and 189 and associated temporary road (Table 27). The modelled change in percent above reference would decrease from 25.0% to 24.3% which equates to 0.2% improvement in instream spawning sediment.

Tepee Creek

The northeastern portions of treatment units 203 and 198 and southwestern portion of 204 drain into a terminal pond located within the Closed Basin analysis area. There is no surface flow connecting the unnamed tributary within the Closed Basin analysis area and the main stem of Tepee Creek. The remaining portion of 204, all of 205, 207, 206 and 208 drain directly into Tepee Creek via a couple of small fishless streams. Instream sediment levels within the Tepee Creek near the confluence of these two fishless streams appear to be very similar to Grayling Creek as reported by Watschke (2006). Travel Management Plan Standard (E-4) would be met within the Tepee Creek analysis area. Percent above reference, instream spawning sediment and embryo survival are the same for all three action alternatives.

Amphibians

The direct and indirect effects for amphibians, primarily western toads, would vary considerably depending on which of the seven analysis areas. The six northern analysis areas including Red Canyon, Johnson Canyon, Little Tepee Creek, Closed Basin, Tepee Creek and Lower Grayling (Figure 21) are characterized by the presence of numerous scattered ponds, lakes and wetlands. Western toads are presumed present within these analysis areas but at a much lower density as compared to The Flats analysis area located immediately adjacent to Hebgen Lake.

Because of the more varied and steeper terrain, generally less vehicle traffic, riparian protection, and no known breeding sites, no specific mitigation measures were proposed to protect western toads within any of these six analysis areas. Direct, indirect and cumulative effects to western toads would be minimal and the same between alternatives.

The Flats analysis area is rich with western toads and other amphibians. There are numerous breeding sites around the entire Hebgen Lake from the dam all the way up to the confluences with the South Fork Madison River, Madison River, Duck Creek and Grayling Creek. It is thought that loose soils, healthy riparian areas, protected bays, isolated oxbow ponds and wetlands, and slow and controlled reservoir drawdowns make for stable habitat conditions for all five amphibians. There are three known western toad breeding sites adjacent to several of the proposed treatment units (Rainbow Point, Savage Bay, and Horse Butte Peninsula).

In the spectrum of animals, there are many species including the western toads that rely on producing as many offspring with each having a relatively low probability of surviving to adulthood. These animals are classified as r-strategists. When dealing with r-strategist species, it is difficult to know how many of their off spring need protecting without causing harm to the population. For trout, which is also considered an r-strategist, it has been reported that 90% of the young-of-the-year fry die naturally each year. The survival strategy allows for loss of offspring.

Three potential impacts could be a concern in the Flats Analysis area. A change in vegetative structure to the point that both thermal and moisture conditions are altered. Western toads use terrestrial habitat in ways that allow them to conserve body water (Bartelt et al. 2004). It has been shown that western toads tend to avoid clear cuts (Bartelt et al. 2004). There is one regeneration treatment units (# 226) adjacent to the three larger breeding sites (Rainbow Point, Salvage Bay, and Horse Butte Peninsula) and that might cause western toads to change their migration patterns to and from their breeding areas as a result of changes to thermal and moisture conditions. Western toads have been shown to migrate around treatments that have resulted in lower humidity. Treatment unit # 77 would include several small group select sub-units basically equating to one to three-acre mini-clearcuts which might result in minor deviation to migration patterns. There would be a minimal number of regeneration harvest near breeding sites. Western toads have been shown to migrate around treatments that have resulted in lower humidity. This ability of toads and toadlets to adapt migration routes would limit potential impact.

There would be an increased the risk of direct mortality to individuals from burning and heavy equipment. Western toads have been shown to use slash pile for their hibernacula (Bartelt et al. 2004) and road prisms of for basking and feeding (Bryce Maxwell, personal communications). A low level of vehicle related mortality is inevitable when western toad distribution overlaps with open roads. The primary mechanism to reduce or eliminate project related mortality from vehicle traffic is to incorporate implementation design criteria to reduce traffic along of opened temporary roads during dusk and dawn periods. Blocking access with movable barricades to temporary project roads at the end of daily work shifts would be effective in keeping non-project vehicles off the temporary roads during dusk and dawn hours.

There would be potential increases in mortality from burning project created slash and slash piles. The primary mechanisms to reduce or eliminate such project related mortality is to implement specific design features such as moving slash away from high density breeding sites and travel corridors or protect landing piles to prevent hibernating. It has been shown that western toads use larger slash piles for their winter hibernacula. Dirt and needles associated of the larger landing piles are thought to increase the insulation value as compared to smaller hand or mechanical piled slash. Fencing off larger landing piles would avoid the loss of individuals in the near vicinity of the three breeding sites by preventing hibernation in the large piles. It is believed that toadlets stay within ¼ mile of their natal breeding sites their first winter. As a result, fencing greater than 1/3 mile would be unnecessary.

There would be an increased risk of indirect mortality from soil compaction. Plains spadefoots burrow down within the loose obsidian sands spending the majority of their life underground. Soil compaction could potentially cap their egress routes up to their terrestrial environment leaving them trapped. As their name implies, plains spadefoots normally live in the plains away from timber. This issue of entrapment is undocumented within available science only speculated. Effects would be minimal because only a small portion of treatment units 20 and 32 fall within what is considered occupied habitat and soil protection BMP’s are included that would limit compaction.

Increased erosion and frequency of landslides is not an issue because of flat terrain and porous soils associated with the obsidian sands in the Flats analysis area. The concern would be increased sediment burying western pearlshell mussel beds or negatively affecting an individual’s ability to filter food or a combination of events that could destabilize stream channels enough to cause bedload movement crushing these immobile organisms. Known western pearlshell mussel beds exist within the project area along Duck Creek and Madison River. It is likely that there are also beds along lower Cougar Creek. Again, due to flat terrain and porous soils in these areas, this is not a concern. Pearlshell mussels would remain constant regardless of the action or non-action alternatives being considered under the North

Hebgen Multiple Resource Project because nothing is planned that might cause stream channel instability or excessive sediment delivery covering beds of mussels.

A large portion of the treatment units closer to Hebgen Lake are pre-commercial thin units implemented by hand or machine and would include smaller and cleaner slash piles. These treatments would not be a concern because changes to thermal and moisture conditions would be minor and the smaller cleaner slash piles would not offer desired conditions for hibernation.

Design features would be included in all action alternatives to protect as many western toads as possible. The inclusions of these protective measures, although untested, have been agreed to by the various Forest Service and Montana Natural Heritage Program resource specialists. The overall objective of these mitigation measures is to keep a strong thriving population strong while minimizing mortality to individual toads and toadlets.

These measures are common to all action alternatives. As a result, there would be no difference between the action alternatives. With or without the inclusion of these mitigation measures, it is believed that western toads would thrive throughout Hebgen Basin (Hebgen Lake and adjacent drainages) not changing their population trend or trajectory.

Cumulative Effects

Alternatives 2-4

The predicted cumulative impacts would be the same or very similar for alternatives 2-4. The R1/R4 sediment modeling was run in a cumulative mode accounting for all roads (existing, previously decommissioned and proposed temporary), previous and proposed timber harvest, previous and proposed prescribed and wild fires, and residential and recreational developments in the analysis drainages (White 2015). This model does not take into account some on-going activities such as livestock grazing on the Whits l

Lake Horse Allotment. Of the current, past and reasonably foreseeable activities listed in the specialist report, a number of ongoing activities and a few new activities could increase sediment delivery above what is already modeled but the combined effect with the proposed actions would be negligible for the following reasons: most of the activity is ongoing and has not resulted in sediment increases, the projects and ongoing permitted activity are generally regulated by permits that incorporate BMPs and needed protective measures. The Hebgen Lake Ranger District would continue to identify and remedy/mitigate any new developments that threaten to impact water quality in the future. Therefore, a combined effect with the proposed actions would be negligible and localized.

Two activities in upper Tepee are planned that would result in an overall reduction of road-related sediment in the watershed. Decommissioning of the two roads in Upper Tepee watershed would involve minor, temporary, and localized ground surface disturbance having negligible effects at the watershed scale. Therefore, a combined effect with the proposed actions would be negligible. However, road decommissioning would result in an overall reduction of road-related sediment in the watershed.

A Tepee trailhead project would include replacement of an old, undersized culvert with a new bridge. Flood conveyance capacity would be greatly increased at the site and the potential for culvert blockage eliminated, which would greatly reduce the chances of road crossing failure (which is typically accompanied by the release of large quantities of sediment into the stream system). Thus, the project would provide long-term protection to Little Tepee Creek against a large sediment influx associated with a potential road crossing failure at this site. The construction would involve minor, temporary, and localized ground surface disturbance and work within the stream channel and would require 404 and 124

permits. Construction BMP's imposed by the permitting agencies and internally by the CGNF would ensure that sediment is contained, stabilized, and is not released into the stream. BMP implementation will ensure this project would have negligible effects on water quality. Therefore, a combined effect with the proposed actions would be negligible.

For amphibians, there could be a cumulative increase in individual western toad mortality primarily related increased nocturnal traffic patterns for some of the activities but that is expected to be minimal due to mitigation associated with these activities that restricts overland travel. Further, the activities are ongoing and have not had a significant impact. Therefore, a combined effect with the proposed actions would be negligible.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans and Other Disclosures

The projected effects associated with sediment delivery from action alternatives 2-4 are very similar and would be difficult to measure the differences. Regardless, all action alternatives would meet Forest Plan standard A-12 Habitat for Regionally designated sensitive species on the Gallatin NF would be maintained in a suitable condition to support these species and A-14 stating that "the Forest will be managed to maintain and, where feasible, improve fish habitat capacity to achieve cooperative goals with Montana Fish, Wildlife and Parks and to comply with State water quality standards." The effects associated with each of the three action alternatives would: 1) have minimal impacts to westslope sensitive species, and would not cause a downward population trend staying consistent with the Forest Service's Sensitive Species Policy; 2) continue to allow for growth and propagation of salmonid fishes and associated aquatic life as required by the Clean Water Act; 3) maintain the quantity, function, sustainable productivity, and distribution of aquatic resources for increased recreational fishing opportunity by evaluating the effects of Federally funded as required by Executive Order 12962; 4) protect all pure and slightly introgressed (90% or greater purity) westslope cutthroat trout populations as required by Memorandum of Understanding and Conservation Agreement (MOUCA) for Westslope Cutthroat Trout in Montana (Powell 2002); and 5) have no measureable negative effects on populations of Management Indicator Species, because the project was designed in a manner, including mitigation measures, that would result in minimal changes to habitat suitibility for either amphibians or fish. Forest Plan level monitoring would continue at the programmatic level.

Instream spawning sediment levels in Red Canyon and Little Tepee creeks have been projected to exceed Travel Management Plan Standard (E-4) for Class A streams. However, a site specifc Travel Plan Amendment is included in the proposed action to allow project activities despite current levels of fine instream sediment.

A comparision study between Little Tepee Creek and an unnamed tributary to Tepee Creek indicated that there is a higher level of sediment related impairment along the unnamed tributary within the Madision Inventoried Roadless Area. Additional habitat survey data indicates that habitat parameters along Little Tepee Creek, especially those parameters closely related to sediment deposition, are similar or better than the unroaded reference reach. Monitoring indicated that the exisiting habitat conditions along Little Tepee Creek are not a result of past timber harvest and associated activities. Because of site specific knowledge, it is believed that the majority of the model predicted sediment would not reach Little Tepee Creek as a result of various routing obstacles previously discussed. With or without the implementation of the action alternatives, the recently introduced population of westslope cuutthroat trout would continue to increase in population size and continue to occupy the once barren habitat upon which they were placed. The design features and mitigation measures are such that any of the action alternatives would have minimal impacts on the existing westslope cutthroat trout population and as a result would meet the intent of Forest Travel Management standards for instream fine sediment to minimize sediment delivery while maintaining quality habitat.

Although slightly elevated above Travel Management Travel standard for protecting spawning tributaries to Blue Ribbon Fisheries, changes to instream sediment level are expected to increase slightly along Red Canyon Creek. Based on the facts that: 1) projected instream sediment increases are slight between three action alternatives; 2) few lacruatrine trout use Red Canyon Creek for spawning; and, 3) the high level of natural sediment delivery from the upstream fault that totally masks projected project generated sediment delivery, the project would meet the intent of Forest Travel Management standards for instream fine sediment to minimize sediment delivery while maintaining quality habitat.

Project design and mitigation measures included in all action alternatives are such that any of the action alternatives would have minimal impacts on the existing habitat and the projected increases in fine substrate sediment would be insignificant. The integrity of the habitat would be maintained and the project would meet the intent of the Travel Plan standard, which is to minimize sediment delivery while maintaining quality habitat. The extent of potenital impacts would be limited in both magnitude and duration having no significant short-term or long-term impacts long-term

Biological Evaluation

Fisheries
Because the project area lays geographically outside the native range of Yellowstone cutthroat trout, Action Alternatives 2-4 would have "No Impact" on the species.

Implementation of all the Action Alternatives 2-4 would have a slight impact on the recently introduced westslope cutthroat trout population located downstream of the project area, primarily related to sediment delivery. Because of project design and mitigation measures built into all action alternatives to reduce sediment delivery from area roads, and knowledge of the local drainage network and routing, I conclude that the amount of project-generated sediment delivered, if any, would be much lower in quantity than what was predicted by WATSED model for Little Tepee Creek analysis area. Living in isolation without other non-native trout, abundant food, and quality habitat will help assure the long-term persistence of this population. These are the exact reasons why westslope cutthroat trout were introduced into Little Tepee Creek in the first place. Potential impacts to water temperature, stream bank stability, riparian cover and habitat and large woody debris recruitment would be avoided as a result of design features. The implementation of either of the three action alternatives "May Impact Individuals or Habitat (MIIH), but would not likely contribute to a Trend Towards Federal Listing or Loss of Viability to the Population or Species" for westslope cutthroat trout.

Amphibians
Because the project area lays geographically outside the native range of northern leopard frog, Action Alternatives 2-4 would have "No Impact" on this species.

Alternative 2 would result in the over story removal (regeneration harvest or group selection) on 338 acres within the larger 12,556 acre Flats analysis area of which 8,138 acres is currently forested toad habitat, which represents 2.7% and 4.2% respectively. The other two action alternatives are very similar to Alternative 2. These opened treatment units for the most part are scattered and not immediately adjacent to any of the three known larger breeding sites. Western toads most likely would avoid migrating through these areas during dry periods until ground temperature and moisture returns to pre-project conditions.

Individual western toads would be impacted by both vehicle/equipment traffic and burning of large landing piles. The high quality amphibian habitat surrounding Hebgen Lake including loose soils, healthy riparian areas, protected bays, isolated oxbow ponds and slow and controlled reservoir drawdowns would compensate for the loss of individual toads and toadlets. I conclude that the level of impacted individuals

would not be such that the entire Hebgen Basin population would decline. The implementation of either of the three action alternatives "May Impact Individuals or Habitat (MIIH), but will not likely contribute to a Trend Towards Federal Listing or Loss of Viability to the Population or Species" for western toads.

Plains spadefoot, a recently listed sensitive species on the Gallatin National Forest, inhabits a strip approximately 0.5 mile wide along southern and northern shores of the Madison Arm. There are three proposed treatment units (17, 20 and 32) within this strip of occupied habitat. Because of their life history requirement, few if any individuals would be directly impacted since they predominately come above ground on rainy periods. Operations generally cease during rainy periods to avoid soil damage. There is a slight chance that a few individuals might be entombed in the ground as a result of soil compaction related to heavy equipment. It is believed that the project impacts to plains spadefoot would be very minimal, if any at all. The implementation of either of the three action alternatives "May Impact Individuals or Habitat (MIIH), but will not likely contribute to a Trend Towards Federal Listing or Loss of Viability to the Population or Species" for plains spadefoot.

Pearlshell Mussel

Nothing is being proposed that would cause occupied stream reaches to become less stable causing harm to western pearlshell mussels. The projected increases in sediment delivery are not substantial that mussel beds would be entirely covered causing harm. It is believed that that the North Hebgen Multiple Resource Project would have "No Impact" on area western pearlshell mussels or their beds.

Climate Change/Carbon Flux

This information is summarized from the North Hebgen Multiple Resource Project *Climate Change and Carbon Storage Report (Seth et. al. 2016)* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. *The report was updated to provide an updated discussion of the current CEQ regulation regarding climate change as of August 2016.*

Overview of Issues Addressed

The importance of carbon storage capacity of the world's forests is tied to their role globally in removing atmospheric carbon that is contributing to ongoing global warming. Meaningful and relevant conclusions on the effects of a relatively minor land management action such as this on global greenhouse gas emissions or global climate change is neither possible nor warranted in this case.[8] Nevertheless, the Agency recognizes that global research indicates the world's climate is warming and that most of the observed 20th century increase in global average temperatures is very likely due to increased human-caused greenhouse gas emissions.

Forests cycle carbon. They are in a continual flux, both emitting carbon into the atmosphere and removing it (sequestration) through photosynthesis. The proposed actions being considered here may alter the rates and timing of that flux within the individually affected forest stands. These changes would be localized and infinitesimal in relation to the role the world's forests play in ameliorating climate change and indistinguishable from the effects of not taking the action. Regional, continental, and global factors related to forest's influence on global climate change are also briefly discussed to provide context for understanding the nature of these local effects.

[8] While huge advances have been made in accounting and documenting the relationship between greenhouse gases and global climate change, difficulties remain in reliably simulating and attributing observed temperature changes to natural or human causes *at smaller than continental scales* (IPCC 2007, pg. 72).

Public comments during scoping for the Project questioned the need for the project because climate and weather are more influential in fire control than fuel treatments. First, this proposal has several desired outcomes in addition to fuel reduction. Further the proposal is not intended to stop fire or eliminate catastrophic fire, which are often the kinds of fires that are influenced by a change in weather. For this project, the fuel reduction treatments are located to change fire behavior in key areas to reduce the risk to firefighter and public safety and property rather than to stop fire.

Another consideration raised was how climate change is impacting the project area. The NEPA requires an agency to take a hard look at the consequences of its actions on the environment, not the other way around. Evaluating the effects of climate change on the project area does not inform the decision maker about project impacts. For this project, in the different specialist reports, specialists write to the trends that are anticipated related to climate change for their resource if there are any associated trends. Further, during the Hebgen Duck Landscape Assessment (2013) and in the development of the proposed action, the interdisciplinary team carefully considered the existing conditions and trends within the area, as well as risks, in designing the proposal to achieve outcomes. Global climatic warming is not something that is about to happen. It has been ongoing for many decades and the trend is expected to continue into the distant future, continuing to increase risks to our nation's forests (Dale, et al. 2001; Barton 2002; Breashears and Allen 2002; Westerling and Bryant 2008; Running 2006; Littell, et al. 2009; Boisvenue and Running 2010, Hicke et al 2012). The existing project area conditions and trends are an expression of the local climate (which may or may not parallel ongoing regional, continental, or global trends) as it has interacted with the other local natural and anthropomorphic influences. As such, the ongoing effects of climate change were considered in developing the proposal.

This proposal addresses specific forest plan and national direction related to forest health (lodgepole, whitebark pine and Douglas fir forest), wildlife habitat (aspen & whitebark pine), and hazardous fuels conditions which represent the trends and risks that exist within the project area today. Nevertheless, those proposed actions are consistent with adaptation actions and strategies recommended for managing forests in light of climate change (Millar, et al. 2007; Joyce, et al. 2008; Ryan, et al. 2008a).

The top three anthropogenic (human-caused) contributors to greenhouse gas emissions (from 1970-2004) are: fossil fuel combustion, deforestation, and agriculture (IPCC 2007, p. 36). Land use change, primarily the conversion of forests to other land uses (deforestation) is the second leading source of human-caused greenhouse gas emissions globally (Denman, et al. 2007, pg. 512). Loss of tropical forests of South America, Africa, and Southeast Asia is the largest source of land-use change emissions (Denman, et al. 2007, pg. 518; Houghton 2005).

Unlike other forest regions that are a net source of carbon to the atmosphere, U.S. forests are a strong net carbon sink, absorbing more carbon than they emit (Houghton 2003; US EPA 2013; Heath, et al. 2011). For the period 2000 to 2008, U.S. forests sequestered (removed from the atmosphere, net) approximately 481.1 teragrams (Tg) of carbon dioxide per year, with harvested wood products sequestering an additional 101 Tg per year (Heath et al 2011)[9]. Our National Forests accounted for approximately 30 percent of that net annual sequestration. National Forests contribute approximately 3 Tg carbon dioxide to the total stored in harvested wood products compared to about 92 Tg from harvest on private lands (Heath et al 2011). Within the U.S., land use conversion from forest to other uses (primarily for development or agriculture) are identified as the primary human activities exerting negative pressure on the carbon sink that currently exists in this country's forests (McKinley, et al. 2011; Ryan, et al. 2010; Conant, et al. 2007).

[9] 1 teragram (Tg) = approximately 2.2 billion pounds

This proposal does not fall within, and is distinguishable from, any of these primary contributors of global greenhouse gas emissions nor is it similar to the primary human activities exerting negative pressure on the carbon sink that currently exists in U.S. forests, namely land use conversion. The affected forests will remain forests, not converted to other land uses, and long-term forest services and benefits will be maintained.

Affected Environment

Forests are in continual flux, emitting carbon into the atmosphere, removing carbon from the atmosphere, and storing carbon as biomass (sequestration). Over the long-term, through one or more cycles of disturbance and regrowth (assuming the forest regenerates after the disturbance), net carbon storage is often zero because re-growth of trees recovers the carbon lost in the disturbance and decomposition of vegetation killed by the disturbance (McKinley, et al. 2011; Ryan, et al. 2010; Kashian, et al. 2006).

The project area can be characterized as a patchwork of forest stands ranging from sapling and pole-sized alpine fir, lodgepole (LPP) and whitebark pine (WBP) to mature sawtimber dominated by LPP, alpine fir, Engelmann spruce and WBP. Generally most of these areas are stocked more heavily than desired as described in the Vegetation Analysis (Konen 2015), thus competition for water and nutrients is high and the trees in the area are more susceptible to drought, insects, disease, fire and competition for shade intolerant species. At this stage of their development, these stands are estimated to be net carbon sinks. That is, they are likely sequestering carbon faster than they are releasing it to the atmosphere. The strength of that sink has likely been weakened in some stands due to recent tree mortality from mountain pine beetle in WBP pine and LPP as well as, spruce budworm and Douglas fir beetle in Douglas Fir forest.

Direct Indirect and Cumulative Effects

Alternative 1 – No Action

There would be no direct human-induced emissions of carbon into the atmosphere under the No Action alternative. Forest stands would likely continue as carbon sinks until the next disturbance event (fire, wind, insect infestation, etc.) occurs. As discussed elsewhere, the risk of some high mortality disturbance events is greater under the no action alternative. The long-term ability of these forests to persist as a net carbon sink is uncertain (Galik and Jackson 2009). Drought stress, forest fires, insect outbreaks and other disturbances may substantially reduce existing carbon stock (Galik and Jackson 2009, Hicke et al 2012). Climate change threatens to amplify risks to forest carbon stocks by increasing the frequency, size, and severity of these disturbances (Dale, et al. 2001; Barton 2002; Breashears and Allen 2002; Westerling and Bryant 2008; Running 2006; Littell, et al. 2009; Boisvenue and Running 2010). Recent research indicates that these risks may be particularly acute for forests of the Northern Rockies (Boisvenue and Running 2010). Leaving areas of forest densely stocked, as in the no action alternative, maintains an elevated risk of carbon loss due to disturbance. Thinning, prescribed fire, and other management actions are often suggested as climate change "adaptation actions" because they may increase forest resilience to these multiple stresses, and thus increase the likelihood of sustaining forest carbon benefits in the long-term (Millar, et al. 2007; Joyce, et al. 2008; Ryan, et al. 2008b). The no action alternative foregoes such climate change adaptation actions.

Alternatives 2, 3 & 4 – The Action Alternatives

Direct and Indirect Effects

The proposed stand vegetation and fuel reduction treatments would reduce existing carbon stocks and temporarily reduce net carbon sequestration rates within treated stands, in some areas possibly enough that for the short term the stands would emit more carbon than they are sequestering. These stands would

remain a source of carbon to the atmosphere (or weakened sink) until carbon uptake by new and remaining trees again exceeds the emissions from decomposing dead organic material. As stands continue to develop, the strength of the carbon sink would increase, then gradually decline, but remain positive (Pregitzer and Euskirchen 2004). Carbon stocks would continue to accumulate, although at a declining rate, until impacted by future disturbances.

Sustaining forest productivity and other multiple-use goods and services requires that land managers balance multiple objectives. The long-term ability of forests to sequester carbon depends in part on their resilience to multiple stresses, including increasing probability of drought stress, risk of fire spread, and insect outbreaks associated with projected climate change. Management actions, such as those proposed with this project that maintains the vigor and long-term productivity of forests and reduce the likelihood of fire spread and insect outbreaks can maintain the capacity of the forest to sequester carbon in the long-term. Thus, even though some management actions may in the near-term reduce total carbon stored below current levels, in the long-term they maintain the overall capacity of these stands to sequester carbon, while also contributing other multiple-use goods and services (Reinhardt and Holsinger 2010).

Cumulative Effects

The action alternatives would not have a discernable impact on atmospheric concentrations of greenhouse gases or global warming, considering the limited changes in both rate and timing of carbon flux predicted within these few affected forest acres and the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities globally contributing to that pool.

Although not a statutorily defined purpose of National Forest System management, forests do provide a valuable ecosystem service by removing carbon from the atmosphere and storing it in biomass (Galik and Jackson 2009). U.S. forests are a strong net carbon sink, absorbing more carbon than they emit (Houghton 2003; US EPA 2013; Heath, et al. 2011). For the period 2000 to 2008, U.S. forests sequestered (removed from the atmosphere, net) approximately 481.1 teragrams (Tg) of carbon dioxide per year, with harvested wood products sequestering an additional 101 Tg per year. Our National Forests accounted for approximately 30 percent of that net annual sequestration. National Forests contribute approximately 3 Tg carbon dioxide to the total stored in harvested wood products compared to about 92 Tg from harvest on private lands (Heath, et al. 2011).

The total carbon stored on the Custer Gallatin National Forest is approximately 145 Tg, or about thirty-two one hundredths of one percent (0.0032) of approximately 44,931 Tg of carbon stored in forests of the coterminous U.S. (Heath, et al. 2011). The North Hebgen Multiple Resource Project would affect only a tiny percentage of the forest carbon stock of the Custer Gallatin National Forest (less than **.2**%), and an infinitesimal amount of the total forest carbon stock of the United States.

Within the U.S., land use conversions from forest to other uses (primarily for land development or agriculture) are identified as the primary human activities exerting negative pressure on the carbon sink that currently exists in this country's forests (McKinley, et al. 2011; Ryan, et al. 2010; Conant, et al. 2007). The affected forest lands in this proposal would remain forests, not converted to other land uses, and long-term forest services and benefits would be maintained.

Conclusion

The action alternatives would not have a discernable impact on atmospheric concentrations of greenhouse gases or global warming, considering the limited changes in both rate and timing of carbon flux predicted within these few affected forest acres and the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities globally contributing to that pool. The proposed actions could in the long-term help to maintain the overall capacity of these stands to sequester carbon by

increasing vigor and resilience as recommended in numerous climate science publications. *Pro-actively managing forests to increase their resilience is the best approach for confronting an uncertain future. Increased resilience will reduce the probability and severity of catastrophic disturbances such as wildfire and pest outbreaks; co-benefits associated with resilient, healthy forests are equally valuable.(2010_CWSF).* The extent of impacts from the action alternatives would be limited to the immediate environment around the treatment units themselves, from a practical standpoint.

Economics

This information is summarized from the North Hebgen Multiple Resource Project *Economics Report (Wooding, R. et.al 2015)* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request.

Restoration projects like North Hebgen enhance or protect values that are important to people. The management of the natural resources on the Custer-Gallatin National Forest (CGNF) has the potential to affect local economies. People and economies are an important part of the ecosystem. Use of resources and recreational visitation to the national forests generate employment and income in the surrounding communities and counties and generate revenues returned to the Federal treasury or used to fund additional on-the-ground activities to accomplish resource management objectives.

This project would have a positive economic effect within the impact area by: reducing risk from wildfire in the surrounding communities; supporting the health and welfare of the community and visitors through improved safety on the local roads and recreation sites in the project area; protect and enhance the biodiversity of national forest system lands that support wildlife and other intrinsic values that promote tourism and recreation in the project area; and, supplying a local mill with commercial wood products.

Alternative 1 – No Action

The no-action alternative would not harvest timber, implement BMPs on haul routes, or take other restorative actions and, therefore, incurs no financial costs. It would also produce no revenue and have no effects on jobs or income.

Alternatives 2, 3 and 4

Project Feasibility

The estimation of project feasibility was based on a residual value appraisal model, which took 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. Project feasibility and financial efficiency relate to the costs and revenues of doing the action. The predicted high bid and minimum rate are displayed in Table 28 Predicted high bids for all action alternatives exceed the minimum rate, suggesting that the project is likely feasible. The revenue estimates from the feasibility analysis are used in the financial efficiency analysis discussed below.

Table 28 Project Feasibility and Financial Efficiency Summary (2014 dollars)

Category	Measure	Alt 1	Alt 2 (Modified Proposed Action)	Alt 3	Alt 4
Timber Harvest Information	Acres Harvested	0	3,839	2,859	3,207
	Volume Harvested (CCF)	0	32,103	24,051	27,187
	Base Rates ($/CCF)	0	$5.05	$6.35	$5.48
	Minimum Rate ($/CCF)	0	$3.00	$3.00	$3.00
	Predicted High Bid ($/CCF)	0	$21.65	$25.68	$25.08
	Total Revenue	0	$695,110.39	$617,607.62	$681,846.61
Timber Harvest & Required Design Criteria	Present Net Value (2014$)	0	$53,149	$121,045	$123,165
Timber Harvest & All Other Planned Activities	Present Net Value (2014$)	0	$37,045	$109,135	$109,745

Financial Efficiency

The financial efficiency analysis is specific to the timber harvest and restoration activities associated with the alternatives (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 restoration activities 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% real discount rate over the project's lifetime.

Table 28 above summarizes the project feasibility and financial efficiency, including the base rates, appraised stumpage rate, predicted high bid, total revenue, and PNV for the proposed alternative. 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. The mandatory stewardship activities include project activities that would occur on the acres where the commercial timber removal occurs. A second PNV includes all activity costs, including some other optional stewardship activities. Results shown in *Table 28 Project Feasibility and Financial Efficiency Summary (2014 dollars*) indicate that all action alternatives are financially efficient (positive PNVs). Both Alternatives 3 and 4 have relatively higher PNVs than Alternative 2. When discounted over the project timeframe while accounting for the year(s) expenditures and costs are expected to occur, Alt 3 and 4's total revenues exceeded total costs, thus resulting in relatively larger PNVs. Although alternative 2 generates the greatest amount of total revenue (being the alternative with the most CCF harvest), however, due to costs (per CCF) associated with helicopter harvest as well as stewardship activities, – more acres harvested = more restoration activities needed – this alternative's PNV is relatively smaller.

As indicated earlier, many of the values associated with natural resource management are non-market benefits. These benefits should be considered in conjunction with the financial efficiency information presented here. These non-market values are discussed in the various resource sections found in the EA. When evaluating trade-offs, the use of efficiency measures is but one tool used by the decision maker in making the decision. Many things cannot be easily or meaningfully quantified, such as effects on wildlife and the restoration of watersheds and vegetation. The decision maker takes many factors into account in making the decision.

Project Expenditures Including Mandatory and Optional Stewardship Activities

Table 29 displays the different expenditures associated with harvest as well as other stewardship activities. Only certain expenditures are used in the PNV calculations (those already included in the appraisal were not included to avoid double counting). Planning costs (NEPA) were not included in any of the alternatives since they are sunk costs at the point of alternative selection.

Table 29. Project Expenditures Including Stewardship Activities

Category	Alt 1	Alt 2	Alt 3	Alt 4
BMP maintenance on haul roads*	$0.00	$112,361	$84,179	$95,155
New temp road construction/obliteration*	$0.00	$163,725	$98,128	$132,129
Landing cleanup*	$0.00	$51,200	$38,000	$42,800
Purchaser slash for site prep	$0.00	$19,200	$14,200	$16,000
Erosion control*	$0.00	$42,376	$30,304	$36,431
Burning fuel piles - landings*	$0.00	$25,600	$19,000	$21,400
Seeding*	$0.00	$10,400	$7,800	$8,450
Regeneration Planting*	$0.00	$97,440	$94,080	$90,720
Regen exams*	$0.00	$7,840	$6,355	$6,700
Brush Disposal - Deposits*	$0.00	$57,334	$42,682	$47,539
Other-Include Contractual Obligations (Road closure, Barriers, Trail Restoration, tc.)*	$0.00	$19,904	$19,962	$20,118
Weed monitoring/control (5 yrs)	$0.00	$36,000	$29,700	$31,050
Sale Preparation	$0.00	$433,391	$324,689	$367,025
Sale Administration	$0.00	$144,464	$108,230	$122,342

**These costs have already been included in the stumpage price appraisal / sales feasibility analysis and therefore excluded from the PNV calculation*

Environmental Justice

CEQ's Environmental Justice Guidelines for NEPA (1997) states that "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." In the case of the two-county analysis area, the population is predominantly white (95 percent of the population) and no minority population is meaningfully greater than the general population for the state of Montana. This

data suggests that the minority populations within the analysis area do not meet the CEQ's Environmental Justice criterion. (Wooding, R. et. Al 2015, Economics Specialist Report)

Persistent poverty status requires a county to have experienced an individual poverty rate in excess of 20 percent for several Census years. In 2012, 13.8% of the population in the 2-county analysis area and 6.9% of families lived below the poverty level, lower percentages than for either the state or the nation. Based on these data, the characteristic of persistent poverty is not present in the analysis area and the data suggests that the populations within the analysis area do not meet the CEQ's Environmental Justice criterion for low-income. The Executive Order also directs agencies to consider patterns of subsistence hunting and fishing when an action proposed by an agency has the potential to affect fish or wildlife. There are no Native American Reservations located near the analysis area.

Heritage

This information is summarized from the North Hebgen Multiple Resource Project *Heritage Report (LaPoint 2015*) which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific resource protections related to Heritage resources are listed in Appendix A - Design Features Common to Action Alternatives.

In terms of cultural resources, the action alternatives are considered undertakings since they could potentially affect historic properties. As such, the decision maker must consider the effects to all historic properties that may be located within the boundary of the area of potential effect (APE). The measure used to analyze the effect is whether there will be an adverse effect to these historic properties, as defined by the National Register of Historic Places (NRHP) regulations (36 CFR 800), that would threaten the historic property's eligibility for nomination to the NRHP. No adverse impacts would be expected on any known heritage site or any other heritage sites that were identified during additional field surveys or during implementation.

All proposed treatment units within the North Hebgen Project Area that involve ground disturbing activities—such as commercial harvesting with machinery and by hand; piling, burning, chipping and/or masticating natural and active fuels; and or prescribed burning—were reviewed. Inventories for the presence of cultural resources were conducted utilizing pedestrian transects and/or cursory examinations depending upon the character of the area (i.e. steepness of slope, vegetation cover, previously disturbed areas, or previously inventoried areas) and in terms of the probability (high, moderate, or low) of cultural resources being present. Forty-eight cultural resource investigations or surveys, dating back to 1961, have been conducted within the North Hebgen Project

Direct Indirect and Cumulative Effects

Alternative 2 & 4

Any treatment involving ground disturbing activities such as timber harvesting, log landing use, machine mastication and piling, and prescribed burning would have the potential to directly or indirectly affect cultural resources if present. Road maintenance, reconstruction, realignment, decommissioning and temporary road construction and obliteration are additional examples of activities that may directly affect cultural resources by altering or changing their existing character or integrity.

Integral to the North Hebgen Project is the use of the SIS as a proactive approach that that would ultimately benefit cultural resources by treating pine stands and reducing fuel loads on the sites. This approach calls for the inclusion of the heritage sites in the proposed activity areas rather than avoiding the site by modifying the timber and/or fuel treatment boundary to exclude the site. It also eliminates the

creation of “untreated islands or donuts” within the treatment areas. All sites would be avoided by ground disturbing harvest and fuel treatment activities, but where feasible, trees that may damage the sites or contribute to increased fuels would be removed. Archaeological site treatments that can be utilized under the SIS include clearing of brush and downed timber, and selective removal of green, dying, and dead trees. Site treatment would be individually designed for each site located within treatment boundaries and implemented prior to harvest and/or fuel treatment activities. Since the approach is individually prescribed and does not allow any ground disturbance within the site boundaries, no adverse effects to known sites is anticipated. These protections are incorporated as a mitigation in all action alternatives.

Under these alternatives eleven of the 42 cultural sites within the project area could become more “fire resistant” through SIS site treatments. The other 31 sites are not in or near treatment units and they would be unaffected. The individual site treatments for the 11 sites would be determined in consultation with sale preparation personnel/implementation team and the MTSHPO. Eight cultural sites are located within Intermediate Harvest vegetation treatment units.

Three sites, the prehistoric camp, Stone circle, and Horse Butte Lookout are located in open areas where no fuels are present. These sites can be easily avoided by Intermediate Harvest vegetation treatments and no construction of landings, equipment parking, or temporary roads would occur within these site boundaries. Even though these sites would not receive individual site treatments, reduction of fuels within the treatment unit around these sites will help protect them from wild fire and fire suppression activities.

For one prehistoric lithic scatter site, removal of fuels around and on the site could protect this site from negative effects of wildfire and fire suppression efforts. Potential disturbance such as construction of landings, equipment parking, or temporary roads within this site boundaries would be avoided.

One site is located in an Intermediate Harvest unit as well as within the proposed Power Line Clearing corridor. The cultural site would benefit from the reduction of fuels across the site within both the treatment unit and power line corridor, but all ground disturbing activities would be required to take place outside of the site boundary.

Historic cultural sites are particularly susceptible to destruction from wildfire and fire suppression activities, especially if flammable materials such as log foundations or structures remain on site. Four sites have flammable artifacts on site and fuel reduction around these historic sites would help protect them from wild fire and fire suppression activities. Potential disturbance such as construction of landings, equipment parking, or temporary roads within these site boundaries would be avoided, as well as any pile or landing burning.

Segments of the recreation trail (155) were originally used as a logging road and a portion of the trail will again be used as temporary access to the two treatment units. No change to the function, alignment, or integrity of the trail will occur and, after this proposed use, the trail will revert back to a recreational trail. As such, there will be no adverse effect to the recreational trail 155.

A historic cabin site, is located within a Group Selection/Natural Regeneration vegetation unit that involves the harvest of nearly all trees from within certain groups to facilitate regeneration of a new class of vegetation. The site contains flammable artifacts and fuel reduction around this historic site would help protect it from wild fire and fire suppression activities. Potential disturbance such as construction of landings, equipment parking, or temporary roads within these site boundaries would be avoided, as well as any pile or landing burning.

There would be no effects to culturally sensitive sites associated with the Great Bannock Trail or stone ring because the trail is located outside of all currently proposed treatment units and the stone circle would be avoided. Consultation would occur with the Shoshone-Bannock and the Crow Tribes should the trail and/or stone circle be included in any treatment units, temporary roads, or other ground disturbing activities.

Segments of three wagon roads within the project area may be considered part of a network of historic wagon trails that provided vital transportation in the area, serving as mail routes, timber roads, and access to the Grayling Post Office. They are all recorded as one site, 24GA1926. While no reconstruction activities are proposed at this time, any reconstruction, decommission or modification to the road template must be evaluated in consultation with the MTSHPO. These roads include the Cougar Creek Road (FS# 1781); the Cougar West Road (FS #6955); the Whiskey Bay Camp Road (FS# 6697); and the Whiskey Bay G Road (FS# 6697G). Routine road surface grading to re-establish surface drainage should have no effect to these historic properties.

One prehistoric site, 24GA0698, is crossed by the Red Canyon Road (FS# 681) slated for routine road surface grading. By staying within the road template, surface grading would not affect 24GA0698.

Temporary road locations would avoid sites.

Impacts from past activities are reflected in the existing condition of these resources. No known foreseeable activities are planned but if new proposals are presented they would be evaluated for potential impacts to cultural resources and necessary protections would be implemented ensuring that no unacceptable impacts would occur. This project would result in no adverse direct or indirect impacts. As a result, there would be no significant combined or cumulative impact with other actions.

Alternative 3

This alternative and its effects to cultural resource sites is the same as Alternative 2 and 4 except one site, a historic sawmill would not be treated or protected. Through the implementation of proposed site treatments, this alternative could preserve and protect 10 (24%) of the recorded cultural resources within the project area perimeter. Thirty-two sites outside of the project treatment units that would remain at risk from wildfire and fire suppression activities. Cumulative effects for Alternative 3 are similar to Alternatives 2 and 4.

Conclusion

No adverse impacts would be expected on any known heritage site or any other heritage sites that would identified during additional field surveys or during implementation. Recommended mitigation is incorporated in all action alternatives ensuring protection of known potential sites, including application of the SIS protocol. Potential impacts to cultural resources would be limited in scope to the sites themselves. Consultation efforts and project design would meet all requirements related to cultural resource protection, consequently there would be no signifcant impacts to cultural resources.

Alternatives 2, 3, and 4 would comply with the NHPA through the use of the “Wildland Urban Interface and Large Scale Hazardous Fuels Reduction Site Identification Strategy (SIS)” which is part of the Montana Programmatic Agreement (MTPA). The Montana Programmatic Agreement (MTPA) is between the Advisory Council for Historic Preservation, the Montana State Historic Preservation Officer (MTSHPO) and Region One of the United States Forest Service and dictates how the Custer Gallatin NF is to comply with certain sections of the NHPA. The SIS protocol allows for proactive archaeological site treatment to reduce hazard fuels making the cultural resource more “fire resistant” rather than avoiding sites and leaving untreated “islands” within project areas. As a result, the alternatives would be consistent

with Forest Plan direction to “maintain and enhance historic and prehistoric cultural resource values” (USDA Forest Service 1986:4, USDA-FS 1987: II-2).

Federal Law
The National Historic Preservation Act (NHPA) and its implementing regulations require Federal Agencies to consider the effects of their undertakings on historic properties. Effects to “cultural resources of traditional religious and cultural importance” must be considered under the NHPA. In carrying out the responsibilities under Section 106 of the NHPA, the Forest Service is required to consult with any tribe that attaches religious and cultural significance to such properties when any federal undertaking may affect them {16 USC 470a(d)(6)(A)}. The North Hebgen Project Area lies within traditional Crow and Shoshone-Bannock Indian territories, as defined by the Ft. Laramie Treaties, and the Ft. Bridger Treaties. The CGNF designed the *Wildland Urban Interface and Large Scale Hazardous Fuels Reduction Site Identification Strategy (SIS)* to address the effects that large scale, landscape level hazardous fuel reduction projects may have on cultural resources and identify measures to reduce or eliminate those effects. The SIS was approved as part of the programmatic agreement between the USDA-Forest Service-Northern Region, the Advisory Council on Historic Preservation and the Montana State Historic Preservation Officer (MT SHPO). The SIS protocol is followed for this project in compliance with the NHPA.

As designed, the project would have no adverse impacts on cultural resources. The Forest Service would consult as required, with MT SHPO prior to a decision. The agency has met consultation requirements with tribes that attach religious and cultural significance to these properties. Consultation will continue. As a result, the project would be consistent with federal laws including the National Historic Preservation Act (NHPA), the Archeological Resources Protection Act (ARPA), the American Indian Religious Freedom Act (AIRFA), and the Native American Graves Protection and Repatriation Act (NAGPRA). Sacred and culturally important places fall under this purview of the NHPA, AIRFA, and the Sacred Lands Executive Order (Executive Order 13007). Native American graves are protected under NAGPRA.

Inventoried Roadless Area Impacts

This information is summarized from the North Hebgen Multiple Resource Project *Roadless Report (Slacks and Seth 2016)* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific resource protections related to the Inventoried Roadless Area are listed in Appendix A - Design Features Common to Action Alternatives.

Portions of this project are within the approximate 181,858 acre Madison I-549 Inventoried Roadless Area (IRA). Approximately 71 acres of tree cutting is being proposed, within Madison (IRA). All of these proposed units are on the southern fringes of the IRA along existing roads (units 121, 135, 136, 150, 151) and 218 is within about ½ mile of a system road. No road building is planned in the IRA, and all tree cutting is limited to generally small diameter trees. Units 126, 146, and 211 within IRA were included in the initial public scoping proposal, but are no longer part of this proposal. Similarly, the 1,600 Cabin Creek prescribed burn is no longer part of the project proposal as it is not in Wildland Urban Interface (WUI) and burning in this location would not be consistent with the Northern Rockies Lynx Management Direction (NRLMD 2007). Unit 146 has adjacent intact roadless surrounding it, and is not bisected by roads, infrastructure as the other proposed units and was dropped from the proposal. Unit 211 was simply a mapping error and was never intended to be included. It was determined that aspen stands in unit 126 were relatively healthy and there were feasibility issues associated with the treatment. As a result, the unit was a low priority for treatment, consequently 126 has been dropped from the proposal, as well.

Issue
During project development the following issue was raised concerning effects to the Inventoried Roadless Area (IRA) resource:

- Proposed tree cutting in units 121, 135, 136, 150, 151, and 218 in the Red Canyon, Whits Lakes, and Tepee Creek Areas are within the Madison IRA on Hebgen Lake Ranger District. The effects of treating these units may result in changes to natural integrity, apparent naturalness, remoteness, solitude, special features, and manageability of boundaries of the defined area.
- Would treatments be consistent with the Roadless Area Conservation Rule (2001)?

Resource Indicators, Measures and Methods
The following five wilderness characteristics are the basis for evaluation of the effects of the alternatives (FSH 1909.12-2015 (72.1) to the roadless expanse. These characteristics are those used to define wilderness attributes of an area and are the basis for evaluating actions or proposals that could affect future wilderness designation. The table also shows the crosswalk between the wilderness attributes identified in Forest Service Handbook 1909.12 and the roadless area characteristics defined in the Roadless Area Conservation Final Rule (36 CFR 294.11).

Table 30. Crosswalk between Wilderness Attributes[1] and Roadless Area Characteristics.[2]

Wilderness Attributes	Roadless Area Characteristics
Natural Ecological systems ae substantially free from the effects of modern civilization and generally appear to have been affected primarily by forces of nature.	• High quality or undisturbed soil, water, and air; • Sources of public drinking water; • Diversity of plant and animal communities; • Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large undisturbed areas of land; and • Reference landscapes.
Undeveloped Degree to which the area is without permanent improvements of human habitation	Natural appearing landscapes with high scenic quality.
Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation • Solitude: opportunity to experience isolation from the sights, sounds, and presence of others from the development and evidence of humans. • Primitive and unconfined recreation: opportunity to experience isolation from the evidence of humans, to feel a part of nature, to have a vastness of scale, and a degree of challenge and risk while using outdoor skills.	Primitive, semi-primitive non-motorized and semi- primitive motorized classes of dispersed recreation.
Special Features and Values Capability of the area to provide other values such as those with geologic, scientific, educational scenic, historical, or cultural significance.	• Traditional cultural properties and sacred sites; and • Other locally identified unique characteristics.
Manageability	No criteria

[1]Wilderness attributes identified in FSH 1909.12, Chapter 70 that describe the basic characteristics that make an area suitable for wilderness recommendation. These principal wilderness characteristics originate from the definition of wilderness in the 1964 Wilderness Act.
[2]Roadless area characteristics defined in the 2001 Roadless Area Conservation Rule (36 CFR Part 294 Subpart B, §294.11

Most roadless characteristics pertain to resource specific issues that were analyzed by other resource specialists for this project (i.e. water quality, wildlife, vegetation, scenery, and soils). Please refer to those sections for a more complete effects analysis for each resource.

The Madison Inventoried Roadless Area (1549) was not re-evaluated for wilderness in the EIS for the Forest Plan because Congress had released it from further consideration in the Lee Metcalf Wilderness and Management Act of 1983 (PL 98-140). However, the Madison IRA (1549) was among the inventoried roadless areas included and analyzed as part of the 2001 Roadless Area Conservation Final Rule (36 CFR 294; Special Areas; Roadless Area Conservation; Final Rule). The Forest Plan and activities within the IRAs are subject to the direction in the Rule.

Special Area Designation
Cabin Creek Wildlife Management Area (CCWMA) is an approximately 38,000 acre area on Hebgen Lake Ranger District and lies adjacent to and north of the analysis area. There are no proposed treatments in the CCWMA so there would be no effect to this area. It contributes as part of the unroaded areas that are near the North Hebgen Project analysis area. The establishment of this area is found in the Forest Plan. The Earthquake Lake geologic area of interest is nearby but is not impacted by the project.

Affected Environment
The Madison IRA (1549), is approximately 181,858 acres in size and is partially shown in Figure 12. Alternative 2 (Proposed Action) North Half Map. The IRA is located in the Madison Mountain Range, south of the Cabin Creek Wildlife Management area, north of Hebgen and Earthquake lakes, north of private/ other ownership lands around the Hebgen and Earthquake lakes, as well as other ownership lands in and around Upper and Lower Beartrap, west of Yellowstone National Park, and east of the Taylor-Hilgard unit of the Lee Metcalf Wilderness. The Red Canyon; Whits Lakes; and Tepee Creek areas all extend north into the southern part of the Madison IRA (see Alternative 2, North Half Map Figure 12) and are surrounded on three sides by the IRA but are not a part of the IRA. The Madison IRA has not been included in recent site specific or omnibus wilderness bills such as Senator Tester's Forest Jobs and Recreation Act, but has been part of the landscape scale conservation and wilderness bill known as Northern Rockies Ecosystem Protection Act (NREPA). No committee action has been taken on the bill (https:www.congress.gove/bill/114th-congress/house-bill/996/all-actions?overview=closed; 3/8/2016).

Proposed treatment units and roads for the various alternatives, including those near the Madison IRA, are displayed in the EA in Figures 12-17. There are 43.6 miles of existing National Forest System Roads (NFSR) proposed to be utilized for the project. These NFSR routes are accessed by State and County roads that include Highways 287 and 191. Within the project area, the roadless expanse consists of smaller unroaded lands between National Forest System (NFS) roads on Horse Butte, in the Flats between Rainbow Point County Road and Cougar Creek Road and near Fir Ridge.

Environmental Consequences

Alternative 1 – No Action

Under the no action alternative, no treatments would occur. The no action alternative would have no direct, indirect, or cumulative effect to the existing roadless expanse, which includes the Madison IRA, Cabin Creek Wildlife Area, and unroaded areas within the analysis area.

Effects Common to Action Alternatives

There are six treatment units that partially or wholly lie within the Madison IRA in the Alternative 2. These are treatment units 121, 135, 136, 150, 151, and 218. These units approximate 71 acres of vegetative treatments within the Madison IRA. Unit 218, approximately 34 acres, is dropped from the set of treatment units in Alternatives 3 and 4. These units are scattered across the northern portion of the project area, adjacent to other treatment units as well as the Madison IRA boundary. Unit 121 (3 acres) lies in the Red Canyon Area, units 135 (12 acres), 136 (5 acres), and 218 (34 acres) in the Whits Lakes Area, and units 150 (12 acres) and 151 (5 acres) in Tepee Creek area.

Vegetation treatments within five treatment units are intermediate vegetation treatments with a primary purpose of enhancing aspen and/or reducing fuels along evacuation routes. Generally, the trees being cut are small diameter lodgepole pine and Douglas-fir. The sixth unit #136 is a precommercial thin unit which could be implemented by hand treatments or machine but no commercial size (7 inch or greater) would be cut. There would be no temporary road construction within the Madison IRA.

Wilderness Attributes

Natural – The extent to which long-term ecological process are intact and operating.

Aspen and riparian areas are considered the most biologically diverse communities in the West. These communities are rich in insect and plant diversity, both of which contribute directly to the diet of grizzly bears. Ungulate species such as moose and elk rely heavily on young aspen shoots for forage. These areas, therefore, provide important foraging areas for grizzly bears, gray wolves and their prey species. (Frost 2015). Succession is reducing aspen presence on the landscape. Treatments would reinvigorate those clones present and maintain or increase aspen forest on the landscape. Aspen enhancement treatments would ultimately improve foraging opportunity of grizzly bear and their prey.

Large and small trees are filling in openings in the forest, creating dense and continuous forest cover that provides crown and ladder fuels that support stand replacing fire. While stand replacement is typical in these forest types, it is also common to have underburns and mixed severity fire that reduce surface, understory and crown fuels. It is possible with treatments, fire behavior would mimic underburns and mixed severity fire maintenance burns rather than the stand replacement burns that also occur in lodgepole pine and mixed conifer forest, this is particularly true in Douglas fir and mixed conifer stands where aspen are present. Thinning would reduce ladder and crown fuel continuity resulting in a desired change in fire behavior that meets the purpose and need. Fires would continue to burn. Natural ecological processes will continue to function (grass, forbs, trees and shrubs grow back; fires insects and disease may affect treatment units and/or areas adjacent to units). Ecological processes are currently intact and would continue to be so after implementation.

Undeveloped – The degree to which development and uses are apparent to most visitors.
Outstanding opportunities for solitude or for a primitive and unconfined type of recreation

The proposed units in the IRA are either immediately along or straddled by main Forest System Roads (FSR) that have moderate to heavy traffic depending on the time of year,. They are also designated snowmobile routes. The roads are FSR # 681 (Red Canyon), 971(Whits Lake) and 986 (Tepee). The exception is unit 218, which is about ½ mile from a road and is along the Johnson Lake Trail 90. This trail is also a snowmobile route. The opportunity for solitude and undeveloped character is limited by the presence of Forest roads and developments such as trailhead infrastructure, ongoing sights and sounds of the Highway 287 and 191, the sounds from boats on the Lake in the summer and nearby private land. There is some amount of solitude available, but the experience is lower quality than areas further into the IRA or further from road systems.

Proposed intermediate harvest and pre-commercial thin treatments would be implemented with mechanized equipment and hand treatment methods like chainsaws. There would be landing, machine and hand-pile burning. There would be direct and indirect effects related to sights, sounds, lights (vehicle or equipment lights), or smells (smoke). For example, when operations are on-going, there will be sawing, log skidding and forwarding operations, log truck traffic and noise, equipment noise, dust, and chainsaw sounds. After operations cease and slash clean-up and burning occur, there would be crews, burning, and smoke in the units and vicinity. Smoke may drift through the areas and sounds may be heard. In addition, ongoing human activities as described in the Cumulative Effects worksheet in the project record, and above can be found in the roadless expanse. Activity in the IRA would likely take less than 15-25 total days occurring most likely in one season. During operations, visitors to these areas most likely would be temporarily displaced as a result of tree cutting and/or burning activities.

Stumps in treatment units may be seen in the short-term (0-10 years), but vegetation would grow back within 1-3 seasons - grass, forbs, and shrubs more quickly than trees. Aspen stands are expected to quickly respond in these areas, however; and hiding cover would be replaced rapidly as aspen seedlings and saplings fill in within a few years (Frost 2016). Depending on the seed bed available, lodgepole pine can be quickly regenerated. Stumps would gray-over due to weather and decomposition; early seral vegetation would quickly grow back (0 to 10 years), hiding some stumps. Pile burning would result in mixed effects depending on burn conditions. Scorch marks may be seen on residual trees, stumps, rocks and in some cases, soils. The project design features to scatter slash visible within 50 feet of NFS trails #75 and #90 within unit 135 and 218, as well as to keep stump cuts low, and chunking in burn piles would help mitigate the effects of proposed treatments and more quickly diminish the seen effects of treatments.

Some effects from the proposed action, such as the sights, sounds and smoke would be temporary, short-term, transient, localized in nature, and of low intensity. Other effects related to the proposal such as stumps, and vegetative regrowth are longer term, approximately 3-15 years, before effects are not as visible. Ecosystems are not static. Over time, trees grow back, the vegetative understory begins to grow and close in, scorch marks diminish and are less visible, and stumps from thinning, gray and decompose. These longer duration effects are of low intensity, transitional as vegetative re-growth occurs, and local in nature.

The Proposed Action and other action alternatives would have temporary impacts on finding opportunities for solitude due to noise from project activities. This additional activity would not change a person's overall experience for solitude or primitive unconfined recreation in the broader Roadless or unroaded area but the immediate vicinity of the unit would be impacted. Post treatment, the forest stands would appear natural because aspen presence would be maintained and conifer would be present outside clones in a more open stand density which is common in these forest types. Since these activities would not persist long term into the future there would be no impact to the future suitability of the Madison IRA for designation as wilderness.

These shorter and longer-term effects may affect unroaded areas, as described, however, the roadless expanse within North Hebgen analysis area provides opportunities for natural appearing landscapes, solitude and primitive/semi-primitive experiences as visitors move north further into the Madison IRA, or the Cabin Creek Wildlife Area or Lee Metcalf Wilderness, or east into Yellowstone National Park. It is unlikely visitors would experience natural or undeveloped landscapes or much solitude in the southern portions of the analysis area. Opportunities for high quality experiences can be found in other locales on the Hebgen Lake Ranger District. These effects, short-term and longer term, when considered in context and intensity are not significant, but do not go unnoticed. Visitors might be displaced, seeking out places where they might find other undeveloped and more natural appearing landscapes, as well as solitude.

Special features and values – Unique ecological, geographical, scenic, and historical features of an area.

Special features within the analysis area have already been identified and designated as such. The Cabin Creek Wildlife Management Area is within the analysis area and has been set aside for purposes "…to maintain presently existing wilderness character, with no commercial timber harvest nor additional road construction permitted." After modifying the Scoping Alternative, there are no proposed treatments in the Cabin Creek Wildlife Management Area. There are no other special features in the analysis area that stand out as unique geographical, biological, ecological, historic or scenic that do not occur in the rest of the analysis area IRA or in other adjacent unroaded forest lands so there is no effect to special features in the Madison IRA.

Manageability – The ability to manage an area for wilderness consideration and maintain wilderness attributes. Consider factors such as:

Most of the North Half of the analysis area lies within the Madison IRA. In the North Half of the North Hebgen analysis area activities have been proposed within the Madison IRA, in the Proposed Action alternative, as well as the other action alternatives that are subject to criteria pursuant to the Roadless Area Conservation Final Rule (5.13.2005 at 36 CFR 294). All the treatment units within the Madison IRA are along or straddled by existing roads except unit 218 which is about ½ mile from existing roads. These units are on the fringe of the IRA and would not influence manageability considerations. The Proposed Action alternative and other action alternatives do not include road construction within the Madison IRA boundaries, and thus would not change the manageability or boundaries of the IRA.

In the South Half of the North Hebgen analysis area (Figure 13) there are approximately 24 sections of land approximating 15,360 acres (rounded) that are fragmented by private lands (subdivisions in Upper/Lower Beartrap, Horse Butte Peninsula), designated motorized routes per the Gallatin Travel Plan (USDA 2006) (see the travel plan map and the project Transportation Report) that provide access to private inholdings, as well as developments (campgrounds, boat launch/landing access), the Hebgen Lake Day Use Area, and a developed campground (Rainbow Point Campground). However, while there are unroaded areas scattered throughout these areas, the on-going development on private lands, as well as that allowed on National Forest System lands within the South Half of the project analysis area, the fragmentation of the area by other approved uses, and that it is not contiguous to the Madison IRA precludes managing unroaded areas for wilderness characteristics.

Evaluate the degree to which the area may be managed to preserve its wilderness characteristics.
As noted in the manageability and effects sections above. The effects of the proposed treatments, short-term and longer term, when considered in context and intensity are not significant and may or may not go unnoticed depending on the observer. Treatment units are adjacent to existing roads designated for motorized use. Thinned stands will grow smaller trees (diameter and height) into trees that are larger in

diameter/size over time (0 to 15 to 20 years to see some results) and aspen would be maintained on the landscape. Visitors passing through or near treatment areas may notice stumps, more widely spaced trees, scorch marks, effects of which will diminish through time. Treatments will be seen by visitors in the short-term (0 to 5 years) after implementation, but will be less likely to be seen as tree growth responds to the thinning, stumps fade and decay, and understory vegetation begins to grow back. The action alternatives would allow the roadless lands within IRA to retain the roadless character necessary to be considered for wilderness designation in the future. Vegetative treatments are not an irretrievable effect. Visitors might be displaced, seeking out places where they might find other undeveloped and more natural appearing landscapes, as well as solitude while the project is being implemented. The proposed treatments would not preclude considering the Madison IRA for wilderness designation at some time in the future because the wilderness" attributes" would be maintained over time.

Cumulative Effects

Past, present and reasonably foreseeable actions that have occurred and/or are occurring within the analysis areas are described in the Cumulative Effects Checklist which provides additional information on past, present, and reasonably foreseeable activities that were considered (Stiles 2015). Within the proposed treatments in IRA there are no known future activities proposed. Past and ongoing activities have contributed to the condition that exists today. Direct and indirect effect would be localized, low intensity and temporary. As a result, the effect of the proposal combined with other ongoing effects would have a minor cumulative impact on roadless character and wilderness attributes but would not compromise these attributes largely because they are already of low quality in these particular fringe stands and disturbance and visual impacts would be temporary.

The effects to the IRA and unroaded areas would be both short-term (hours to days) and longer-term 2-15 years). Expected impacts would be limited to the treatment units themselves or the immediate vicinity of the units. There would be no significant impacts that would preclude the consideration of the treated portions of the Madison IRA treated within this project to be a wilderness at some future date.

Consistency with Laws, Regulations & Policies

The Proposed Action and other action alternatives focus treatments on generally small diameter timber with residual stand diameter generally increasing post treatment indicating that the focus was on smaller diameter trees. No road construction is proposed in the IRA. The treatments proposed in the IRA would improve and maintain threatened and endangered species habitat by enhancing aspen which will improve grizzly bear foraging opportunity. Units 121, 135, 136, 150 and 151 will maintain the desired characteristics of ecosystem structure and function by reducing wildfire effects in evacuation routes. Wildfires would continue to burn. It is likely that with treatments, fire behavior would mimic understory or mixed severity burns rather than the stand replacement burns that also occur in lodgepole pine and mixed conifer forest. While stand replacement is typical in these forest types, it is also common to have fires that reduce surface and understory fuels through surface and mixed severity fire. This is particularly true in Douglas fir and mixed conifer stands where aspen are present. Several roadless area characteristics would be maintained or improved. High quality soil, water and air would be maintained (Keck, 2016, White 2016 and Dzomba 2015). Habitat for threatened and endangered species would be maintained or improved (Frost 2016). A diversity of plant and animal communities would be maintained (Konen 2015, Frost 2016, Lamont 2015b). Traditional cultural properties would be maintained (LaPoint 2015). The treatments adhere to exception categories i and ii that allow tree cutting in the IRA. One or more roadless characteristics would be maintained or improved. For these reasons, the project is consistent with the Roadless Area Conservation Rule (36 CFR 294.13(b)(1)(i, ii)).

The proposed treatments would not preclude considering the Madison IRA for wilderness designation at some time in the future because wilderness attributes are not impaired. The five "wilderness" attributes

were reviewed above to evaluate consistency with the National Forest Management Act. There are no specific standards in the Forest Plan related to the Inventoried Roadless Area or unroaded lands. All Action Alternatives are consistent with the NFMA and the Roadless Final Rule 2005 at 36 CFR 294. *The effects to roadless character from the proposed intermediate harvest treatments would be very local in scope, limited to 71 acres or less along existing well travelled forest system roads on the outer fringes of the Madison IRA. The most apparent effects would occur during project operations, for example noise associated with equipment. It is expected that implementation of these acres in the IRA would take considerably less than a season, Vegetative recovery would occur rapidly and stumps should be less visible in a few years due to growth of grasses and shrubs. There would be no significant impacts to the roadless character with such limited magnitude and scope of effects. All roads proposed are temporary and would be restored, therefore the impacts to unroaded areas would also be temporary in nature and of short duration.*

Range

This section summarizes the *Range Specialist Report (Lamont 2015a).* Within the area of the North Hebgen *project area* there are two active horse allotments, Grayling and Moose allotments. Grayling allotment is adjacent to proposed treatment units along Whits Lake road, and horse travel along trails in a few proposed units in the Whits Lake area. The Grayling allotment has one pasture that contains aspen which are very healthy. There is a concern from the public that livestock would limit aspen regeneration. The current condition of the pasture shows that aspen are regenerating successfully in this area even with livestock grazing. Moose Allotment is not near any of the units (more than half a mile away).

Moose allotment contain 23 acres of sagebrush/Idaho fescue habitat type (*Artemisia tridentate* / *Festuca idahoensis*), and there are no signs of aspen within the pastures. Since there are no aspen in the pasture and the allotment is spatially separated from the proposed units (more than half a miles apart). The project would have no effect to the allotment or to aspen regeneration success related to the alternatives.

Based on field observation in the Grayling allotment, the aspen appear to be regenerating successfully and not being severely browed by horses even though the pasture is grazed every year. The pasture appears to be very productive for aspen regeneration based on the number of stems per acre and the vigorous growth rate of the shoots. Also, because the horses are not impacting aspen regeneration inside the pasture, where they spend about 2 weeks grazing every year, they would not impact aspen regeneration in the treatment units which are outside of the pasture. The action alternatives would not impact the allotment and the horses would not impact the aspen regeneration outside of the allotment. Since there would be no direct or indirect effects of livestock grazing on the treatment units, there would be no cumulative effects for any of the alternatives.

Recreation

This information is summarized from the North Hebgen Multiple Resource Project *Recreation and Special Uses Report (Stiles and Seth 2016),* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Resource protections related to recreation and uses are listed in Appendix A - Design Features Common to Action Alternatives.

This summary addresses the potential effects of the proposed North Hebgen Multiple Resource project on recreation and special use resources within the project area. Affected environment descriptions and environmental analyses are based on general reviews of the project area, site-specific field reviews, outfitter actual use reports, and visitor use monitoring. The North Hebgen project area lies within an area of high year round recreation use. Types of recreation use include, but are not limited to, outfitting and guiding, hiking, hunting, fishing, trapping, camping, recreation residence use, swimming, boating, OHV use, snowmobile use, cross-country skiing/snowshoeing, and mountain biking.

Non-Recreation Special Uses

A wide variety of non-recreation "lands" uses are also authorized by special use permit on Hebgen Lake Ranger District and specifically within North Hebgen project area. These uses include a solid waste transfer station, overhead and underground utilities, roads to private property and easements and or right-of-ways to entities such as Montana Department of Transportation, communication sites, powerlines, weather stations, seismic monitoring stations, two horse grazing allotments, and a rural fire station. There are no plans to restrict use by the permit holders or eliminate these uses as a result of the North Hebgen project. Any minor disruption to permit holders would be temporary in nature and would be coordinated in advance to allow the permit holder to plan for the disruption. As a result, this concern will not be discussed further.

Snowmobile Trail Access and Use

The general public and eight snowmobile outfitters that operate in Hebgen Basin use all groomed trails across the Ranger District including roads in the project area such as Horse Butte Trail #918(FSR 6697), Horse Butte Loop #928 (FSR 610/6106/6106A), Cougar Creek Trail #927 (FSR 6697G/1780/1781/ 6778), Big Sky Trail #910 (FSR 9986/2527). Two additional Idaho based outfitters administered by Caribou-Targhee National Forest also have operating areas associated with the project area. The Gallatin Travel Plan does not allow wheeled vehicles on these groomed trails between 12/1-4/15 and does not allow plowing. There is a potential for these groomed trails to be plowed for this project should the project contractor wish to operate in winter but only if alternative routes are available. See the Appendix A - Design Features Common to Action Alternatives, there are some opportunities to keep groomed snowmobile access open to snowmobilers while allowing plowing of specific routes if desired. Either way, access would continue for these users and potential impacts would be limited to minor reroutes that provide access to all areas normally accessible except the immediate vicinity of logging activity. There is ample terrain available outside the specific treatment units for a similar snowmobile experience as a result impacts to snowmobile users would be maintained and therefore impacts would be minor.

Recreation Access and Use

Vegetation management activities associated with the project, (timber harvest, construction of temporary roads/skid trails/ landings, mastication, pile burning, temporary trail closures, winter road plowing) could potentially impact recreation access and use patterns.

Recreation access would not be impeded by the project except for short-duration timeframes when equipment is entering and exiting units, and during actual operations. There are no long-term impacts on recreation use associated with the project in that no trails or facilities are proposed to be closed with this

project. Some short-duration impacts will occur, such as temporary closure of: dispersed non-fee campsites in Whits Lake, Red Canyon, and Tepee Creek Road areas, dispersed non-system trails near Whits Lake, and FS system trails Johnson Lake #90, Dutchman Basin #232, Old Tepee Trail #236, and Skyline Trail #151 while actual treatment operations are taking place. As indicated in the design features common to action alternatives, trailheads would not be encumbered by logging activity in such a way as to exclude access to the trail system and improvements would be protected. It is also recognized that dispersed recreation uses such as walking, snowshoeing, snowmobiling, hunting, skiing, among other uses occur in dispersed fashion on National Forest lands adjacent to private property in areas such as Horse Butte. There will be short duration timeframes when these activities are not possible when actual operations are occurring in a given unit. However, multiple opportunities of similar nature exist in the near vicinity that are not affected in anyway by this project and it is not likely that multiple areas will be closed at once even within the project area. Treatment operations will not take place within ¼ mile of Rainbow Point Campground or the two adjacent recreation residences for safety, access, and disturbance reasons during the prime camping and cabin visitation season from mid- May through October 1. For these reasons, recreation access would be maintained and will not discussed further.

Recreation Experiences

Vegetation management activities associated with the project, (timber harvest, construction of temporary roads/skid trails/ landings, mastication, pile burning, temporary trail closures, winter road plowing) and their potential effects on soil, forest composition, and noise during operations, could negatively impact recreation experiences.

Soil disturbance and changes in forest composition are addressed in the soils and scenery sections, respectively. Timber harvest operations will produce noise. However, logging noise is expected to have nominal impact on most recreationists for multiple reasons. First, it is temporary in nature and generally confined to one geographic area, and operations would not be as expansive as the overall North Hebgen project area. Second, there are nearby opportunities for similar recreation activities outside the project area. In addition, logging operations will compete with noise from existing boating traffic on Hebgen Lake, OHV traffic on roads, recreational vehicle and private subdivision access vehicle traffic, and water and beach activities. Quiet recreation opportunities will still abound in areas where they exist now. Campers at Rainbow Point Campground and the two adjacent recreation residence cabins will have very minimal interaction with logging operations/noise due to the timing restrictions on harvest operations. All logging operations will be temporary in nature, and not have a lasting effect. Therefore, the effects of logging noise is determined to be an insignificant impact and as result, will not discussed further, except in the case of the Parade Rest outfitted client, as discussed separately.

Unwanted activities/enforcement issues from temporary roads

Vegetation management activities associated with the project, (construction of temporary roads/skid trails, winter road plowing) may create unwanted activities and enforcement issues if these temporary roads and plowed winter access are used illegally by general public.

Hebgen Lake Ranger District maintains an active law enforcement, recreation technician, off-highway vehicle (OHV) ranger, and snow ranger program for year-round patrol and maintenance of recreation sites. The general public regularly accesses the project area on a year-round basis through a wide variety of recreation opportunities. North Hebgen project area falls within regular patrol routes of OHV rangers, recreation technicians, and Law Enforcement personnel. The Gallatin National Forest Travel Plan restricts use of roads and trails for wheeled and over snow vehicles by vehicle type and season of use. Roads and trails are not open to motorized travel unless specifically designated open and displayed on the Gallatin National Forest Motor Vehicle Use Map. Public use of temporary roads would not be authorized, and would be regulated with temporary barricades, signing and patrol by agency personnel. At the

conclusion of the project, all temporary roads would be decommissioned with scarification and debris placement so they will not be desirable or feasible to use by wheeled vehicles. There is no proposal to designate any of the temporary roads as permanent open motorized routes. Closed temporary roads will be regularly patrolled, just as existing decommissioned/ closed roads are currently patrolled. Additional law enforcement problems related to temporary roads are not expected, and patrols will continue as normal. Therefore, potential impacts associated with this issue are determined to be insignificant and as a result will not be discussed further.

Outfitting/Guiding

Vegetation management activities associated with the project, (timber harvest, construction of temporary roads/skid trails/ landings, mastication, pile burning, winter road plowing) could potentially impact recreation experience for outfitted clients.

Parade Rest Ranch conducts the majority of its day use horseback rides within or near portions of the project area, and has its base of operations on private land immediately adjacent to units south of Whits Lake Road. Parade Rest Ranch operation sis discussed below. Nineteen other outfitters operate in North Hebgen project area. These outfitters offer a range of services including fly fishing, sea kayaking, horseback riding, hiking, cross country skiing, and snowmobiling. All nineteen outfitters have a wide range of operating areas outside the North Hebgen project area on Hebgen Lake Ranger District. These outfitters generally utilize a large portion of their operating area to provide service for clients. Because of the wide ranging use of their respective operating areas the proposed project activities would be easy to avoid if desired, as a result impacts to these outfitter operations will not be discussed in detail.

Rainbow Point Campground

Vegetation management activities associated with the project, (timber harvest, construction of temporary roads/skid trails/ landings, mastication, pile burning, winter road plowing) could potentially impact recreation experience for campground users at rainbow Point.

A design feature in all action alternatives would limit activity in the campground vicinity during the operating season. With this restriction, operations would have no impact on campground users during the operating season. Improvements in the facility would be protected or replaced if needed prior to the operating season, as required. Revegetation would be ensured through Soil, water and invasive weed best management practices. Revegetation could take a season to be fully restored but the visible impacts would be short term. The campground would be safer in the long term because of the treatments and healthier more vigorous trees would be maintained. There would be no direct impacts to the campground users and any damage to the facilities would be repaired. Indirect impacts due to skiing operations would be minor and short term. In the longer term, vegetation management would be beneficial improving safety and providing for healthier trees onsite

Affected Environment

Evaluating Parade Rest Ranch data for the last five years (2010-2015) of commercial outfitter use on NFS land indicates that they utilize nearly 1,500 service days (a service day is any portion of a day where a client is provided commercial guided service) annually on trails between Whits Lake Road and their private property. As a result, Parade Rest Ranch takes the vast majority of its clients through areas associated with units 132-145 and 218-219. It is common that guest ranches utilize public lands adjacent to their base of operations to avoid use of horse trailers, and to give clients an experience where they ride right from the ranch onto National Forest System lands. Parade Rest Ranch does have operating areas outside the project area, but their actual use clearly shows that the lion’s share of their use occurs in the project area.

Clients on rides with Parade Rest Ranch may experience varying levels of solitude depending on where they are within their overall operating area. In Cabin Creek Wildlife Management Area outside the North Hebgen project area, clients may find deep solitude, especially prior to the area opening on July 16th annually to motorbike use on some trails. This area is screened from sights and sounds of human development associated with highways, subdivisions, and developed roads and trailhead facilities on National Forest System lands. Due to it being a roadless area, it appears substantially wild, undeveloped, and natural. Near Parade Rest Guest Ranch itself however, where much of their use occurs, depending on local influences of a given trail such as visual and audible screening relative to trees and terrain features, clients may be in direct sight and sound of Highway 287 and Whits Lake Road #971. These features lessen solitude due to the sight and sound of human influences. Solitude can be subjective from one person to another, so it is important to note that not all people are equally influenced by this attribute of the National Forest experience, nor do all people put equal weight to its importance relative to their overall quality of experience.

In the case of Parade Rest Guest Ranch, the ranch is allowed to operate on designated Forest Service System trails in an area generally described as from the northshore of Hebgen Lake up to the Madison/Gallatin hydrologic divide (Cabin Divide/Tepee-Bacon Rind Divide). They must stay on these system trails, with the notable exception that they are authorized to utilize a series of non-system trails as previously mentioned between their private property base of operation and Whits Lake Road. This area is shown specifically in their special use permit in an appendix map; no additional creation or use of trails within this area is authorized. Parade Rest is authorized a total of 1,700 day use horseback service days. As with the general public, outfitters may be temporarily restricted from portions of their operating areas or trails in the case of public emergencies like wildfire, a grizzly bear/human safety situation, or other natural disaster or public safety situation. These closures are done only to protect public safety, and are always kept to the minimum timeframe and area size necessary to meet safety objectives.

Direct, Indirect and Cumulative Effects

Alternative 1 – No Action
The No Action Alternative would have no additional effects to existing outfitter guide operations or client experience within the project area. Assuming existing outfitters continue to operate, outfitted services will continue with the No Action alternative within the overall broad scope of National Forest regulations specific to outfitter/guide operations. No changes are proposed to snowmobile trails or use.

Alternative 2 – Proposed Action
Alternative 2 involves the most treatment units near Whits Lake Road and in the vicinity of the Johnson Lake Trail. It includes one more unit south of the Whits Lake Road (144) than exists in both alternatives 3 and 4.

Mitigation common to all action alternatives largely eliminates concerns about client solitude for Parade Rest Ranch guests because operations would not occur involving harvest and its associated noise during the majority of the operating season south of Whits Lake Road where most of the authorized access trails are located. There are however, no timing restrictions on harvesting units 218/219 along Johnson Lake Trail, and units north of Whits Lake Road (130-136). Consequently, it is possible those units could be harvested during the busy summer months. This would potentially disrupt solitude during that time period for however long operations occurred in those units for Parade Rest clients causing a direct effect to solitude. The units near the Johnson Lake Trail would likely take 1-2 weeks to complete and units 130-136 would likely take four weeks or less to complete. It is expected that operations would occur in a portion of one season and that the scope of operations would not involve temporary closure of portions of Trail 75 and 90 at the same time due to the distance between the units on the ground. Logging operations

typically start at one end of an area and progress in a way that minimizes move in and move out costs and unnecessary equipment hauling due to time lost and expense. Operators typically do not operate in large areas simultaneously; they ensure that their operations are efficient from a cost perspective. Most of the aforementioned treatments would be within ½ to 1 mile of the guest ranch from a sight and sound perspective so the additional impact to solitude and noise would be minimal because this portion of the use area does not offer high quality solitude. Disruption would not be permanent, as operations would cease when complete.

Harvest operations in units near Whits Lake and Johnson Lake Trails would require that a portion of trails be closed during actual harvest operations causing a direct effect to Parade Rest client trail access to trails #75 and #90, south of Whits Lake Road, this would not occur during the prime operating season due to mitigation measures common to all action alternatives. Clients on trips outside this peak operating season may be directly affected south of the road should actual harvest operations be occurring that prohibit their use of the permitted accessory routes. They would be displaced from the outfitter trails south of the road during operations but alternative routes would be available for use. The logging operation would be expected to occur in one season so the impact would be short term.

Cumulative impacts result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. If there are no direct or indirect effects of the proposed action, there cannot be cumulative effects. Displacement of outfitted guests near Whits Lake Road would be limited to the shoulder season for the parade rest guests would be which would impact few guests for a short period. These potential direct and indirect impacts would be limited in scope to the immediate area and limited in duration to the logging operation period so expected effects would be minimal. Additive impacts with other activities would be negligible because there are no other known activities that would limit access to these areas during the season that are not already occurring. The potential cumulative effects are essentially the same for all action alternatives.

Alternative 2, though larger in scope in terms of treatment units, would still be compatible with maintaining a quality opportunity for Parade Rest Ranch clients, as well as maintaining access to trail networks or large subsets of trail networks throughout the project area. Because timing restrictions are in place for all action alternatives, the vast majority of clients at Parade Rest would not be affected by harvest operations. There is a large network of trails, which means logging activity could be avoided all together by choosing different routes or trailering stock to other locations after Labor Day.

Alternative 3

Alternative 3 involves the fewest treatment units near Whits Lake Road and in the vicinity of the Johnson Lake Trail. The potential effects from all activities are similar to Alternative 2 with the exception of the potential impacts associated with the following treatment units. Unit 144 south of the Whits Lake Road (144) and units 130/131 north of the road are excluded. Units 218/219 are dropped adjacent to Johnson Lake Trail #90. Either way, the potential impacts would likely be limited to one shoulder season or less. These areas could be avoided by opting for other routes away from operations.

Alternative 3, is the smallest in scope in terms of treatment units, and would be most compatible with protecting Parade Rest Ranch client solitude experience, as well as protecting access to entire trail networks or large subsets of trail networks throughout the project area without disruption.

Alternative 4

Alternative 4 involves fewer treatment units near Whits Lake Road and in the vicinity of the Johnson Lake Trail than Alternative 2, but more than is planned in Alternative 3. The potential effects from all activities are similar to Alternative 2 with the exception of the potential impacts associated with the

following treatment units. Unit 144 south of the Whits Lake Road (144) is excluded, while units 130/131 north of the road are included. Units 218/219 are dropped adjacent to Johnson Lake Trail #90. Either way, the potential impacts would likely be limited to one shoulder season or less. These areas could be avoided by opting for other routes away from operations.

Alternative 4, is the middle option in scope in terms of treatment units, and would be more compatible with protecting Parade Rest Ranch client solitude experience relative to Alternative 2, and slightly less compatible than Alternative 3. Similarly, Alternative 4 is between Alternatives 2 and 3 with respect to protecting access to entire trail networks or large subsets of trail networks throughout the project area.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans and Other Disclosures

All action alternatives are consistent with the Gallatin National Forest Plan and the applicable Management Area (MA) direction. Relevant direction is discussed below.

MA 1-These areas include all developed campgrounds, picnic areas, boat ramps, and visitor information sites plus potential developed sites. MA goals include: to maintain these sites and facilities for the safety and enjoyment of users; to maintain developed sites to prevent deterioration and to manage developed sites in occupied grizzly bear habitat to minimize the potential for human/grizzly bear confrontation. *The purpose and need of this project, and the plan for Rainbow Point Campground and Boat Launch Area intends to do just this by reducing the possibility of a large die off of trees due to insect and disease episodes. A large scale die off would make protection of improvements at Rainbow Point difficult, and would greatly diminish the recreation experience. The treatments in this area are also intended to reduce the risk related to wildfire to the public and firefighters and to reduce the risk of grizzly bear/human encounters, all of which help to maintain the site for the safety and enjoyment of users.*

MA 5- These areas are travel corridors that receive heavy recreation use. Areas included are portions of highways U.S. 191 and 287 in the West Yellowstone vicinity, the Red Canyon Road (FSR#681) and areas adjacent to Hebgen Lake. Goals are to maintain and improve the wildlife habitat values and the natural attractiveness of these areas to provide opportunities for public enjoyment arid safety. *The purpose and need for action is designed to enhance public safety in these areas through evacuation route treatments, thinning to reduce wildlife collisions along Highway 191 for safety reasons. Aspen treatments in these areas improve wildlife habitat consistent with the goals. Proposed treatments as designed, are consistent with standards.*

Gallatin National Forest Travel Plan - the proposal is consistent with the direction in the Travel Management Plan related to recreation. Groomed snowmobile routes will remain open or accessible to the public and outfitters. There are no other standards specific to recreation or uses related to recreation management for this project because the project is not proposing recreation management or special uses management activities but rather mitigation of impacts to these resources.

Conclusion

The proposed activity would have short term impacts to Parade Rest Ranch client opportunities for solitude during actual harvest operations during the shoulder season when operations could occur south of the Road and from activity north of the Whit's Lake Road. As as pointed out in the analysis, timing restriction from June 1- October 1 common to all action alternatives significantly reduces potential impacts to Parade Rest Ranch clients because a large percentage of their time is spent south of Whit's Lake Road and on Parade Rest Ranch base property. The other issues related to recreation include: campground impacts, non-recreation special uses, use by other outfitters, access and use for snowmobilers, general recreation access and use, recreation experience and unwanted use of temporary roads. These issues were discussed earlier and potential impact would be minor. Numerous design

features are incorporated in all action alternatives (Appendix A) which protect and maintain recreation improvements, as well as access and use.

The project area and adjacent areas offer a multitude of recreation opportunities. If recreation users want to avoid noise or disruption from proposed activities, there are areas nearby that offer opportunities of similar nature that would not be affected by this project in anyway. Regardless of what alternative is selected, all impacts to access and solitude would be short in duration, and only occur during actual harvest operation periods. It is unlikely that logging operations would be occurring over large areas simultaneously so impacts would be spread out and occur over time thereby minimizing intensity of impacts at any one locale. As discussed the potential impacts associated with all recreation and outfitter related issues are limited in scope to the area of operations and in duration to activity periods. For these reasons there would be no significant impacts to forest users recreation experience or that of outfitted guests.

Sensitive Plants

This information is summarized from the *North Hebgen Sensitive Plants Report and Biological Evaluation (Lamont 2015b)* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific resource protection measures for Sensitive Plants is in Appendix A - Design Features Common to Action Alternatives.

Direct, Indirect and Cumulative Effects of the Alternatives

There are currently 19 sensitive plant species listed for the Gallatin National Forest. The species are listed in the Table 31 below, along with the typical habitat and elevation where the plants grow. The habitat and elevation descriptions are summarized from literature review. The project area was divided into five areas based on similar land types (see header in table below). A pre-field habitat assessment was completed for species within each area. Table 31 displays if potential habitat may occur (Yes/No). The habitat type for each zone within the project area is based on soil types (Shovic, H F. and C.E. Davis. 1996) and on previous field experience within the area. The list of plants that may have both the potential habitat and elevation are the ones most likely to occur within in the survey area. A field survey was conducted to look for the presence of suitable habitat and for all sensitive plant species. Finally, a biological determination code and rationale for the determination was assigned to each species for the entire project in Table 31.

Alternative 1 – No Action

Under the No Action alternative, the current stand density would continue to increase. It is expected that the trees would grow at a slower rate given the higher density levels (McCarter and Long, 1986). Whitebark pines are considered intermediate in tolerance to shade (Arno and Hoff, 1989), meaning they are less tolerant to shade than subalpine and spruce but more tolerant than lodgepole. Plus, the dense stands are more susceptible to mountain pine beetle mortality (Perkins and Roberts, 2001). Ultimately the area could become more shaded under this alternative.

There would be no direct or indirect effect to the large-leaved balsamroot because the area is in an open meadow and not shaded by trees.

Direct, Indirect and Cumulative Effects – Action Alternatives

Based on field reconnaissance there are three sensitive plants in the project area (dwarf purple monkeyflower, large-leaved balsamroot and whitebark pine). The dwarf purple monkeyflower was found in the project area but not inside the treatment units during the field survey. Since this plant is spatially separate from the treatment there would be no direct or indirect effects. The rest of the assessment considered the impacts of the project on two known sensitive plant species within the treatment units.

First, large-leaved balsamroot has historically been present along the Red Canyon road but was not found in 2015. The mitigation measure incorporated into this project would avoid the historic site (leave a 30 foot buffer around the historic site). The avoidance would eliminate any effects resulting from the project.

Second, whitebark pines (WBP) are occasionally present in the project area above 7,000 feet but are more common above 8,000 feet. The primary purpose for thinning and logging the existing stands above 8,000 feet is to improve the condition of the WBP. The action alternatives would remove competition from other conifers and leave the best WBP treees. Alternative 2 would treat 1128 acres of WBP forested area; Alternatives 3 and 4 would treat 31 fewer acres. The WBP pine treatments would focus on removing competition from other species so that the residual WBP would have more available resources for growth or establishment. As indicated in design features common to action alternatives, where possible, all healthy WBP pine would be left in the treatment units. A few of the unhealthy or over crowded trees may be removed to improve the overall condition of the stand. These types of treatment are supported by in the GYA Whitebark pine Strategy (GYCC-Whitebark Pine Subcommittee. 2011, pages 32 and 34; BLM Whitebark Pine Management Guidelines 2012). The net effect is that the remaining WBP would benefit from more available resources (more sunlight, water and nutrients) (McCarter and Long, 1986).

Some of the stands between 7,000 and 8000 feet adjacent to the Tepee Creek Road #986 have scattered WBP throughout the area. While the primary purpose for treatment in many of the units is to create a fuel break by changing fire behavior, the treatment would also benefit the growth of residual trees. Although some WBP may be removed, many would be retained on site and would benefit from the treatment (more available nutrients, sunlight and water). The net effect is that the units with the primary purpose for fuel reduction between 7,000 and 8,000 feet would also benefit the remaining WBP.

An indirect effect of clearcuts (units 159, 191, 196 and 199) adjacent to a popular snowmobile route may increase the amount of snowmobile use in the treatment units which in turn may damage the tops of the WBP when they grow above snow depth. The trampling causes the top to dieback and the tree developed multiple branches. This type of damage has been observed in other areas on the Hebgen Lake Ranger District. In some areas the trees do not grow taller than the snow depth. A design features is included in the action alternatives leaving a buffer strip of trees, 20 to 50 feet wide, next to the trail which would help to reduce the amount of off-trail use.

There would be no significant cumulative effects associated with this project and sensitive plants because the direct and indirect impacts from the project would be minimal and no known foreseeable activities are expected to have an impact on these plant populations.

The impact of the alternatives on the sensitive plants are listed under the Determination Codes -- May Impact Individuals or Habitat (MIIH). The reason for the determination is listed under the column labels Rationale codes: 2=suitable habitat may be present but species is not known in the project area or vicinity, 3= species present but action would not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.

There would be NO IMPACT to the following species because suitable habitat is not present: following species: Musk Root - Adoxa moschatellina, Short-styled Columbine - Aquilegia brevistyla, Small Yellow Lady’s Slipper - Cypripedium parviflorum, English Sundew - Drosera anglica, Beaked Spikerush - (Eleocharis rostellata), Giant Helleborine - Epipactis gigantean, Slender Cottongrass - Eriophorum gracile and Alpine Meadowrue - Thalictrum alpinum.

The alternatives would not have a detrimental impact on sensitive plants. Although activity in the harvest units could damage a few individual whitebark pine trees, the treatments are intended to benefit whitebark pine over the long term. Other sensitive plant species would not be impacted either because they are not

present or design features incorporated in the action alternatives would avoid impact. Impact to sensitive species would be avoided or minimized in accordance with direction and treatments would enhance whitebark pine as directed in the Forest Plan. The scope of potential impacts is localized because they would be limited to individual plants in the treatment units or the immediate surroundings. For these reasons there would be no significant impact to sensitive plant species.

Table 31. Pre-field habitat assessment, Biological Evaluation determination and rationale where suitable habitat may be present.

Plant Name – common and species	Habitat and Elevation	Horse Butte 6,550 -6,800 ft	Rainbow Pt & Hwy 191, Duck Ck 6,500-6,600	Fir Ridge 6,600 - 7,000 ft	Tepee Ck 6,600 - 9,000 ft	Whits Lake, Johnson Lake & Red Canyon 6,600 - 8,000 ft	Determination Code – all action alternatives	Rationale Code
Large-leaved Balsamroot - *Balsamorhiza macrophylla*	Open hills, associated w/ bunch grasses. 7,000-8,500 feet.	No	No	Yes	Yes	Yes	MIIH	3
Hiker's Gentian - *Gentianopsis simplex*	Meadows, bogs, seeps; usually crystalline parent material; 4,400-8,400 feet.	No	No	Yes	Yes	Yes	MIIH	2
Northern Rattlesnake Plantain - *Goodyera repens*	Open mossy forests, mountains, limestone, shale or moist limestone slopes of old growth Douglas-fir, cool north aspects, spruce /twinflower or subalpine-fir /twinflower habitat types. 5,700-6,800 feet.	Yes	No	Yes	No	Yes	MIIH	2
Discoid Goldenweed - *Haplopappus macronema*	Rocky, open or sparsely wooded slopes, talus, above timberline. 7,640 feet +	No	No	No	Yes	Yes	MIIH	2
Hall's Rush - *Juncus hallii*	Moist to dry meadows and slopes; 6,900-8,400 feet.	No	No	Yes	Yes	Yes	MIIH	2
Dwarf Purple Monkeyflower *Mimulus nanus*	Dry gravelly or sandy slope; 6,565 feet.	Yes	Yes	No	No	No	MIIH	2
Austin's Knotweed - *Polygonum douglasii spp. austiniae*	Open, gravelly, shale soils with eroding slopes and banks in montane. 5,800-6,600 feet.	Yes	Yes	No	No	No	MIIH	2
Whitebark Pine - *Pinus albicaulis*	High elevation forests. 7,000-10,500 feet.	No	No	Yes	Yes	Yes	MIIH	3
Barratt's Willow - *Salix barrattiana*	Boggy meadows; forms extensive thickets near or above timberline; from very calcareous to acidic. 6,800-10,500 feet.	No	No	No	Yes	Yes	MIIH	2

Plant Name – common and species	Habitat and Elevation	Horse Butte 6,550 -6,800 ft	Rainbow Pt & Hwy 191, Duck Ck 6,500-6,600	Fir Ridge 6,600 - 7,000 ft	Tepee Ck 6,600 - 9,000 ft	Whits Lake, Johnson Lake & Red Canyon 6,600 - 8,000 ft	Determination Code – all action alternatives	Rationale Code
Shoshonea - *Shoshonea pulvinata*	Open, exposed, windswept limestone outcrops, thin rocky soils 6,800-9,000 feet.	No	No	No	Yes	Yes	MIIH	2
California False Hellebore - *Veratrum californicum*	Wet meadows and streambanks in montane and subapline, alpine. Meadows, spruce, Doug fir. 5,000-8,500 feet.	Yes	No	Yes	Yes	Yes	MIIH	2

Soils

This information is summarized from the North Hebgen Multiple Resource Project *Soils Report (Keck 2016)* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific resource protections related to soils are listed in Appendix A - Design Features Common to Action Alternatives.

Areas of greatest concern from a soil disturbance perspective are the valley floor, otherwise known as the obsidian sand plain and the headwaters of Little Tepee Creek. Both these areas have been severely impacted during past timber harvesting that occurred during the period of 1967 through 1982. Although the resource damage done was associated with clearcutting, it was not the clearcutting itself that caused the most of the damage. Overly aggressive land scarification procedures used at that time were the main source of DSD which resulted in removal of surface litter and mineral soil layers through dozer piling.

Potential soil issues associated with the North Hebgen Restoration are primarily associated with high levels of pre-existing or prior, activity caused, detrimental soil disturbance (DSD) that are present in portions of the project area. A related issue of lesser concern is the level of soil disturbance likely to occur as a result of currently proposed forest management activities.

Measurement of detrimental soil disturbance (DSD), including the effects of soil compaction, displacement, rutting, severe burning, surface erosion, loss of soil organic matter, and soil mass movement, has been used in Region 1 as a surogate measure to ensure that land productivity and soil quality are not impaired. The Regionwide standard (USFS-R1 1999) requires that new activities be designed so they “do not create detrimental soil conditions on more than 15 percent of an activity area”. In the case of timber harvests, each treatment unit represents an individual activity area. When detrimental soil disturbance exists from prior management activities within treatments units, the combined DSD from past and currently planned management actions must not exceed 15% or must be reduced to at least the level of prior DSD after all treatment and mitigation actions have been completed (USFS-R1 1999).

Affected Environment

The overall project area includes 5,894 acres of treatment units within the North Hebgen portion of the West Yellowstone District of the Custer-Gallatin National Forest. The area to be treated overlaps six distinct soil-landscape types.

The spatial boundaries for direct and indirect effects to soil resources from the proposed treatments are the individual treatment unit boundaries. Because productivity effects are spatially static in most instances and productivity at one location, in the absence of soil erosion or deposition, does not influence productivity in another location, it is often appropriate to limit the direct and indirect effects analysis to the actual activity areas where land disturbance will occur (USFS-R1 2009). Spatial boundaries for the cumulative effects analysis may include all treatment units that are clustered together with a single soil-landscape type as well as the adjacent connecting areas between treatment units and downslope (or upslope) areas that could potentially be affected by currently proposed activities.

Soil monitoring on the Gallatin portion of the CGNF has found only limited evidence of past soil disturbance associated with timber harvesting that occurred prior to 1960. Thus, the temporal boundary used going backward will be 60 years from the current date. The temporal boundary for direct and indirect effects going forward will be 40 years from the date when all remediation actions associated with the project have been completed due to the persistence of soil disturbance in several of the soil-landscapes where treatment activities are proposed.

Treatment units of the North Hebgen Project are proposed in six distinct physiographic, i.e. soil-landscape, types within the North Hebgen Basin area of the Custer-Gallatin National Forest. These areas differ from one another in terms of geology, topography, soil properties, soil productivity, susceptibility to soil disturbance, level of past timber harvesting, and resulting pre-existing levels of detrimental soil disturbance (DSD). Strong correlations also exist between soil-landscape types and the type or types of silvicultural prescriptions proposed in the North Hebgen Project. Detailed descriptions have of each soil-landscape area have been provided in the full Soil Specialist report for this project. Brief descriptions follow for the two soil landscape areas of greatest concern, the obsidian sand plain and the headwaters of Little Tepee Creek.

Obsidian Sand Plain – Soils covering the valley floor (sand plain) in this area are very droughty and have low soil fertility. Soil textures in the top 8 to 12 inches of mineral soil are sandy loam to gravelly sandy loam and provide a shallow cap over the underlying course, glacial outwash that fills the basin. This substrate material is almost exclusively very gravelly, coarse sand. Rock fragments in nearly all instances are pea gravel size. These soils support mainly pure stands of lodgepole pine with limited understory vegetation. Slopes are 0 to 2 percent except along drainage swales or escarpments.

Headwaters Little Tepee Creek – It came as a surprise to find that soils in the headwaters area of Tepee Creek contained a moderately thick volcanic ash cap covering underlying volcanic flow rock which is primarily welded tuff. Much of the original fertility and water holding capacity of soils in this area is due to the presence of volcanic ash at the surface. The underlying bedrock is coarse grained and relatively resistant to erosion. Tree species present include lodgepole pine, whitebark pine, subalpine fir, and Engelmann spruce. Slopes range from moderately sloping to steep (4 to 45%).

Although soils and landscapes in these two areas are both quite different, they share one common attribute that makes both landscapes highly susceptible to detrimental soil displacement. They both have, loose, relatively rock free, mineral soil layers at the surface which covers much coarser and/or much rockier, infertile substrate materials at shallow depths.

Methods

Initial field assessments were made of land and soil resources in all six soil-landscape areas within the North Hebgen project during the summer of 2014. Review of available outside sources of resource information helped in the interpretation of initial field assessments and with the continual refining of these concepts during subsequent field work. Soil survey information from the Soil Survey of the Gallatin National Forest, Montana (USDA-GNF 1996) was also reviewed for the North Hebgen project

area. This document's lack of resolution or specificity about soil resources within the project area greatly limited its usefulness at the project level.

As noted previously, detrimental soil disturbance (DSD) is the metric used in Region One to assess the degree negative impacts to site productivity and soil quality from management activity caused soil displacement, soil compaction, rutting, severe burning, soil erosion, mass movement, and indirectly lost soil fertility. Quantifiable field criteria are used on the Gallatin National Forest to consistently identify the presence of each type of DSD (Keck 2012).

In the NEPA analysis, the assessment of DSD in treatment units is assessed at three levels: 1) prior or pre-existing DSD present within treatment units that has resulted from past management actions, 2) the expected level of DSD likely to be created as a result of currently proposed management actions, and 3) the anticipated reduction in DSD due to proposed mitigation actions. Final DSD equals the sum total of all three assessments. The Region One 15% maximum allowable DSD standards have management implications when either pre-existing or total DSD levels exceed 15%. For all three DSD determinations, a systematic, quantitative of the approach has been used based on the procedures developed for the Gallatin National Forest and protocols set forth in the Region 1 Approach to Soils NEPA Analysis Regarding Detrimental Soil Disturbance in Forested Areas (USFS-R1 2009).

The level of pre-existing DSD is initially assessed based on GIS analysis that determined the degree of overlap between past timber harvest by harvest type as recorded in the Forest Service FACTS database and currently proposed treatment units. This analysis was then coupled with targeted field sampling of pre-existing DSD levels in representative treatment units for the current project as well as field sampling results from comparable soil-landscape by harvest type areas elsewhere on the Forest. Both the intensity and extent of field sampling are dictated by the likelihood that treatment units exceed or will exceed the Region in accordance with guidance provided by the Region One Approach to Soils NEPA Analysis (USFS-R1 2009).

The approach used to make predictions about treatment caused DSD levels as well as the effectiveness of mitigation actions to reduce DSD levels within a specified time period is based on partitioning treatment areas into subareas related to the type of activity(s) occurring at each. Thus, timber harvest units are partitioned into four distinct subareas: temporary roads, landings, skid trails, and dispersed harvesting areas between skid trails. Landings from a mitigation effectiveness standpoint are further split between the area under the burn pile and the donut landing area surrounding burn piles where all timber processing, loading, and unloading occurs. Very distinct patterns, aerial extent, and types of DSD occur in each of these subareas.

Many of the aerial extent values used are based on standard measurements, such as the disturbance width along temp roads, or are specified by the project design, e.g.: the length of temp roads allocated to each unit. Prediction of the extent of DSD that occurs along temp roads, at landings, and on skid trial, generally accounts for 80% to 90% of the total DSD created by current commercial timber harvest units (assuming extensive land scarification does not occur) even though they represent just 10 to 20% of the total treatment unit area. The assessment of DSD in these areas is based on numerous field measurements and observations made in past harvest areas throughout the Forest as well as in the local area.

Finally, the same type of systematic approach has been used to quantify mitigation effectiveness on a harvest unit by harvest subarea basis. The underlying tenant is that any mitigation action(s) taken must specifically address the type or types of DSD present in each subarea. Mitigations are mainly targeted at those areas with the greatest concentrations of DSD, landings, temporary roads, and to a lesser degree skid trails. Mitigation effectiveness is assessed at the end of year 2 after all treatment and mitigation

actions have been completed on a treatment unit basis. Predictions of mitigation effectiveness are based on the degree to which the proposed mitigation will have a direct effect on the physical, chemical or biological issue causing the expected detrimental condition. In all cases, predictions made are conservative, i.e. made high enough, to reasonably ensure little likelihood exists that actual DSD levels will exceed predicted levels.

Direct, Indirect and Cumulative Effects

No Action Alternative
Existing conditions would remain unchanged. Existing levels of soil DSD would remain much the same as current conditions and little or no attempt would be made to initiate remediation actions in those areas most heavily impacted by past clearcutting and land scarification.

Alternative 2 – Modified Proposed Alternative
Environmental effects for soils includes legacy impacts from past timber harvesting since both past and currently proposed treatment activities are considered in the soil DSD analysis. Soil monitoring data collected for this project was primarily targeted at those areas where extensive past clearcutting and aggressive ground scarification had occurred. These data indicate levels of DSD in past clearcut areas of the obsidian sand plain have pre-existing DSD levels of 24%. Landscapes in these areas are quite homogenous and transects were run through a number of different, lodgepole pine stands where past clearcutting occurred. All transect segments sampled had approximately the same level of soil disturbance. The level of pre-existing DSD associated with the same past timber harvesting techniques in upper Little Tepee Creek was measured to be 32% DSD. It is possible that some landscape bias may have entered into the analysis if inadvertently a higher portion of steep south-facing slopes were sampled relative to the population as a whole. Regardless, both areas exceed the 15% DSD standard in these areas.

Table 32 provides summary data of the DSD analysis for this project. These data are summarized based on the predominant harvest type(s) by soil-landscape area. A large disparity exists among different soil-landscape areas with regard the type and extent of past management actions and the extent and severity of past soil disturbance. Results show that most treatment units are predicted to fall within a suitable range of 2-12% DSD at year two after mitigation. Further reductions in DSD levels would occur over time. No treatment units were predicted to exceed the 15% DSD after mitigation except those units which already had high DSD levels exceeding the standard based on pre-existing DSD levels. Mitigation actions proposed for the high DSD areas are designed to decrease pre-existing DSD levels by 2% at the time of treatment.

Table 32. Averages of predicted DSD by harvest subarea, reduced DSD due to mitigation and total DSD levels at year 2 as a function of primary treatments proposed by soil-landscape area.

Activity Area Description				Detrimental Soil Disturbance (%)							
Soil-Landscape	Treatment	No.	Acres	Prior	Land.	Temp. Road	Skid Trail	Disp.	Total	Mit.	Final
Horse Butte	Improvement	8	341	0.2	3.2	1.2	3.3	1.7	9.5	-3.5	6.1
Lower LT Cr.	Comm. Thin	14	370	0.4	4.5	1.1	1.8	1.6	9.4	-3.4	6.0
	Post & Pole	5	170	0.3	2.7	0.7	2.2	2.1	7.9	-2.6	5.4
Obs. Sand Plain	Clearcut	13	176	3.2	4.8	0.5	3.2	3.0	14.7	-3.8	10.9
	Comm. Thin	19	725	4.7	3.5	0.4	4.0	2.0	14.5	-3.5	11.0
	Group Select.	10	695	5.2	2.4	0.7	2.1	0.9	11.3	-2.3	9.0
	Pre-com Thin	33	848	20.6	0	0.2	0	0.3	21.1	-2.0	19.1
Red Canyon	Comm. Thin	9	124	0	5.7	0.7	5.6	2.4	14.4	-5.3	9.2
	Improvement	7	88	0	7.2	0.8	3.7	1.6	13.3	-5.2	8.1
Upper LT Cr.	Daylight	9	830	31.8	0	0.5	0	0	32.3	-2.2	30.1
	Overstory Cut	6	136	1.3	3.5	0.7	4.6	2.6	12.7	-3.8	8.9
	Seed Tree	8	149	0.9	3.4	1.8	4.9	3.1	14.2	-4.5	9.7
Witts Lake	Clearcut	4	44	1.4	4.5	0.2	3.3	2.9	12.2	-3.5	8.7
	Improvement	9	276	0.4	3.0	0.7	3.3	2.4	10.0	-3.2	6.8

Areas predicted to have between 12 to 15% DSD after mitigation would be targeted for soil monitoring at year two after mitigation. It appears, based on past soil monitoring, that current timber harvesting practices on the Custer-Gallatin National Forest would not create near the level of soil disturbance as that which resulted from some previous harvest and land scarification techniques. It is also unlikely that current harvesting practices, by themselves, would create enough soil disturbance to exceed the Region One standard. Only when currently proposed management actions coincide with legacy impacts with high, pre-existing DSD levels are problems likely to occur.

The total treatment unit area exceeding the 15% DSD standard prior to currently proposed management actions equals approximately 1,620 acres. This acreage is split almost evenly between the obsidian and plain and the headwaters of Little Tepee Creek. The Forest is aware that this is a long term land management issue and has incorporated initial land restoration actions into the North Hebgen Project. The first step in this process is to not create any new DSD in the treatment units with excessively high, pre-existing DSD levels.

It is uncertain at this time how many overall acres of whitebark pine daylight treatments in upper Little Tepee Creek or pre-commercial thinning on the obsidian sand plain would occur as a result of the currently proposed actions. Whatever the amount, restoration involving the spreading of topsoil from old soil mounds scattered throughout these areas would be conducted in direct proportion to the amount of thinning at a rate of one acre of land restoration per each 40 acres of thinning. This would create a 2% direct reduction in existing DSD in both areas which translates to an 8% decrease in the overall level of DSD in those treatment units of the obsidian sand plain and a 6% decrease for treatment units in upper Little Tepee Creek. Although these may be relatively small decreases, they represent a potentially large step forward towards future land restoration work.

Past timber harvesting and other activity caused detrimental soil disturbance (DSD) that occurs within individual treatment units of the North Hebgen Project have been accounted for in the direct and indirect effect analysis of this project. Cumulative soil disturbance can occur within a contiguous area that encompass clusters of treatment units plus associated past harvest areas outside the treatment unit

boundaries and the adjacent unharvested lands within a defined geographic area. A cumulative effects analysis of DSD was conducted for the contiguous cumulative effects area of upper Little Tepee Creek. Results indicate a predicted DSD level of 14.8% for the area as a whole. The Forest is aware of this issue and is taking steps to initiate restoration efforts as part of the North Hebgen Project. Although there is currently no Region One standard that directly applies, Regional guidance does not preclude Forests undertaking additional steps that provide benefit to the natural resources they manage. The question of assessing cumulative effect outside treatment unit boundaries falls within a gray area in the Region One guidance where professional judgement by the Soil Scientist and use of Best Available Science apply (Personal communication with Vince Archer, Region One Soil Scientist (2/16/16). There would be additive impact with the implementation of this project that would be insignificant because overall impact would be reduced after mitigation is in place.

Alternatives 3 and 4

Action Alternatives 3 and 4 are both reduced versions of the Proposed Action Alternative. Although they treat fewer acres, neither of these alternatives has any substantive benefit over the currently proposed Alternative with respect to soil disturbance issues. The treatment units removed in each case do not selectively include units with high levels of pre-existing DSD. Thus, eliminating or reducing the size of those units would not reduce the overall levels of DSD in comparison to the Proposed Alternative.

Summary

Although issues exist related to the level of past DSD in portions of the North Hebgen Project area, on a whole, this project would provide greater public benefit than negative impact and provides an opportunity to begin addressing a legacy of past, large scale, soil disturbance issues that exist on some Forest Service lands which predate the advent of detrimental soil disturbance standards. Over time, one of the net results from this project would be a small but measurable decrease in the total level of DSD that exists in the Basin. The impacts of this project would be limited in scope to the immediate surrounding of the treatment units and the severity of impacts is limited through project design. Implementation of mitigation to reduce DSD in areas with past harvest areas would result in a net decrease in DSD in those areas. The project complies with the Region-wide standard (USFS-R1 1999) and as a result, complies with the Gallatin Forest Plan and the National Forest Management Act. There would be no significant impacts related to this project.

Transportation

This information is summarized from the North Hebgen Multiple Resource Project *Transportation Report (Morrison updated 2016)* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific resource protections related to transportation and public safety are listed in Appendix A - Design Features Common to Action Alternatives which includes detailed road treatment and management by route information and a compilation of all reoad management information is available on the project webpage.. It is called, *2016_1221TemporaryRoadManagementCompilation.*

Roads play an essential part in any vegetation manipulation project. They provide general administrative access, access for sawyers and equipment, access for log hauling equipment, and access for emergency purposes. The goal of any road system is to provide safe and efficient access for intended uses while minimizing effects to natural resources.

Direct, Indirect and Cumulative Effects Common to Action Alternatives
Road issues and treatments common to all action alternative are discussed in this section. There are no unique road treatments between alternatives except the number of miles of temporary road proposed so the project impacts would be proportional.

All existing public open or administrative National Forest System roads that would be effected by this project are discussed in Appendix A which includes Road Management and Treatment by Route. Those standards would provide a safe and efficient road system capable of responding to the additional road needs imposed by this project.

Road use would increase on a number of area roads due to the proposed project and it's related thinning, harvesting, and administrative traffic. During the times when these new uses are anticipated, the existing users would be notified of the change in volume and type of traffic. Since harvest and hauling signs are not normally permanent installations on most forest roads, the project would install warning signs at key entrances and exits during the time of the activity and removed or covered during times of inactivity.

The existing project roads planned to be reopened would be constructed, operated, and restored as temporary roads in the contract. These roads are old/unused road prisms, and would be classified as temporary roads for this project, meaning they are shown on the maps as temporary roads and would be closed to the same standards. Sufficient work would be accomplished to provide a safe manageable facility for logging trucks and related traffic. Following project completion, the roads would be closed (within 1 year, unless otherwise stated) by an earthen berm, ripped and slashed, non-driveable waterbars installed, and seeded or obliterated as needed, depending on the condition of the road after use. During project operation, the public shall be restricted from using the road by installation of a "ROAD USE RESTRICTED" sign near the beginning of the road.

Temporary roads, when prescribed, are intended to minimize the cost of transporting logs and fuel consumption by transporting logs by more efficient log trucks rather than ground-based skidding and to protect adjacent resources such as sensitive soils and stream courses that would be adversely effected by repeated ground-based skidding. Temporary roads, by design, are a single entry access and not intended to be a permanent part of the road system and as such would be located and constructed to minimize investment, dirt moving, and disturbance. Following use, these roads would be permanently closed and rehabilitated to meet adjacent land management objectives with no regard to future access, this includes obliteration and/or re-contouring, seeding, and slashing of the corridors. Temporary roads would be closed and rehabilitated or obliterated before termination of the timber sale contract.

Temporary roads are not constructed to safely accommodate mixed commercial and public traffic, so all temporary roads would be signed or gated as "closed to the public" during periods of harvest activity. Normal Timber Sale clauses for temporary road construction would be used for this project. Alternative 2 includes an estimated 21 miles of temporary road, while Alternative 3 includes 12 miles and Alternative 4 includes approximately 17 miles.

Skid trails used for ground-based skidding and transport are not considered roads and are managed as part of the thinning/harvest unit.

No cumulative effects to roads have been identified. The project as proposed would provide for it's commensurate share of road construction and maintenance costs to maintain the roads in as-good or better condition following the project. No cumulative effects to trails have been identified. The trails would be restored to its pre-project condition or better (additional armored drainage).

The existing condition reflects past and present activities. There are no known changes or foreseeable actions that would have an additive impact to the existing transportation system that are not considered in the direct and indirect effects discussion. No decisions are included in the proposed action that would change use as decided under the Travel Plan.

This project can be completed without negative direct or indirect effects to the road and trail system. Increased road use during the project would be mitigated using signage, and imposing localized speed limits. The project as proposed would provide for its commensurate share of road construction and maintenance costs to maintain the roads in as-good or better condition following the project. Any new temporary "project roads" planned to be constructed would be constructed, operated, and restored. Sufficient work would be accomplished to provide a safe manageable facility for logging trucks and related traffic. Following project activities, the roads would be closed and rehabilitated. The alternatives as proposed would be consistent with the Travel Plan (2006) and the Gallatin Forest Plan as amended 2015. Potential transportation and access related impacts would be limited to the duration of the project and limited in scope to the roads planned for use and the temporary roads proposed. As a result, there would be no significant impacts to the transportation system or its use.

Compliance with Forest Plan and NFMA
The project would comply with the Gallatin Forest Plan as amended (2015) and Travel Plan (2006).

National Forest Management Act finding:

Construction of temporary roadways in connection with timber contracts, and other permits or leases: Unless the necessity for a permanent road is set forth in the forest development road system plan, any road constructed on land of the National Forest System in connection with a timber contract or other permit or lease shall be designed with the goal of reestablishing vegetative cover on the roadway and areas where the vegetative cover has been disturbed by the construction of the road, within ten years after the termination of the contract, permit, or lease either through artificial or natural means. Such action shall be taken unless it is later determined that the road is needed for use as a part of the National Forest Transportation System (16 USC 1608(b)).

Standards of roadway construction: Roads constructed on National Forest System lands shall be designed to standards appropriate for the intended uses, considering safety, cost of transportation, and impacts on land and resources (16 USC 1608(c)).

Finding: The Gallatin National Forest Travel Plan (2006) analysis and decision has rigorously determined the management objectives of the entire road system throughout the Forest, including this area. This fulfills the roads analysis requirements for project level analysis. In the Travel Plan, disposition of "project roads" was left to the project level decision-making process. Project roads are those roads not open for motorized public use or those open for administrative use.

No additional system roads would be constructed as part of this project. Proposed temporary roads would be constructed and used for the life of the project and would be restored to surrounding area vegetation management objectives as part of the project closeout and not added to the Forest road system. As proposed in all action alternatives, the temporary roads to be constructed would be built to the minimum standard needed to implement the alternatives. The need for temporary roads and restoration plans are discussed in the description of the alternatives and design features common to the action alternatives.

Water Quality

This information is summarized from the North Hebgen Multiple Resource Project *Water Resource Report (White 2015)* which is available on the Gallatin National Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific resource protections related to the water resource are listed in Appendix A - Design Features Common to Action Alternatives.

During project development, internal and external discussions revealed a number of potential issues of concern relating to water quality. These issues, which helped frame the water quality analysis, include increased sediment levels in streams, reduced stream channel stability, increase in water yield, increased peak flows, risk of rain on snow events, effects on identified water quality limited streams, effects upon wetlands and floodplains, and effectiveness of mitigation measures/Best Management Practices. Water resources analysis included quantitative assessment of sediment yield, water yield, and stream channel stability, as well as qualitative assessment of peak flows, rain on snow events, effects on identified water quality limited streams and effects on floodplains and wetlands within the area affected by the proposed action

Table 33. Quantitative measurement indicators and measures for assessing effects which correlate closely with water quality, stream geomorphology, and aquatic ecosystem condition

Resource Element	Resource Indicator	Measure
Water Quality	1. Water Yield in Acre-Ft/Year	% change from reference condition. Changes in water yield of less than 5-10% are considered too small to be measurable.
Water Quality	2. Sediment Yield in tons/year and % change from reference condition	To protect water quality and aquatic species, Gallatin National Forest standards set an allowable limit of 30% above reference level for sediment in Class A streams and 50% above reference level for sediment in Class B streams [10]
Water Quality	3. Stream Channel Stability - A stability rating system indexing Pfankuch stability to Rosgen channel classification was utilized in determining channel stability ratings (Rosgen, 1996).	The resulting stability rating (good, fair, or poor) indicates the stability of a surveyed channel relative to the typical stability level for its Rosgen channel type.

Affected Environment

The proposed project is located in the southern part of the Madison Range north and east of Hegben Lake. All of the drainages in the area are tributary to Hebgen Lake. Elevations range from approximately 6,500 feet to 10,355 feet. Average annual precipitation in the analysis area varies from about 25 - 45 inches (at Sage and White Peaks) and runoff from about 0.8 to 4.0 acre-feet/acre. Rainfall intensity includes moderately high storm intensities, with the 2 yr-6hr storm at around 0.9 inches and the 10 year-6hr storm at 1.3 inches. Vegetative cover within the project area is comprised of approximately 65% forested and 21% shrub/herbaceous cover, with the remaining 14% of the surface being covered by water (primarily Hebgen Lake).

The northern portion of the project area lies in mountainous terrain north of Hebgen Lake. Analysis areas defined within the northern portion of the project area include the following Little Tepee Creek, Tepee Creek, Lower Grayling Creek, Johnson Lake and Red Canyon (see Figure 21). The southern portion of

[10] This standard is the only numeric standard related to water resources. The other measures are indicators of water quality that help the hydrologist make a determination of effects related to other Forest plan standards and water quality related laws.

the project area, known as “The Flats,” includes areas adjacent to Hebgen Lake near Duck Creek and on Madison Arm, including Horse Butte. The topography is typically very flat in this area and there is little evidence, in the form of channels or swales, of surface water flow. It is likely that surface runoff occurs in this area only under extreme and very rare circumstances. The very high infiltration rates and quick-draining nature of the soils results in precipitation and snow melt infiltrating rather than running off the ground surface. For the purpose of water resources analysis the southern portion of the project area includes a single analysis area referred to as “The Flats.”

The project area includes portions of the Duck Creek, Tepee Creek, Grayling Creek, Cougar Creek, Gneiss Creek, Lower Madison River, and Hebgen Lake HUC6 watersheds. The Watershed Condition Framework ratings listed all of the project area watersheds as functioning properly except for Hegben Lake which was classified as functioning at risk due to factors including the Hegben Lake impoundment and fuels buildup in the Lonesome Wood project area west of Hegben Lake. Proposed project area within the Hebgen Lake HUC6 consists only of the northern half (approximately) of Horse Butte. The proposed actions are not expected to affect watershed condition ratings in any watersheds.

An inventory of existing wetland type, location, and acreage was carried out using wetland and riparian mapping information obtained from the Montana Heritage Heritage Program (MTHP) Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. The MTHP map layers provide locations of wetlands and riparian areas one acre or larger based on 2005 aerial photography. In the creation of these maps, wetlands were identified and classified using the Cowardin classification system (Cowardin, 1979) adopted by the National Wetland Inventory and riparian areas were delineated and classified using the U.S. Fish and Wildlife Service’s system for mapping western riparian areas.

Direct, Indirect and Cumulative Effects

Peak Flows

Peak flow is the maximum stream water level reached during a flow event. The flow event may be associated with a period of rapid snowmelt (such events generally produce annual peak flows in Southwest Montana) or it may simply be associated with a precipitation event. Flow rates for peak flows in project area streams were not estimated in this analysis. However, the *potential for the proposed actions to affect peak flows* was addressed utilizing available literature and knowledge of the nature and extent of the proposed activities.

Timber harvest, road building, and other land management activities have the potential to affect peak flows in streams by altering a variety of hydrological variables including interception, snowmelt rates, snowpack distribution, and runoff pathways (Anderson et al, 1976). The potential for the proposed actions to affect peak flows in the assessment area was assessed primarily based on available literature relevant to clearcutting, thinning, or partial cut treatments.

The potential for peak flow increase was assessed for existing and proposed conditions based on the percentage of forest cover removal proposed of each given watershed. Based on the literature, it was assumed for all alternatives that within any given watershed in the study area forest cover removal of less than 15-20% would be unlikely to cause a measurable increase in peak flows (MacDonald et. Al. 1997); and contribution of thinning treatments to peak flow increase would be negligible (USDA FS-2010).

Table 34. Estimated Forest Cover Removal for Alternative 2 based on average forest cover before and after each type of treatment.

Analysis Area	Forest Cover Removed
Tepee Creek	<4%
Little Tepee Creek	12%
Johnson Lake	<2%
Red Canyon	<1%

Alternative 2, of the three alternatives analyzed, would remove the most forest cover. With thinning treatments excluded from the analysis, in accordance with the conclusion of USDA-FS (2010), forest cover removed under Alternative 2 ranges from 12% in Little Tepee Creek Analysis Area to <1% in Red Canyon Analysis Area. This amount of forest cover removal falls below the lower end of the range in which peak flows changes, if any, would be measureable. Based on the literature cited above and forest cover removal estimates of less than 15% it is not likely that Alternative 2, or any of the other proposed alternatives, would result in a detectable increase in peak flows in any of the assessment area watersheds.

It should be noted that the peak flow analysis was based on complete project implementation during a single year (2016). Since project implementation would occur over several years actual effects on peak flows, if any, would be slightly smaller due to initiation of watershed recovery on the first-harvested units.

The Lower Grayling Assessment Area and the Flats Assessment Area were not included in the peak flow analysis because surface drainage in that area occurs only under extreme and very rare circumstances or not at all. Given that surface runoff in these areas only under extreme and very rare circumstances (i.e., with recurrence intervals much longer than 6 years) it can be concluded that any effects of the proposed actions on peak flows would be negligible. The exceptions within The Flats Assessment Area are the west and south slopes of Horse Butte which contain several small catchments. Several of these catchments (which average approximately 40 acres in size) contain poorly defined ephemeral channels. The forested areas within these catchments are sparse, have a significant aspen component (aspen trees would not be harvested) and occupy minor portions of the catchment areas. Proposed treatments would remove very little forest cover in these areas and it is likely that effects of proposed harvest activities on peak flows in these small catchments would be non-existent or negligible.

Rain on Snow Events

Rain-on-snow events exert far less hydrologic influence on Montana watersheds located east of the Continental Divide (e.g., the Custer Gallatin National Forest) than they do upon watersheds to the west. Although rain-on-snow events occasionally occur in the western portion of the Custer Gallatin National Forest they are historically quite rare due to several factors. To exert significant influence on peak flows in this region, rain-on-snow events typically must occur during the May-June period. By that time of year the lower elevation snowpack, which is required to "fuel" a sizable rain on snow event, has generally melted or exists only in remnant form. Within the May-June period the only storms large enough to generate significant precipitation tend to be cold, frontal storms. Such storms typically yield snow in areas above 6000-7000' elevation, bolstering the snowpack in these locations, and rain at lower elevations where the snow pack tends to be already completely melted or present only in remnant form. This temporal disconnect between rainfall and lower elevation snowpack availability causes rain-on-snow events to be very rare in the western Custer Gallatin National Forest. Based on this analysis it is anticipated that the effects of the proposed action on rain-on-snow events would be non-existent or

negligible. For this reason no further analysis of the potential effects of the proposed project on rain-on-snow events was carried out.

Effects on identified water quality listed streams.
Forest management activities such as timber harvest and temporary road building would have the potential to exacerbate identified existing water quality problems in streams draining the project area. Although TMDL development for Red Canyon Creek has not been completed, the Montana Code Annotated – 2007 75-5-703 Section (10)(c) specifies that "pending completion of a TMDL on a water body listed pursuant to 75-5-303 new or expanded non-point source activities affecting a listed water body may commence and continue if those activities are conducted in accordance with reasonable land, soil, and water conservation practices." This provision would allow for the proposed project activities to commence and continue prior to the completion of Red Canyon Creek TMDL since reasonable land, soil, and water conservation practices (in the form of project BMP's and project mitigation measures) would be applied. *If the Red Canyon TMDL is finalized prior to project implementation, additional sediment analysis and consultation with MDEQ would be carried out as necessary to ensure compliance with the TMDL*

Water Yield
The concept that reduction in forest cover is likely to increase water yield and the establishment or re-establishment of forest cover on sparsely vegetated land is likely to decrease water yield (Hibbert 1967, Bosch and Hewlett 1982) is widely accepted. This does not mean, however, that any given reduction in forest cover would result in a *detectable* increase in water yield. Literature examining the effects of forest harvest practices on water yield has generally agreed that a minimum of 20 percent of the forest cover must be removed from a forested watershed in order to produce a detectable change in water yield (Hibbert, 1967; Bosch and Hewlett, 1982; Troendle, 1983). Analysis of water yield at the regional level suggests that the threshold for detectible change in water yield may be 15-20 percent forest cover removal in the Rocky Mountain/Inland Intermountain Region (MacDonald et al., 1997; Stednick, 1996). Based on a literature review by Tobin-Scheer (1992) a hydrologic recovery period of 45 years was assumed for water yield in the forest/landscape type found in the assessment area. Thus, effects of timber harvest on water yield can be expected to disappear completely within approximately 45 years after logging. This recovery does not proceed in a linear fashion, however, and about 50% of the recovery can be expected to take place within the first 10 years after harvest.

The Flats and Lower Grayling Creek analysis areas (Figure 21) show little evidence indicating that surface water drainage occurs on a regular basis. This is due to extremely high infiltration rates associated with local soils. In such locations it was not relevant to calculate effects on annual water yield because there is, effectively, no annual water yield.

In all other areas, effects of the proposed alternatives on water yield were calculated using the Equivalent Clearcut Area (ECA) water balance method (Belt, 1980). The ECA method is a quantitative approach for estimating the effects of past and future activities such as vegetation management on water yield in a given watershed. Originally developed for use in Northern Idaho and Montana, it is now widely used across the Northwestern U.S. for water yield assessments (Ager and Clifton 2005; Belt, 1980). Data sources for ECA model analysis included digital elevation data, past activities data stored within the corporate Forest Activities Tracking (FACTS) database, and proposed activities compiled by alternative. Estimated increases in water yields due to the proposed actions plus existing land management activities and development range from 0.3% in Red Canyon Creek to 5.9% in Little Tepee Creek (Table 35).

Based on field reconnaissance 29% of the Little Tepee analysis area is composed of sub-drainages which appear to generate surface flow only under extreme and very rare circumstances. These areas contain 51% of the proposed treatment acres within the watershed, and if these areas were removed from the

water yield analysis the increase in water yield would be approximately 31% lower than that shown in Table 35 . Thus, the 5.9% increase shown in Table 35 is likely an over-estimate, and the actual increase would be expected to be approximately 4.1%. This adjusted value is also shown on Table 35.

Changes in water yield of less than 5-10% are considered too small to be measurable. Based on this analysis, effects of Alternative 2 on water yield would be minor and of a magnitude which is not measureable in the Tepee Creek, Little Tepee Creek, Johnson Lake, and Red Canyon Assessment Areas. Corresponding effects on water quality are expected to be negligible or non-existent. Based on Tobin-Scheer (1992) any effects on water yield would be expected to decrease by 50% ten years after harvest operations and disappear completely within 45 years after harvest. Potential effects to water yield in the Flats and Lower Grayling Creek Assessment Areas were not analyzed because surface drainage in those areas occurs only under extreme and very rare circumstances or not at all, so analysis of annual water yield does not apply to these areas. Annual water yield in these areas is negligible under existing conditions and would remain so under the Alternative 2. Alternatives 3 and 4 would have less of an impact on water yield and those estimates are in the summary, Table 37.

Table 35. Estimated Effects of Alternative 2 on Annual Water Yield for the Analysis Areas. This table shows the estimated average annual water yield under "reference" (no human disturbance) conditions, under existing conditions (year 2015), and the first year following project implementation is shown.

Parameter	Tepee Creek	Little Tepee Creek	Johnson Lake	Red Canyon
Watershed Area (mi^2)	2.1	4.5	2.0	10.4
"Reference" Conditions Water Yield (acre ft./yr)	20,100	4,446	1,591	9,561
Existing Water Yield in 2015 (acre ft./yr)	20,143	4,472	1,592	9,566
Existing % Above Reference	0.2%	0.6%	0.1%	0.1%
Predicted Water Yield, First Year after Implementation of Prop. Action (acre ft./yr)	20,433	4,711	1,608	9,591
Percent Above Reference, First Year after Implementation of Proposed Action	1.7%*	5.9%* (Entire watershed) 4.1% (Adjusted)**	1.0%*	0.3%*

*To simplify the analysis procedure, the water yield analysis was based on complete project implementation during a single year (2016). This provides a conservatively high estimate of effects due to project activities. Since project implementation would occur over several years actual water yield increases, if any, would be slightly smaller than shown in due to initiation of water yield recovery on the first-harvested units.

**Adjusted to account for sub-drainages which generate surface flow only under extreme and very rare circumstances (see text below).

Sediment Yield

Sediment yield in streams is a useful indicator of water quality, particularly with respect to stream channel stability and impacts on aquatic organisms. As with water yield, it was not relevant to calculate effects on annual sediment yield in areas that exhibit little evidence indicating that surface water drainage occurs on a regular basis as there is effectively no annual sediment yield in these areas. This includes the Flats and Lower Grayling Creek Analysis Areas.

In all other areas annual sediment yields were evaluated using the WATSED sediment model (Cline et al. 1981). The WATSED sediment assessment procedure predicts stream sediment yield at the watershed scale based upon on-site erosion associated with roads, timber harvest, and fire. The model estimates on-site erosion (adjusted for local soil and terrain characteristics), delivers the eroded material to the stream system, and routes it through the watershed to an "accounting point" chosen by the model operator. As is true for most models that simulate the behavior of complex and variable natural systems, the WATSED model is most accurate when evaluating relative effects of different scenarios such as comparing the effects of proposed actions to each other or to the natural, undisturbed state. The Forest Plan Sediment Standard E-4 is based upon such comparisons. In addition, the ability of the WATSED model to calculate watershed-scale sediment yield makes it uniquely suited for addressing the Forest Travel Plan Sediment Standard.

To assess watershed/catchment compliance with forest-wide sediment standards, the analysis incorporated a comparison between the "reference" sediment yield in tons/year, existing sediment yield and estimated sediment yield under each proposed alternative. The "reference" sediment yield represents average annual watershed sediment yield under pre-management conditions (pre-anthropogenic disturbance), and thus represents a baseline condition based on land types within the watershed and associated basic natural erosion rates. "Existing condition" sediment yield includes reference sediment yield plus the effects of all known past and present human activities/impacts within the assessment area. Sediment yield under each proposed alternative includes the predicted effects of each alternative combined with existing sediment yield. In order to protect water quality and aquatic species, Gallatin National Forest standards set an allowable limit of 30% above reference level for sediment in Class A streams and 50% above reference level for sediment in Class B streams (GNF Travel Plan 2006).

Table 36. Predicted Effects of Alternative 2 on Sediment Yield in Assessment Area watersheds

Parameter	Tepee Creek	Little Tepee Creek	Johnson Lake	Red Canyon
Reference sediment yield (tons/year)	322.3	93.4	99.4	309.9
Existing (2015) sediment yield (tons/year)	328.1	98.7	99.9	313.5
Percent above "reference" under existing conditions (2015)	1.8%	5.7%	0.5%	1.2%
Predicted sediment yield in first year of implementation of proposed action (2016).* (tons/year)	346.0*	116.8*	101.6*	320.2*
Predicted percent above "reference," in first year of implementation of proposed action (2016)*	7.4%*	25.0%* (Entire watershed) 17.3% (Adjusted)**	2.2%*	3.3%*
Predicted sediment yield after complete recovery from proposed action - approximately 6 years after project implementation is complete (tons year)	328.9	99.6	99.9	314.5
Predicted percent above "reference," after complete recovery from proposed action (approximately 6 years after project implementation is complete)	2.3%	6.6%*	0.5%	1.5%

* Assumes complete project implementation in 2016. This provides a conservative estimate of sediment yield increases due to project activities. Actual increases will be slightly lower than shown because sediment producing project activities will actually occur over a 3-5 year period during which some degree of recovery will take place in the first-treated harvest units.

**Adjusted to account for sub-drainages which generate surface flow only under extreme and very rare circumstances (see text below).

As shown in Table 36, existing sediment yield in the modeled assessment area watersheds is slightly higher than reference levels. This is due to past and current management activities involving timber harvest and roads. Predicted sediment yield in the first year after implementation of the action alternatives would range from 0.8% to 25.0% above the reference level depending on the watershed. These levels would be below the allowable limit of 30% above reference level set forth in *Forest Plan Standard E-4 Water, Fisheries, and Aquatic Life* for the Tepee, Little Tepee, and Red Canyon watersheds and below the allowable limit of 50% above reference level in the Johnson Lake watershed.

Based on field reconnaissance 29% of the Little Tepee analysis area is composed of sub-drainages which appear to generate surface flow only under extreme and very rare circumstances. These areas contain 51% of the proposed treatment acres within the watershed, and if these areas were removed from the sediment yield analysis the increase in water yield would be approximately 31% lower.Thus, the 25.0% first-year increase in sediment yield shown in Table 36 is likely an over-estimate and the actual increase would be expected to be approximately 17.3% as shown in the Table. Actual sediment *delivery* to Tepee Creek would be further reduced (significantly) by wide untreated buffers below units 180, 181, 177, 176, 174, 172, and 173, by limiting activities to hand treatment in unit 185, and by spot graveling four potential sediment-contributing segments of FS Road # 986 (Roberts, 2015).

To simplify the analysis procedure, the predicted sediment yield increases discussed above were calculated based on complete project implementation during a single year (2016). In actuality the project would be implemented more gradually, over the course of approximately 3 years, and some degree of "recovery" towards reference level would occur in the first-harvested treatment units during the project implementation period. Thus, the results of this analysis (Table 36) provide a conservatively high estimate of impacts of the alternatives on sediment yield. Predicted increases in sediment yield would be less for alternatives 3 and 4. The estimates are included in Table 37.

Effects of the proposed harvest activities would be expected to diminish relatively quickly, with sediment yield in all watersheds expected to return to pre-project (or nearly pre-project) levels approximately 6 years after project activities cease. At that time residual increases in sediment yield, if any, would be attributed to small amounts of sediment associated with the decommissioned temporary project roads.

Effects upon sediment yield in the Flats and Lower Grayling Creek Assessment Areas were not analyzed because surface drainage in those areas occurs only under extreme and very rare circumstances or not at all, making analysis of annual sediment yield irrelevant. Annual sediment yield in these areas is negligible under existing conditions and would remain so under all action alternatives.

Increases in sediment yield would be temporary and below the allowable limits set forth in *Forest Plan Standard E-4 Water, Fisheries, and Aquatic Life* in all assessment areas. This would ensure that any increases in sediment yield due to project implementation would fall below the threshold required to degrade the quality of aquatic habitat. In doing so, adherence to the sediment standard would also adequately protect stream stability and function, and effects on stream stability are expected to be negligible. The increases in sediment yield would be temporary, and sediment yield in all watersheds would be expected to return to pre-project (or nearly pre-project) levels within approximately 6 years after project activities cease (Table 36).

Stream Channel Stability

Stream channel stability is an indicator of existing stream condition and resilience of a channel to disturbance and, as such, represents an indicator of water quality with respect to sedimentation. The potential for the

action alternatives to affect stream channel stability was addressed based on current stream condition and classification and on available literature. The primary mechanisms by which the proposed action has the potential to affect stream channel stability is by causing increased water yield, peak flows, and/or sediment inputs. Potential effects to stream channel stability were not assessed in the Flats and Lower Grayling Creek Assessment Areas because surface drainage in those areas occurs only under extreme and very rare circumstances or not at all and, as a consequence, the drainage network in those areas does not include defined channels (with the exception of Horse Butte, which is discussed below). Because defined channels were not present, channel stability analysis was not conducted in these areas.

Channel stability was assessed using a protocol established by Pfankuch (1975). The Pfankuch channel stability assessment protocol (Pfankuch, 1975) provides a combined assessment of upper bank, lower bank, and channel stability by scoring numerous physical parameters and generating an overall stability rating. The overall stability rating is a measure of the capacity of a stream reach to resist the detachment of bed and bank materials and to recover from potential changes in flow or sediment production (Collier, 1992). Several studies have shown that the Pfankuch stability rating is correlated with the taxonomic richness and abundance of benthic invertebrate communities, the biomass of periphyton, and trout (Collier, 1992; Rounick & Winterbourn, 1982).

The inherent stability of stream channels differs by stream channel type. The Rosgen stream classification system was utilized to determine stream channel types. This classification system, which defines an array of stream channel types based on common patterns of channel morphology, is the most widely used stream channel classification method in the United States (Ward et al, 2008). For this analysis a modified stability rating system indexing Pfankuch stability to Rosgen channel classification was utilized in determining channel stability ratings (Rosgen, 1996). The resulting stability rating (good, fair, or poor) indicates the stability of a surveyed channel relative to the typical stability level for its Rosgen channel type.

Based on the analysis in White 2016 and this summary it is not expected that the effects of activities prescribed by the Alternatives upon water yield, peak flows, and sediment (alone or in aggregate) would be adequate in magnitude or duration to produce changes in existing stream stability on streams within the project area. Stream stability ratings would be expected to remain at existing levels, which are primarily "good" with one stream rated "fair" and another (UNK0214) rated "good" but containing an incised reach rated as "poor". The incised stream reach lies on UNK0214, which is a small, ephemeral tributary to Red Canyon Creek. The incised segment of UNK0214 is recovering naturally from incision, the cause of which has not been determined. Due to its small size and seasonal flow pattern, this stream contributes very little to overall Red Canyon Creek sediment yield.

Cumulative Effects

By definition cumulative effects (40 CFR 1508.7) result from the proposed action alternatives and thus are not germane to the No Action Alternative.

Past and current actions were identified by data bases, informational systems, aerial photos, and other records. This information was incorporated into the effects analyses summarized here, thus cumulative impacts of past and current actions/activities with the proposed actions have already been incorporated into those analyses. Future actions/activities were incorporated into the cumulative effects analysis through consideration of the magnitude and duration of the effects as discussed in White 2016. Sediment impacts of future actions/activities could result in cumulative effects with proposed actions within the project area, however those effects would be insignificant because the impacts would be limited in magnitude and/or duration, because design features are typically included in Forest Service activity authorizations in order to limit impacts, and because the practice of the Forest Service when administering

activity on FS lands is to monitor and remedy resource conflicts. New activities would be evaluated under their own NEPA process. This cumulative effects assessment concludes that the identified present and known future activities within the project area would not, individually or in aggregate, cumulatively contribute to significant effects to water quality.

Summary of Effects of the Alternatives

Table 37. Summary of Effects for Alternatives 2-4

Tepee Creek Assessment Area					
Resource Element	**Resource Indicator**	**No Action Alternative**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Water Quality	Water Yield - Changes in water yield of less than **5-10%** are considered too small to be measurable.	Expected to remain at existing level, but may decrease slightly as effects associated with past logging diminish over time. Existing level is 0.2% above reference level.	Temporary increase to 1.7% above reference level (possible minor increase of a magnitude which is not measureable.)*	Temporary increase to 1.6% above reference level (possible minor increase of a magnitude which is not measureable.)*	Temporary increase to 1.7% above reference level (possible minor increase of a magnitude which is not measureable.)*
Water Quality	Sediment Yield	Expected to remain at existing levels which is 1.8% above reference conditions.	Temporary increase to 7.4% above reference level**	Temporary increase to 7.3% above reference level**	Temporary increase to 7.3% above reference level**
Water Quality	Stream Channel Stability	Expected to remain at existing level.	Negligible change from existing level.	Negligible change from existing level.	Negligible change from existing level.
Little Tepee Creek Assessment Area					
Resource Element	**Resource Indicator**	**No Action Alternative**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Water Quality	Water Yield	Expected to remain at existing level, but may decrease slightly as effects associated with past logging diminish over time. Existing level is 0.6% above reference level	Temporary increase to 4.1% above reference level (possible minor increase of a magnitude which is not measureable.)*	Temporary increase to 3.7% above reference level (possible minor increase of a magnitude which is not measureable.)*	Temporary increase to 3.7% above reference level (possible minor increase of a magnitude which is not measureable.)*
Water Quality	Sediment Yield	Expected to remain at existing level which is 5.7% above reference conditions	Temporary increase to 17.3% above reference level**	Temporary increase to 16.8% above reference level**	Temporary increase to 16.8% above reference level**
Water Quality	Stream Channel Stability	Expected to remain at existing level.	Negligible change from existing level.	Negligible change from existing level.	Negligible change from existing level .
Lower Grayling Assessment Area					
Resource Element	**Resource Indicator**	**No Action Alternative**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Water Quality	Water Yield	Annual water yield is negligible under existing conditions and would remain so under the No Action Alternative	Annual water yield is negligible under existing conditions and would remain so under the Alternative 2	Annual water yield is negligible under existing conditions and would remain so under the Alternative 3	Annual water yield is negligible under existing conditions and would remain so under the Alternative 4

Water Quality	Sediment Yield	Annual sediment yield is negligible under existing conditions and would remain so under the No Action Alternative	Annual sediment yield is negligible under existing conditions and would remain so under Alternative 2	Annual sediment yield is negligible under existing conditions and would remain so under Alternative 3	Annual sediment yield is negligible under existing conditions and would remain so under Alternative 4
Water Quality	Stream Channel Stability	Negligible effects	Negligible effects	Negligible effects	Negligible effects
		Johnson Lake Assessment Area			
Resource Element	**Resource Indicator**	**No Action Alternative**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Water Quality	Water Yield	Expected to remain at existing level, but may decrease slightly as effects associated with past logging diminish over time. Existing level is 0.1% above reference level	Temporary increase to 1.0% above reference level (possible minor increase of a magnitude which is not measureable.)*	Temporary increase to 0.5% above reference level (possible minor increase of a magnitude which is not measureable.)*	Temporary increase to 0.5% above reference level (possible minor increase of a magnitude which is not measureable.)*
Water Quality	Sediment Yield	Expected to remain at existing level which is 0.5% above reference conditions	Temporary increase to 2.2% above reference level**	Temporary increase to 0.8% above reference level**	Temporary increase to 0.9% above reference level**
Water Quality	Stream Channel Stability	Expected to remain at existing level.	Negligible change from existing level.	Negligible change from existing level.	Negligible change from existing level.
		Red Canyon Assessment Area			
Resource Element	**Resource Indicator**	**No Action Alternative**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Water Quality	Water Yield	Expected to remain at existing level, but may decrease slightly as effects associated with past logging diminish over time. Existing level is 0.1% above reference level	Temporary increase to 0.3% above reference level (possible minor increase of a magnitude which is not measureable.)*	Temporary increase to 0.3% above reference level (possible minor increase of a magnitude which is not measureable.)*	Temporary increase to 0.3% above reference level (possible minor increase of a magnitude which is not measureable.)*
Water Quality	Sediment Yield	Expected to remain at existing level which is 1.2% above reference conditions	Temporary increase to 3.3% above reference level**	Temporary increase to 2.9% above reference level**	Temporary increase to 3.3% above reference level**
Water Quality	Stream Channel Stability	Expected to remain at existing level. ***	Negligible change from existing level. ***	Negligible change from existing level. ***	Negligible change from existing level. ***
		The Flats Assessment Area			
Resource Element	**Resource Indicator**	**No Action Alternative**	**Alternative 2**	**Alternative 3**	**Alternative 4**
Water Quality	Water Yield	Annual water yield is negligible under existing conditions and would remain so under the No Action Alternative	Annual water yield is negligible under existing conditions and would remain so under the Alternative 2	Annual water yield is negligible under existing conditions and would remain so under the Alternative 3	Annual water yield is negligible under existing conditions and would remain so under the Alternative 4

Water Quality	Sediment Yield	Annual sediment yield is negligible under existing conditions and would remain so under the No Action Alternative.	Annual sediment yield is negligible under existing conditions and would remain so under Alternative 2	Annual sediment yield is negligible under existing conditions and would remain so under Alternative 3	Annual sediment yield is negligible under existing conditions and would remain so under Alternative 4
Water Quality	Stream Channel Stability	Negligible effects	Negligible effects	Negligible effects	Negligible effects

* Effects on water yield would be expected to decrease by 50% ten years after harvest operations and disappear completely within 45 years after harvest.

** These levels would be below the allowable limit of 30% above reference level set forth in Forest Plan Standard E-4 Water, Fisheries, and Aquatic Life for the Tepee, Little Tepee, and Red Canyon watersheds and below the allowable limit of 50% above reference level in the Johnson Lake watershed. Sediment yield is expected to return to pre-project (or nearly pre-project) levels within approximately 6 years after project activities cease.

*** The incised segment of the ephemeral channel UNK0214 would continue to slowly recover through natural processes, with improvement in channel stability being the expected end result.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

State of Montana Water Quality Regulations

The State of Montana maintains primacy with respect to water quality standards and pollutant discharge management programs. This primacy status requires that the provisions of the State of Montana Water Quality Act meet or exceed all requirements of the Federal Clean Water Act.

The proposed actions would meet State of Montana Clean Water Act requirements to protect, maintain, and improve the quality of water for beneficial uses for the following reasons and therefore the Clean Water Act requirements.

- *Best Management Practices (BMP's) would be applied.*

The Administrative Rules of Montana (ARM 16.20.603) stipulates that "land management activities must not generate pollutants in excess of those that are naturally occurring", regardless of the stream's classification. "Naturally occurring" is defined in the ARM as "conditions or material present from runoff or percolation over which man has no control or from developed lands where all reasonable land, soil, and water conservation practices have been applied." The ARM 16.20.603(21) defines "reasonable land, soil, and water conservation practices" as "methods, measures, or practices that protect present and reasonably anticipated beneficial uses." These practices include effective Best Management Practices (BMP's) employed to protect beneficial uses. All of the proposed alternatives would require the implementation of effective BMP's throughout the project area.

One water body within the assessment area has been designated as water quality Category 5, and thus is considered an impaired water body and appears on the 2016 303(d) list: Red Canyon Creek from headwaters to mouth (waterbody MT41F006_020) (MDEQ, 2016c). The listed probable causes for impairment on this 6-mile long stream are "sediment/siltation," "physical substrate habitat alterations, and "alterations in stream-side or littoral vegetative covers" (MDEQ, 2016a). Sources are listed as "grazing in riparian or shoreline zones," "natural sources," and "silviculture activities." The MDEQ concluded that the beneficial uses associated with agricultural use and drinking water are fully supported while those associated with aquatic life and recreation are not fully supported (MDEQ, 2016a). *TMDL guidelines have not yet been developed for Red Canyon Creek. The MDEQ has assigned a TMDL development status of "in progress" and TMDL priority of "high" to Red Canyon Creek (MDEQ, 2014b).*

Although TMDL development for Red Canyon Creek has not been completed, the Montana Code Annotated – 2007 75-5-703 Section (10)(c) specifies that "pending completion of a TMDL on a water body listed pursuant to 75-5-303 new or expanded non-point source activities affecting a listed water body may commence and continue if those activities are conducted in accordance with reasonable land, soil, and water conservation practices." This provision would allow for the proposed project activities to commence and continue prior to the completion of Red Canyon Creek TMDL since reasonable land, soil, and water conservation practices (in the form of project BMP's and project mitigation measures) would be applied. *If the Red Canyon TMDL is finalized prior to implementation, additional sediment analysis and consultation with MDEQ would be carried out as necessary to ensure compliance with the TMDL.*

- *Custer Gallatin Forest BMP's are consistently monitored for effectiveness, and improvements are instituted as needed.*

A formal project implementation review process has been used on the Custer Gallatin NF since 2005 to review implementation and effectiveness of a wide variety of projects, including vegetation management projects such as the North Hebgen Project, and to document conclusions and recommendations for improvement. Among items evaluated in the implementation reviews are mitigation measures and Best Management Practices (BMP's). In general, rating of the application and effectiveness of BMP's has shown them to be very effective. The vast majority of BMP's have been found to meet requirements and provide effective and adequate protection of resources. In cases where application objectives or effectiveness goals have not been fully met, improvements to BMP's have been developed and instituted to improve effectiveness. Implementation Review Reports are available on the Custer Gallatin NF website at: http://www.fs.usda.gov/detail/gallatin/landmanagement/?cid=stelprdb5190912.

Gallatin National Forest Plan as amended 2015

The Gallatin National Forest Land and Resource Management Plan (Forest Plan) provides standards for protection of water quality.

Applicable forest wide standards (Forest Plan pp. II-24-25)

- Best management practices will be used on all Forest watersheds in the planning and implementation of project activities (Forest Plan Appendix C and planning records – "Watershed Management Guidelines for the Gallatin National Forest")
- All management practices will be designed or modified as necessary to maintain land productivity and protect beneficial uses.

  As described in the preceding paragraphs the proposed actions would employ Best Management Practices to mitigate impacts occurring to the watershed resource from land use activities and meet State of Montana Clean Water Act requirements which would *maintain land productivity and protect beneficial uses. Therefore, the proposed project would meet this Forest Plan standard.*
- Require a watershed cumulative effects feasibility analysis of projects involving significant vegetation removal, prior to including them on implementation schedules, to ensure that the project, considered with other activities, will not increase water yields or sediment beyond acceptable limits.

  The effects analysis presented in the Water Resources Report (White 2016), which included cumulative effects with past, present and reasonably foreseeable future activities, showed that the proposed actions would not increase water yields or sediment beyond acceptable limits. This standard would be met because increases in sediment and water yields associated with the project would be minor, temporary, and would fall within acceptable limits established by the Gallatin National Forest Plan.

Forest Travel Plan Direction
Standard E-4 Water, Fisheries, and Aquatic Life sets the acceptable limits for sediment associated with management activities. Sediment yield analysis was carried out as part of the water quality analysis. *The proposed project would be consistent with Standard E-4 Water, Fisheries, and Aquatic Life because calculated increases in sediment associated with the project would be minor, temporary, and would fall within acceptable limits established by the Gallatin National Forest Plan as amended by the Gallatin National Forest Travel Management Plan Detailed Description of Decision – Chapter 3 (USFS, 2006).* These limits were established at levels designed to fully support the protection of water quality, and habitat for fish, riparian dependent species and other aquatic organisms.

Executive Order 11990 – Protection of Wetlands
Executive Order 11990 calls for the identification, assessment, and protection of wetlands by requiring Federal agencies to avoid, if possible, and practicable, adverse impacts to wetlands and to preserve and enhance the natural and beneficial values of wetlands. *The proposed project would be consistent with these requirements because operation of vehicles and logging machinery as well as deposition of materials within wetland areas would be prohibited.*

Executive Order 11988 – Floodplain Management

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. *The proposed project would be consistent with these requirements since no occupancy or modification of floodplains is proposed. Furthermore, the 15 ft no-cut zone adjacent to streams and State-mandated SMZ requirements will ensure that little or no disturbance will occur within the narrow floodplain areas associated with the project area streams.*

State and Federal Permit Requirements
The proposed project would be consistent with permitting requirements because all required water quality permits would be acquired by the Gallatin NF prior to any ground disturbance activities for the proposed action including 124 permits and Nationwide 404 permit compliance validations for stream crossings (at this time, there has been no activity identified which would require these permits).

Conclusion
The potential impacts related to the action alternatives would be limited in scope to the area near streams in the analysis area. The proposed actions would employ Best Management Practices to mitigate impacts occurring to the watershed resource from land use activities and as a result would meet State of Montana Clean Water Act requirements and Forest Plan requirements. Project design and BMP's would limit the potential impacts to within acceptable limits under the Forest Travel Plan. As a result, the intensity of impacts is very limited. No significant impacts would be expected to the water resource.

Wildlife

Wildlife resources summarized from the *Wildlife Specialist Report (Frost 2016)* include federally listed species, FS Region 1 sensitive species, management indicator species identified in the GNF Land and Resource Management Plan, migratory bird Species of Concern (SOC), and species/issues of interest as identified through scoping. The Report is available on the Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request. Specific design features and resource protections related to Wildlife are listed in the description of alternatives and in Appendix A - Design Features Common to Action Alternatives

Species Threatened and Proposed for listing under ESA

Canada Lynx (Frost 2016 pp. 52-68)

Canada lynx (referred to herein as lynx) was listed as a threatened species in the contiguous United States under the ESA in 2000. Critical habitat has been designated for the species, but the project is not located within the critical habitat boundary. According to the most current understanding of lynx ecology and behavior, timber harvest has the potential to affect lynx productivity through impacts on foraging habitat (USDA Forest Service 2007d pg. 2; Ruediger et al. 2000 pp. 2-2 through 2-5).

Because vegetation management projects may affect lynx through impacts on foraging habitat, this factor was selected as the resource indicator for this analysis to compare effects of the alternatives on Canada lynx. Effects on foraging habitat were measured by quantifying how the project would affect lynx foraging habitat (i.e., snowshoe hare winter habitat), which includes stands in the stand initiation and multi-storied structural stages, and whether the project is consistent with FP direction.

The Lynx Conservation Assessment and Strategy (Interagency Lynx Biology Team 2013) and NRLMD Record of Decision (ROD) (USDA Forest Service 2007d, Attachment 1, p. 12) discuss the use of a lynx analysis unit (LAU) to analyze project impacts to Canada lynx. LAUs approximate the area used by an individual lynx and are the units used to analyze the effects of a project. The NRLMD ROD identified the lynx analysis unit (LAU) as the appropriate scale for analysis and consultation (USDA Forest Service 2007d), Attachment 1, pg. 12). The project lies mostly within the Upper Madison LAU, which is *97,174* acres in size. Horse Butte and areas south of Cougar Creek are not within any LAU boundary. This is because, at the time LAU boundaries were drawn, it was determined that some of the soils in the Hebgen Basin do not have the potential to support habitat capable of providing an adequate prey base for lynx, and these areas were excluded from LAUs. The Upper Madison LAU was used as the analysis area for lynx and those portions of the project area that are outside the LAU are not considered lynx habitat. See Figure 11 in the Wildlife Specialist Report (Frost, 2015, p. 186)

Affected Environment
The USFWS listed Canada lynx as a threatened species in March 2000. USFWS determined that the main threat to lynx was the "lack of guidance for conservation of lynx and snowshoe hare habitat in National Forest Land and Resource Plans and BLM Land Use Plans (USDI Fish and Wildlife Service 2000 pg. 8). In March of 2007 the FS issued the NRLMD ROD (USDA Forest Service 2007d). The ROD was amended to forest plans in the Northern Rockies, including the GNF FP, and established management direction to conserve and promote recovery of the Canada lynx, by reducing or eliminating adverse effects from land management activities on NFS lands, while preserving the overall multiple use direction in existing plans.

The NRLMD provides standards and guidelines to apply to lynx habitat. Although developed in 2007, the NRLMD is consistent with more recent science that has been published regarding lynx habitat and populations. A review of recent information and science concluded that the NRLMD is consistent with recent information, and, thus, is applicable as a management strategy (USDA Forest Service 2013a).

In the NRLMD, objectives define desired resource conditions for lynx habitat (USDA Forest Service 2007d pg. 7). Standards are non-discretionary management requirements used to meet objectives. Guidelines are management actions normally taken to meet objectives. The objectives, standards, and guidelines of the NRLMD were incorporated into the design of the vegetation treatments proposed in the North Hebgen Project. Those that apply to this project are discussed here.

In summary, the following standards and guidelines set the regulatory framework for management of lynx habitat (excluding the use of prescribed fire) when considering the design and effects of a vegetation management project.

Table 38: Regulatory Framework for vegetation management projects in lynx habitat applicable to this project

Label	Direction
Standard VEG S1	With some exemptions, if more than 30% of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects.
Standard VEG S2	With some exemptions, timber management projects shall not regenerate more than 15% of lynx habitat on National Forest System lands within an LAU in a 10-year period.
Standard VEG S5	Precommercial thinning projects that reduce snowshoe hare habitat may occur from the stand initiation structural stage until the stands no longer provide winter snowshoe hare habitat only: (1) within 200' of administrative sites, dwellings, or outbuildings; (2) for research studies or genetic tree tests evaluating genetically improved reforestation stock; (3) based on new information…where a written determination states that a project is not likely to adversely affect lynx, or that a project is likely to have short term adverse effects on lynx or its habitat but would result in long-term benefits to lynx and its habitat; (4) for conifer removal in aspen, or daylight thinning around individual aspen trees where aspen is in decline; (5) for daylight thinning of planted rust-resistant white pine where 80% of the winter snowshoe hare habitat is retained; or (*6)* to restore whitebark pine. *For the Gallatin portion of the Custer Gallatin National Forest, up to 1,310 acres in the stand initiation structural stage may be treated for other resource benefits under the exception criteria to Veg S5 (NRLMD BO).* Fuels treatment projects within the WUI that do not meet these Standards shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest).
Standard VEG S6	Vegetation management projects that reduce snowshoe hare habitat in multi-story mature or late-successional forests may occur only: (1) within 200' of administrative sites, dwellings, outbuildings, recreation sites, and special use permit improvements, including infrastructure within permitted ski area boundaries; (2) for research studies or genetic tree tests evaluating genetically improved reforestation stock; or (3) for incidental removal during salvage harvest (e.g., removal due to location of skid trails). Fuels treatment projects within the WUI that do not meet these Standards shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest).

Label	Direction
Guideline VEG G10	Fuel treatment projects within the WUI as defined by the Healthy Forests Restoration Act should be designed considering Standards VEG S1, S2, S5, and S6 to promote lynx conservation.
Standard ALL S1	New or expanded permanent development and vegetation management projects must maintain habitat connectivity in an LAU and/or linkage area.
Guideline HU G9	On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is over, these roads should be reclaimed or decommissioned, if not needed for other management objectives.

Lynx have not been observed on the Hebgen Lake Ranger District since 1999, but the species is considered by USDI Fish and Wildlife Service to be present on the District (USDI Fish and Wildlife Service 2015). The Hebgen Lake Ranger District files contain four reports of lynx observations on the District, all of which occurred prior to 1999. Three of the four observations occurred on the north side of Hebgen Lake: two along Tepee Creek Road and one close to Skyline Ridge. These are all in the vicinity of the project area. The fourth observation was south of Highway 20, which is several miles from the project area boundary. MFWP has only one record of a lynx observation on the district (also prior to 1999), and that record corresponds with one of the Hebgen Lake Ranger District sightings along Tepee Creek.

For this analysis, the amount of potential lynx habitat and existing snowshoe hare winter habitat (lynx foraging habitat) within the Upper Madison LAU was identified. Potential lynx habitat includes all areas that are capable of providing habitat for lynx, regardless of their current condition. Snowshoe hare winter habitat includes mature multi-storied stands and stands in the stand initiation structural stages that have regenerated between 15 and 40 years. Habitat was identified in a two-stage process: 1) GIS analysis followed by 2) field verification of the GIS data.

Over time, the methodology for delineating lynx habitat has changed as Regionally-developed and supported data layers, updated GIS analysis techniques, and guidance from recently published literature and lynx researchers has become available. As part of updating potential lynx habitat mapping, methodologies were developed to categorize potential lynx habitat into the forest structural stages commensurate with those in the Northern Rockies Lynx Management Direction (NRLMD). An updated existing vegetation layer (2015 R1VMap) became available recently and is based on recent satellite imagery. The accuracy assessment for this layer indicates that it is very robust in classifying lifeform (tree versus grass), vegetation size class, canopy cover, and dominance type. One advancement of the VMAP used for the 2016 analysis is that the newer version picks up recent disturbance in previously forested habitats. In addition, previous queries of existing vegetation and ecological data that eliminated southerly aspects as potential lynx habitat were eliminated. As a result, the lynx habitat identified in the North Hebgen project differed between the Draft EA and the Final EA. Refinement of the queries used and use of updated vegetation data resulted in more lynx habitat being identified in the North Hebgen analysis area in the analysis contained in the Final EA. Documentation of this 2016 lynx habitat mapping refinement effort for the Custer Gallatin National Forest (CGNF) is provided in Canfield (2016). The methodology and binning logic described in Canfield (2016) for identification of lynx habitat is consistent with the Regional Forester's memo dated September 6, 2016 regarding lynx habitat mapping in Region 1 (Marten 2016).

For more detailed information about the methodology *used to bin and identify lynx habitat in the Upper Madison LAU* see the *Wildlife Specialist Report (Frost 2016)* on the Forest Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request.

Table 39: Potential Lynx Habitat within the Upper Madison LAU

LAU Name	LAU Total Acres	Total Lynx Habitat Acres	Stand Initiation[1] (provides winter forage) Acres (% of lynx habitat)	Early Stand Initiation[2] (provides summer forage only) Acres (% of lynx habitat)	Multistory[3] (forage) Acres (% of lynx habitat)	Other[4] (Stem exclusion; multistory non-feeding) Acres (% of lynx habitat)
Upper Madison	*97,174*	*44,841*	*331 (0.7%)*	*646 (1.4%)*	*32,280 (72%)*	*11,584 (25.8%)*
% of LAU	*100*	*46*	*<1*	*1*	*33*	*12*

[1] Stand initiation structural stage is where the trees have grown tall enough such that limbs protrude above the snow in winter and are available to snowshoe hares for winter foraging and habitat.

[2] Early stand initiation structural stage that currently does not provide winter snowshoe hare habitat. Depending on time since disturbance, this stage may provide summer forage.

[3]Multi-story structural stage has high horizontal cover created by several age classes of conifers, shrubs, and other trees. These stands provide yearlong snowshoe hare habitat and also provide the necessary conditions for lynx denning habitat.

[4] Other – Stem exclusion (open and closed canopy) and mid-seral/multi-story. This group includes closed canopy stands with limited understory vegetation. These stands do not provide snowshoe hare foraging habitat during any season. Some of these stands may provide denning habitat for lynx.

Direct and Indirect Effects

Alternative 1 – No Action

Natural disturbances and forest succession within the LAU would affect the amount and quality of lynx foraging habitat over time. These changes are difficult to predict; although, both disturbance and transition to late successional stages can increase lynx foraging opportunities over time

Alternatives 2, 3, and 4

The information contained in this portion of the North Hebgen Multiple Resource Project Environmental Analysis is a summary of the effects analysis disclosed in the wildlife specialist report. Please refer to the wildlife specialist report (Frost 2016) for additional details regarding the analysis of project impacts on the Canada lynx. Table 40 summarizes the amount of lynx habitat that would be treated under each Action Alternative, separated out by structural stage and treatment types. Table **41** simplifies the summary by just showing the amount treated by structural stage and referencing the amount treated as a proportion of the amount of lynx habitat in the LAU.

To be as conservative as possible in this analysis with respect to lynx, it was assumed that all treatment types that would occur in snowshoe hare habitat would reduce the suitability of that habitat for snowshoe hares in the winter. *The project would affect 154 acres of existing snowshoe hare winter habitat in the stand initiation structure stage under Alternative 2, 149 acres under Alternatives 3, and 152 acres under*

Alternative 4. This would account for less than 1% of all snowshoe hare winter habitat in the Upper Madison LAU. The project could also affect up to 519 acres of habitat in the multi-storied structural stage with implementation of Alternative 2, up to 425 acres with Alternative 3, and up to 465 acres with Alternative 4. For all alternatives, this accounts for 1.5% of all lynx habitat in the Upper Madison LAU. In total, each of theall action alternatives would treat no more than 2% of the existing snowshoe hare winter habitat (stand initiation, early stand initiation, and multi-storied structural stages) in the Upper Madison LAU.

While it is assumed that treated stands would no longer be suitable for snowshoe hare foraging, the majority of treatments would retain overstory and understory trees and other vegetation that will provide structure that will provide for lynx movement across the landscape. Intermediate treatments would maintain in excess of 60 feet of basal area, which equates to 50 to 200 trees per acre, depending on size. Improvement thinning would maintain existing aspen and those conifers not competing with or suppressing aspen stand regeneration. Activities designed to improve whitebark pine stands, precommercial thinning, post and pole thinning, and hand treatments would also retain live structure (understory and overstory) and dead wood features that contribute to hiding cover. While some stands would be regeneration harvested to address the purpose and need for the project, the openings created in these stands would be no larger than 40 acres, distributed throughout the planning area within a matrix of suitable lynx habitat and other forested stands, and in areas with topographic variety. Following implementation, the juxtaposition of structural stages and compositions in the project area would provide for the movement of lynx across the landscape. No new development (residential development, paved road construction, etc.) would occur under this project that would restrict the movement of lynx across the landscape.

As stated in USDA Forest Service (2007c), Appendix P, pg. 40083, lynx have evolved to adapt to a shifting boreal forest composed of a mosaic of species, stand ages, and structures to support snowshoe hares. That document also stated that lynx operate at large scales and an activity would have to occur across a very large area (at least several home ranges) to significantly impact a local lynx population (USDA Forest Service 2007c pg. 40083). The action alternatives would maintain a mosaic across the LAU and the changes would occur at such a small scale so as to have a minimal effect on lynx.

Table 40: Summary of effects of precommercial thinning, regeneration harvest, and other treatments by alternative

Treatment Type		Alt 2					Alt 3					Alt 4				
		ESI [1]	SI[2]	MS [3]	Other [4]	Total Alt 2	ESI [1]	SI[2]	MS [3]	Other [4]	Total Alt 3	ESI [1]	SI[2]	MS [2]	Other [4]	Total Alt 4
PCT[5]	*Daylight*	*0*	*93*	*77*	*126*	*296*	*0*	*93*	*77*	*126*	*296*	*0*	*93*	*77*	*126*	*296*
	PCT	*0*	*30*	*8*	*12*	*50*	*0*	*30*	*8*	*12*	*50*	*0*	*30*	*8*	*12*	*50*
	Total PCT	*0*	*123*	*85*	*138*	*346*	*0*	*123*	*85*	*138*	*346*	*0*	*123*	*85*	*138*	*346*
Regen-eration[6]	*Group Selection*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Regen	*0*	*12*	*115*	*271*	*398*	*0*	*7*	*103*	*232*	*342*	*0*	*10*	*109*	*247*	*366*
	Total Regen	*0*	*12*	*115*	*271*	*398*	*0*	*7*	*103*	*232*	*342*	*0*	*10*	*109*	*247*	*366*
Other[7]		*0*	*19*	*319*	*500*	*838*	*0*	*19*	*237*	*440*	*696*	*0*	*19*	*271*	*484*	*774*
Total All Harvest		*0*	*154*	*519*	*909*	*1,582*	*0*	*149*	*425*	*810*	*1,384*	*0*	*152*	*465*	*869*	*1,486*

Notes:

1. ESI = Early stand initiation structural stage where the trees have not grown tall enough to protrude above the snow in winter.
2. SI = Stand initiation structural stage that currently provides winter snowshoe hare habitat
3. MS = Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat.
4. Other = Stem exclusion Structural Stage (closed canopy with understory limited) and multistory structural stage with many age classes and vegetation layers that do not provide snowshoe hare habitat.
5. PCT = Precommercial thin as defined in the NRLMD ROD (USDA Forest Service 2007d pg. 13): “Precommercial thinning is mechanically removing trees to reduce stocking and concentrate growth on the remaining trees, and not resulting in immediate financial return.” Treatment types that fall under this definition proposed for this project include daylighting, and precommercial thinning.
6. Regeneration = Regeneration Harvest as defined in the NRLMD ROD (USDA Forest Service 2007d pg. 14): “The cutting of trees and creating an entire new age class; an even-age harvest. The major methods are clearcutting, seed tree, shelterwood, and group selective cuts.” Treatment types that fall under this definition proposed for this project include group selection and regeneration harvest.
7. Other = treatment types that do not fall under the precommercial thinning or regeneration harvest definitions. Treatment types that fall under this definition that are proposed for this project and that will occur in lynx habitat include hand treatments, intermediate harvest, post and pole, and powerline clearing/thinning.

Table 41: Lynx habitat to be treated within the Upper Madison LAU by action alternative

Alter-native	LAU Total Acres	Total Lynx Habitat Acres	Early Stand Initiation[1] Acres (% of lynx habitat)	Stand Initiation[2] Acres (% of lynx habitat)	Multistory[3] Acres (% of lynx habitat)	Existing Snowshoe Hare Winter Habitat[4] Acres (% of lynx habitat)	Other[5] Acres (% of lynx habitat)
2	97,174	44,841	0 (0%)	154 (<1%)	519 (1%)	673 (2%)	909 (2%)
3	97,174	44,841	0 (0%)	149 (<1%)	425 (1%)	574 (1%)	810 (2%)
4	97,174	44,841	0 (0%)	152 (<1%)	465 (1%)	617 (1%)	869 (2%)

Notes:
1. Early stand initiation structural stage where the trees have not grown tall enough to protrude above the snow in winter; these stands may provide summer foraging habitat.
2. Stand initiation structural stage that currently provides winter snowshoe hare habitat
3. Multistory structural stage with many age classes and vegetation layers that provide snowshoe hare habitat.
4. Total of stand initiation and multi-storied structural stages.
5. Other = potential lynx habitat that does not provide winter snowshoe hare habitat. May include stem exclusion structural stage (closed canopy and more open canopy with limited understory) or mid-seral structural stages that do not provide snowshoe hare habitat.

Cumulative Effects of the Action Alternatives

The description of the affected environment included past actions. In addition to the reasonably foreseeable actions in the LAU, this project would further contribute to the mosaic of structural stages that characterize the LAU. Lynx evolved to adapt to shifting habitat conditions across the landscape, and the action alternatives would contribute to that diversity. In comparison to the size of the entire LAU, the quantity of acres proposed for treatment with the action alternatives is so minimal in size that effects on lynx foraging habitat at the scale of the LAU would be negligible.

Consistency with FP Direction specific to Canada Lynx

The NRLMD incorporated the Terms and Conditions of the Incidental Take Statement in the BO (USDI Fish and Wildlife Service 2007b) for the NRLMD (as explained on pp. 29-30 of the NRLMD ROD (USDA Forest Service 2007d), and, therefore, compliance with the NRLMD ensures compliance with the Terms and Conditions of the BO. Compliance with the NRLMD is summarized in the following Table. Compliance with terms and conditions from the Incidental Take Statement in the BO (USDI Fish and Wildlife Service 2007b) is described in Table 43

Table 42. Northern Rockies Lynx Amendment Standards and Guidelines applicable to the project

Standards and Guidelines	Standard Met?
ALL S1: New or expanded permanent development and vegetation management projects must maintain habitat connectivity in an LAU or linkage area.	Yes – Connectivity of lynx habitat and cover provides travel corridors between habitat patches which increases the likelihood of successful lynx dispersal (USDI Fish and Wildlife Service 2000 pg. 16079). However, lynx can traverse a variety of habitats and obstacles, including rivers, non-forested habitats, and various types of roads (USDI Fish and Wildlife Service 2000 pg. 16079). Forest roads have not been shown to negatively impact resident lynx populations (USDI Fish and Wildlife Service 2000 pg. 16081). High volumes of traffic and associated suburban developments are known to inhibit dispersal and movements within home ranges, and may contribute to loss of habitat connectivity (USDI Fish and Wildlife Service 2000 pg. 16081). High traffic volumes would not result from this project. The project would alter structural stages of potential lynx habitat but would not result in construction of any barriers known to inhibit lynx movements.
VEG S1: If more than 30% of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects.	Yes – *646* acres of the lynx habitat in the LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat (referred to in this report as "early stand initiation"). This accounts for *slightly more than 1% of the lynx habitat in the* LAU (Table 39 and Table 41). The project is, therefore, in compliance with this standard.
VEG S2: Timber management projects shall not regenerate more than 15% of lynx habitat on National Forest System lands within an LAU in a 10-year period.	Yes – Regeneration harvest is planned for a maximum of *398* acres of lynx habitat within the Upper Madison LAU. The Upper Madison LAU contains *44,841* acres of lynx habitat. Regeneration harvest is, therefore, proposed for a maximum of 1% of the lynx habitat (*398/44,841 acres) in the LAU, and is therefore compliant with VEG S2.*

Standards and Guidelines	Standard Met?
VEG S5: Precommercial thinning projects that reduce snowshoe hare habitat may occur from the stand initiation structural stage until the stands no longer provide winter snowshoe hare habitat only: (1) within 200' of administrative sites, dwellings, or outbuildings; (2) for research studies or genetic tree tests evaluating genetically improved reforestation stock; (3) based on new information…where a written determination states that a project is not likely to adversely affect lynx, or that a project is likely to have short term adverse effects on lynx or its habitat but would result in long-term benefits to lynx and its habitat; (4) for conifer removal in aspen, or daylight thinning around individual aspen trees where aspen is in decline; (5) for daylight thinning of planted rust-resistant white pine where 80% of the winter snowshoe hare habitat is retained; or (5) to restore whitebark pine. Fuels treatment projects within the WUI that do not meet these Standards shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest).	Yes – No precommercial thinning is proposed in early stand initiation habitat. Precommercial thinning *or other activities that will reduce horizontal cover are* proposed to occur in 154 acres of stand initiation habitat (with Alternative 2). Of this total, *93* acres of stand initiation habitat are proposed to be treated with daylight treatments to restore whitebark pine (with all alternatives). These *93* acres, therefore, meet VEG S5, under *exception 5. For the Gallatin portion of the Custer Gallatin National Forest, these 93 acres, when combined with the existing number of acres treated in SI stands for other resource benefit (40 acres) would total 133 acres. This cumulative total is below the 1,310 acre limit identified in the NRLMD BO.The remaining 61 a*cres of precommercial treatments are within the WUI (all treatments proposed for this project are within the WUI, as explained in Section 0 on pg. 155). See Notes below for further explanation as to how these WUI treatments meet the exemption criteria under the NRLMD. Figure 12 in Frost 2016 depicts the precommercial thin treatments in lynx habitat.
VEG S6: Vegetation management projects that reduce snowshoe hare habitat in multi-story mature or late-successional forests may occur only: (1) within 200' of administrative sites, dwellings, outbuildings, recreation sites, and special use permit improvements, including infrastructure within permitted ski area boundaries; (2) for research studies or genetic tree tests evaluating genetically improved reforestation stock; or (3) for incidental removal during salvage harvest (e.g., removal due to location of skid trails). Fuels treatment projects within the WUI that do not meet these Standards shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest).	Yes – This project would result in treatments being implemented in up to *519* acres of multi-storied habitat (under Alternative 2) that do not meet the exception criteria listed for this standard. See Notes below for further explanation as to how these WUI treatments meet the exemption criteria under the NRLMD. Figure 13 (p. 188) in the Wildlife Specialist Report (Frost 2016) depicts treatments that include multi-storied habitat.

Standards and Guidelines	Standard Met?
VEG G10: Fuel treatment projects within the WUI as defined by the Healthy Forests Restoration Act should be designed considering Standards VEG S1, S2, S5, and S6 to promote lynx conservation.	Yes – Fuels treatments were designed to balance the need to improve public safety with minimizing impacts to wildlife species such as lynx.
Guideline HU G9: On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is over, these roads should be reclaimed or decommissioned, if not needed for other management objectives.	Yes – no new system roads would be built. Temporary roads constructed for the project would be reclaimed or decommissioned and public motorized use would be restricted. See Appendix A for design features common to action alternatives.

Notes: The WUI[11] exemption states that fuels treatment projects within the WUI that do not meet VEG S5 or VEG S6 shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest). The WUI exemption would apply in up to *61* acres of lynx habitat in the stand initiation structural stage that would be precommercially thinned (see explanation under VEG S5 above). In addition, up to *519* acres of multi-storied lynx habitat would be treated with this project under the WUI exemption (as explained under VEG S6 above). All of these treatments meet the definition of fuels treatments projects as defined in the NRLMD (USDA Forest Service 2007d Attachment 1 pg. 11). The treatments to which the WUI exemption would apply either have a specific fuels objective, or, in some cases, they are being applied to restore a fire adapted ecosystem. The treatments that do not have a fuels objective are either designed to enhance aspen or whitebark pine, both of which are in decline partly due to lack of wildfire. Treatments in these areas would restore stands to a condition that would be more typical if fire was allowed to play its role.

To summarize, the FS is proposing to treat a total of *580 a*cres (*61* acres under VEG S5 + *519* acres under VEG S6) of lynx habitat that do not meet the exceptions under VEG S5 or VEG S6. All of the proposed treatments meet the definition of fuels treatment projects as defined in the NRLMD and all are within the WUI. To date, on the Gallatin side of the Forest, a total of *2,886* acres of treatments have been scheduled under the exemption for fuels treatment projects in the WUI. This project, in addition to those already scheduled, would, therefore, result in a total of *3,466* acres (2,*886 + 580*) of fuels treatments projects within the WUI that do not meet the exception criteria across the Gallatin portion of the CGNF. Lynx habitat modeling in 2007 (used in the NRLMD) showed that approximately 870,000 acres of lynx habitat were present on the

[11] Four of the vegetation standards listed above have an exemption for fuel treatment projects in the wildland urban interface (WUI). The NRLMD (USDA Forest Service 2007d) states that fuel treatment projects within the WUI that do not meet Standards VEG S1, VEG S2, VEG S5, and VEG S6 shall occur on no more than 6 percent (cumulatively) of lynx habitat on each administrative unit (a unit is a National Forest). The NRLMD defines fuel treatment as a type of vegetation management action that reduces the threat of ignition, fire intensity, or rate of spread, or is used to restore fire-adapted ecosystems (USDA Forest Service 2007d pg. 11). The NRLMD ROD defines the WUI as the area adjacent to an at-risk community that is identified in a community wildfire protection plan (USDA Forest Service 2007d pg. 15). The WUI identified in the Gallatin County Community Wildfire Protection Plan (Gallatin County 2007) meets this definition. As shown in Gallatin County (2007), the entire project area lies within the WUI boundary identified in that document. Guideline VEG G10 ensures that, in cases where the WUI exemption is used, projects will be designed with the consideration of these standards.

Standards and Guidelines	Standard Met?
Gallatin portion of the CGNF. Six percent of this total is 52,200 acres. The cumulative total of 3,*466* acres is below 52,200 acres, and, therefore, this project would be in compliance with the requirement that fuels treatments projects within the WUI that do not meet the exception criteria to VEG S5 and VEG S6 shall occur on no more than 6 percent of lynx habitat on the Gallatin portion of the CGNF.	

Table 43 Terms and conditions from the BO on the effects of the Northern Rocky Mountains Lynx Amendment on Canada Lynx applicable to project

Term and Condition	Compliance
Fuels management projects conducted under the exemptions from standards VEG S1, S2, S5 and S6 in occupied habitat shall not occur in greater than 6% of lynx habitat on any Forest	Yes – *580* acres are planned for treatment under the exemptions from these standards. This project would amount to a total of 3,*466* acres planned for treatment on the Gallatin portion of the CGNF under the exemptions from these standards. Approximately 250 acres have been implemented as of 6/7/2016.
Fuels management projects conducted under the exemptions from standards VEG S1, S2, S5 and S6 in occupied habitat shall not result in more than 3 adjacent LAUs not meeting the VEG S1 standard of no more than 30 percent of an LAU be in stand initiation structural stage.	Yes – This project is not affecting the S1 standard.
In occupied lynx habitat, precommercial thinning and vegetation management projects allowed per the exception listed under VEG S5 and S6, shall not occur in any LAU exceeding VEG S1, except for protection of structures.	Not applicable – The Upper Madison LAU does not exceed VEG S1.

Summary and Conclusion

The NRLMD ROD (USDA Forest Service 2007d) established management direction to conserve and promote recovery of the Canada lynx, by reducing or eliminating adverse effects from land management activities on NFS lands, while preserving the overall multiple use direction in existing plans. It provides standards and guidelines to apply to lynx habitat. In total, all action alternatives would treat no more than 2% of the existing snowshoe hare winter habitat (stand initiation and/or multi-storied structural stages) in the Upper Madison LAU. *The proposed activities would reduce horizontal understory cover used by snowshoe hare for foraging. These impacts would occur in the eastern portion of the LAU; the majority of the LAU would not be affected by project activities.* The action alternatives would maintain a mosaic across the LAU and the changes would occur at such a small scale so as to have a minimal effect on lynx. *Multi-story habitat would remain quite abundant in the LAU following implementation. Approximately 32,000 acres or 71% of the available lynx habitat in the LAU would be in a multi-story structure condition. In comparison to the size of the entire LAU, the quantity of acres proposed for treatment with the action alternatives is so minimal in size that effects on lynx foraging habitat at the scale of the LAU would be negligible. The project is consistent with the standards and guidelines in the NRLMD and NRLMD Biological Opinion, as discussed above. For the above reasons, the action alternatives may affect, and are likely to adversely affect the Canada lynx.*

North American Wolverine (Frost 2016, pp. 68-73)

The North American wolverine is proposed as a threatened species (2013 US Fish and Wildlife Service Proposal to List as a Threatened Species was reinstated following court proceedings in 2016). Proposed species on National Forest System lands are managed under the authority of the Federal Endangered Species Act (PL 93-205, as amended) and the National Forest Management Act (PL 94-588). Under provisions of the ESA, Federal agencies shall use their authorities to carry out programs for the conservation of listed species, and shall ensure that any action authorized, funded, or implemented by the agency is not likely to jeopardize the continued existence of proposed species (16 USC 1536).

The primary threats to the contiguous United States wolverine population (Distinct Population Segment or DPS) listed in the federal register include climate change and inadequacy of existing regulatory mechanisms to climate change as the primary threats with harvesting/trapping and small population size as secondary threats. Human disturbances and disease and predation are not considered threats (Federal Register Proposed Rule http://federalregister.gov/a/2013-01478). The proposed rule states that "wolverines are not thought to be dependent on specific vegetation or habitat features that might be manipulated by land management activities, nor is there evidence to suggest that land management activities are a threat to the conservation of the species."

In response to the initial status change of the North American wolverine from a Region 1 sensitive species to a proposed species (contiguous United States DPS), Region 1 of the Forest Service prepared a Programmatic Biological Assessment for North American Wolverine (USFS 2014). The purpose of this programmatic biological assessment was to describe and analyze projects routinely conducted on National Forest System lands within the Northern Region that are not likely to jeopardize the continued existence of the North American wolverine. These activities were sub-divided into the following general categories: timber harvest, mechanical equipment use, existing gravel pit use, roads and road maintenance, silvicultural activities, range management, recreation management, forest products, habitat maintenance and restoration, prescribed fire, watershed restoration, weed control, and administrative and non-recreational special uses. A letter of concurrence for the programmatic BA was received on May 23, 2014; in it, the US Fish and Wildlife Service concurred with the Forest Service determination that

these types of projects are not likely to jeopardize the continued existence of the DPS of the North American wolverine.

The North Hebgen Multiple Resource Project would include activities that would fall within several of these categories, including timber harvest, mechanical equipment use, roads and road maintenance, silvicultural activities, habitat maintenance and restoration, prescribed fire (activity fuels and pile burning in units), and weed management (connected action). The programmatic BA determined that these project types and associated activities are not considered a threat to the wolverine and are therefore not likely to jeopardize the continued existence of the DPS of the North American wolverine. For this reason, formal consultation is not required for this species. Compliance with the screening criteria for the included project types will be documented in the appropriate North American wolverine Screens Compliance Summary Sheet and included in the project file.

Although not a threat to wolverine conservation, human presence and noise associated with the use of heavy equipment needed to implement the project may have short-term disturbance impacts on wolverine and/or may affect distribution of prey species.

Effects to wolverine were evaluated in terms for project activities to cause displacement of wolverine or their prey species. There are no established thresholds for these indicators that are used by the Forest as a target level for which to manage, and the FP does not contain any quantitative standards specific to these indicators. The conclusion of how changes in these indicators would affect wolverine was, therefore, qualitative in nature.

Affected Environment

Dr. Bob Inman confirmed that the Tepee Creek Road area was used by wolverine during the years that he had collared wolverines in the area. The project area is outside the wolverine territories identified in Inman et al. (2008), pg. 3, but the Tepee Creek area does contain suitable habitat for wolverines (personal communication, Bob Inman, meeting on 2015-02-05).

According to habitat models developed by Inman et al. (2013), the entire project area is located in suitable dispersal habitat for both male and female wolverine, meaning that these areas are suitable for use on the order of days or weeks. All of the units at the end of Tepee Creek Road (designed to enhance whitebark pine) and Units 166, 172, 173, 174, 175, 176, 177, 178, 180, 185, and 214 on Tepee Creek Road are all located in primary wolverine habitat. Primary habitat refers to areas that are suitable for long-term survival (year-round, long-term use by resident adults). About 13 acres of suitable denning habitat is contained within Units 191 and 195 (at the end of Tepee Creek Road

Wolverines are considered habitat generalists in the summer, using a foraging strategy typical of opportunistic omnivores (Banci 1994 p. 113). Summer habitat use is influenced by food availability, temperature regulation, and breeding activities. Food is most available in spring and summer with a wider variety of potential food sources including carrion, small mammals, insects and insect larvae, eggs and berries (Hornocker and Hash 1981 p. 1298). Elk, moose, and mule deer are the most abundant species in primary wolverine habitat in the summer and likely provide the most reliable sources of meat for wolverine that use the project area.

Wolverines remain active year-round, and, in winter, adapt their foraging strategy to that of scavenger. As scavengers, winter wolverine foraging habitat becomes more of an association with other species (i.e. food sources for wolverines are somewhat dictated by the distribution of big game species). Winter range for elk and moose occurs at lower elevations and does not overlap modeled primary habitat. Bighorn sheep and mountain goats do not winter in the project area. Winter-killed ungulates are, therefore, not likely to be a reliable source of prey for wolverine in the project area.

Direct, Indirect and Cumulative Effects of the Action Alternatives

Activities associated with implementation of the action alternatives would include increased human presence and operation of heavy machinery in the project area. This could result in disturbance to wolverines, including interruptions in dispersal, foraging, and, to a very small degree, denning. During implementation, it is expected that wolverines would alter their patterns and use nearby undisturbed habitats and resume their normal behavior. Although more activities would be associated with Alternative 2 and the least amount of activities would occur under Alternative 3, the differences between the alternatives with respect to disturbance would not likely be discernable. *The programmatic BA for the wolverine (USDA 2014) indicates that disturbance associated with land management activities like those proposed under the North Hebgen Project are not a threat to the wolverine*.

During project implementation, big game are likely to avoid the project area and, thus, would reduce foraging opportunities for wolverine in the short-term. In the long-term, treatments are expected to improve summer habitat for elk and mule deer by increasing the presence of understory species such as grasses and forbs, and also resulting in enhancements in aspen. Improvements in forage conditions may improve the health of big game herds, which help to maintain a sustainable prey base for wolverines. *Disturbance to prey is not listed as a potential threat to the wolverine in the programmatic BA (USDA 2014).*

Implementation of the action alternatives would add to disturbance factors affecting wolverine. If wolverines are already disturbed by recreational activities occurring on Tepee Creek Road, project activities may further reduce suitability of the area while implementation is taking place. Effects would be short-term, and individual wolverines would likely adjust their habitat use patterns to less disturbed areas to the north. Project activities would also add to disturbance factors affecting wolverine dispersal, but wolverines transitioning between more suitable habitats already encounter such a variety of human activities that the additional effects of project implementation are likely to be minimal.

Prey species could temporarily be displaced from Lonesome Wood 2 Vegetation Management and North Hebgen treatment units, if implementation of both projects overlapped. Foraging habitat is abundant and widely available in the vicinity of both projects, so prey species would be able to adjust their movements to areas with less disturbance and suitable forage opportunities. Wolverines would adjust their foraging patterns to meet energy requirements. Effects would be temporary. In the long-term improved forage in both project areas could enhance conditions for prey species across the analysis area, which would result in a long-term benefit for wolverines.

Consistency with FP direction specific to wolverine

Table 44: FP standards specific to wolverine habitat management and how the project complies with those standards

Standard	Compliance
There are no Forest Plan standards specific to the Proposed North American wolverine.	Action alternatives may displace wolverines or their prey. Effects will be short term. Long term benefits to forage for prey species will benefit wolverine.

Summary and Conclusion

The action alternatives may displace wolverine from the project area through disturbance of both individual wolverines and their prey. Most of the project area provides dispersal habitat, and dispersal habitat is widespread and abundant across the analysis area, so wolverine would be able to alter their travel routes into adjacent areas in order to avoid project activities. Effects would be temporary and limited in spatial extent. Long-term forage benefits for prey species could benefit wolverine. The proposed actions are:

- not a threat to wolverine
- individual project activities and cumulative actions will result in relatively small-scale disturbances in relation to the large wolverine home range size
- the wolverine is capable of adjusting to and co-existing with moderate levels of disturbance
- project and cumulative effects will not result in barriers to dispersing individuals

Therefore, the action alternatives are *not likely to jeopardize the continued existence of the wolverine*.

Sensitive Terrestrial Animal Species (Frost 2016, pp. 74-96)

Sensitive species are those plant and animal species identified by the Regional Forester for which population viability is of concern. All Forest Service planned, funded, executed or permitted programs and activities are to be reviewed for possible effects on sensitive species (USDA Forest Service n.d.). This section summarizes the effects on sensitive terrestrial animal species from the Wildlife Report (Frost 2016). Sensitive aquatic wildlife species, including fish, amphibians, and reptiles were analyzed in the *Aquatic Species (Roberts 2015*). Sensitive plants were analyzed in the *Sensitive Plant Report (Lamont 2015)*.

Sensitive terrestrial animal species known or suspected to occur on the Gallatin portion of the CGNF include American peregrine falcon, bald eagle, bighorn sheep, black-backed woodpecker, flammulated owl, gray wolf, harlequin duck, trumpeter swan, and Townsend's big-eared bat. Effects to these species are described in this section.

American Peregrine Falcon (Frost 2016, pp. 74-79)

The peregrine falcon was removed from the Endangered Species List in August 1999 and is now treated as a Forest Service Region 1 sensitive species. Peregrine falcons breed and forage in the vicinity of the project area, and proposed project activities have the potential to impact breeding behavior and foraging opportunities.

The project has the potential to affect breeding behavior through disturbance. Foraging opportunities could be altered by treatments that affect forest structure which could have an effect on the potential prey base for peregrines within their home range. The resource indicators used for this analysis were based on these potential effects and consisted of consideration of how proposed activities could affect breeding through disturbance and effects on foraging habitat within peregrine falcon home ranges. There are no established thresholds for these indicators that the Forest uses as a target level for which to manage. The conclusion of how changes in these indicators would affect peregrine falcon was, therefore, qualitative in nature. The FP does have standards that speak specifically to management of peregrine falcon habitat, and those standards were considered in this analysis and in project design.

Affected Environment

Since its delisting in 1999, the peregrine falcon population has steadily increased in Montana and on the Gallatin portion of the CGNF. The Montana Peregrine Institute monitors the status of the peregrine eyries in the Hebgen Basin on annual basis.

Peregrine falcons vary in their response to human disturbance. They tend to be more sensitive to disturbances occurring above cliffside eyries, than to disturbances occurring below (Herbert & Herbert 1969, Ellis 1982, Hustler 1983 as cited in Ruddock and Whitfield (2007)). In their review of the scientific

literature regarding the response of peregrines to human disturbance, Ruddock and Whitfield (2007) conclude that peregrines can tolerate some human disturbance, as evidenced by their occupation of disturbed nest sites such as working quarries and urban centers, but the level of tolerance likely depends on the regularity and form of disturbance which occurs as compared to what they refer to as 'background'.

Peregrines nest in cliff and rock formations typically associated with hydrographic features such as rivers and lakes. The three eyries considered in this analysis fit this description, and all three are located in cliff formations in some proximity to water. All three are visible from a major highway, but disturbance within 0.5 miles is fairly limited.

The peregrine is a predatory bird that feeds almost exclusively on other avian species. Riparian habitat and open meadows are preferred hunting areas. Foraging opportunities are abundant in the analysis area, and foraging habitat is not known to be limited in the vicinity of the known eyries.

Home range size, defined as the hunting range beyond the defended territory around the eyrie, during breeding season depends upon prey density. Mean home range size for peregrine falcon in Colorado during nesting was estimated as 138 - 582 mi2 (88,460 - 372,600 acres), and in a prey-rich area of Scotland as 45 mi2 (28,910 acres). To be most conservative, the smallest home range size (45 mi2) was used to define the analysis area, such that effects from proposed treatments would be the most amplified.

The area within 3.8 miles of a given location creates a polygon that is approximately 45 mi2 in size. A buffer of 3.8 miles was, therefore, drawn around the three peregrine falcon eyries that are within 3.8 miles of proposed treatments to estimate impacts on their home ranges. The three eyries include the Grayling Creek pair, the Red Canyon pair, and the Kirkwood pair. The home ranges of these three eyries overlap to the extent that the home range of the Red Canyon pair is almost entirely within the home ranges of the other two pairs. The analysis area is 66,687 acres (104 mi2) in size.

The USFWS Montana Ecological Services Field Office recommended use of raptor protection guidelines developed by the USFWS Wyoming Ecological Field Services Field Office (USDI Fish and Wildlife Service Wyoming Ecological Services n.d.) in managing for peregrine falcons (among other raptors). The Wyoming Ecological Services Field Office recommends that a spatial protective buffer of 0.5 miles be established around peregrine falcon eyries between 1 March and 15 August to protect breeding activity at eyrie sites.

Direct, Indirect and Cumulative Effects of the Action Alternative

Project activities have the potential to affect peregrine breeding activity through disturbance. Portions of Units 135, 136, and 139 are located within 0.5 miles of the Grayling Creek eyrie. No treatments or activities are proposed within 0.5 miles of the Red Canyon or Kirkwood eyries. To minimize effects of disturbance on peregrine falcons, mitigation measures would be implemented to reduce activities within 0.5 miles of the Grayling Creek eyrie. No ground-disturbing activity would take place within 0.5 miles of an active eyrie from 1 March to 15 August. It is possible that peregrines may establish a new eyrie site and time before project completion. These measures would also apply to any newly discovered sites, to protect breeding activity at those locations. It is possible that disturbance further than 0.5 miles from any eyrie site could affect peregrines, but all three eyries are within viewing distance of a major highway and have home ranges that overlap major highways and other sources of disturbance. Peregrines at these sites, therefore, already display some level of tolerance of major activities in the vicinity of their eyrie sites. It is not likely that project activities further than 0.5 miles of an eyrie site create a level of disturbance that would affect breeding activities.

Proposed activities would affect peregrine foraging habitat. Because peregrines prefer to forage in open areas, activities could benefit peregrines by creating more openings in the canopy. The home range of the Grayling Creek pair eyrie would have the most areas treated, with 11% of the area treated under Alternative 2, 10% treated under Alternative 3, and 9% under Alternative 4. Treatments in the Red Canyon home range would affect 6% of the home range under Alternative 2 and 5% under Alternatives 3 and 4. All three alternatives would affect 1% of the home range of the Kirkwood pair. Foraging habitat is widely available in the vicinity of the peregrine eyries, and forested areas are generally not considered to be high quality foraging habitat for peregrines. Project activities may have some benefit for peregrines by creating more openings within home ranges.

Timber harvest took place within 0.5 miles of the Red Canyon and Grayling Creek eyries in the mid-1980s, which contributed to the existing vegetation structure that is present in this area. The Red Cub trail is in 0.5 miles of the Red Canyon eyrie, and two private residences are just inside the buffer. No other actions ongoing or reasonably foreseeable actions are expected to occur within 0.5 miles of any of the eyries.

The amount of disturbance from past and present activities within 0.5 miles of the eyries is very limited. Because of the mitigation measures that would be employed with the action alternatives, additional disturbance associated with implementation of this project would be minimal.

A total of 852 (3%) acres of the home range would be treated under Alternative 2, while a total of 801 (3%) acres would be treated under Alternatives 3 and 4. Effects on peregrines could be beneficial because these treatments would open up the forest canopy to some extent. With so much foraging habitat available in the home ranges of all three eyries, the cumulative effects of implementing this project in addition to the past, present, and reasonably foreseeable actions would be minimal.

Consistency with FP direction specific to peregrine falcon.

Table 45: FP standards specific to peregrine falcon habitat management and how the project complies with those standards

Standard	Compliance
MA5: Inventory and manage suitable nesting territories for peregrine falcon.	Mitigation measures for peregrine falcon would protect nesting pairs. Foraging habitat for peregrine falcons will be enhanced with proposed treatments. Peregrine falcons in Hebgen Basin are monitored annually by Montana Peregrine Institute.
Habitat for Regionally designated sensitive species on the Gallatin NF will be maintained in a suitable condition to support these species.	Foraging habitat will be enhanced with implementation of the action alternatives. Nesting habitat would be protected with design features common to all action alternatives.

Summary and Conclusion

Mitigation measures would reduce disturbance impacts on nesting peregrine falcons. Foraging habitat would be affected, but peregrines may benefit from treatments due to creation of more openings in the forest canopy. Peregrine falcon populations would not be affected at the planning unit level. Given these potential effects, implementation of the action alternatives may impact individuals or habitat, but would not contribute to a trend toward federal listing.

Bald Eagle (Frost 2016, pp. 80-87)

The bald eagle is currently listed as a Forest Service Region 1 sensitive species. It was also identified in the FP Cleanup Amendment as a MIS for threatened and endangered species (USDA Forest Service 2015a); although, it is no longer listed under ESA. Bald eagles may be affected by a variety of human activities, including timber harvest, that cause disturbance or alter habitat. Responses to such activities can range from abandonment of nest sites and/or territories to temporary avoidance of human activities. All of the home ranges within the analysis area contain several miles of shoreline along Hebgen Lake, and the lake is the primary foraging area for all bald eagles that use the area. The project is not expected to have any effects on the lake or the food sources it provides to bald eagles, so consideration of effects on foraging was not part of this analysis. The project does have the potential to affect nesting and perching habitat through alterations in current availability and ongoing recruitment of suitable trees. Methodology and Information Sources.

The Montana Bald Eagle Management Guidelines (Montana Bald Eagle Working Group 2010) recommend that a protective spatial buffer 0.5 miles in size be established around bald eagle nest sites where forest management activities such as thinning and/or removal of forest vegetation are planned. The spatial buffer is recommended to be in place from 1 February to 15 August. The analysis area for disturbance was, therefore, the area within 0.5 miles of bald eagle nest sites.

A Bald Eagle Management Plan for the Greater Yellowstone Ecosystem (Greater Yellowstone Bald Eagle Working Group 1996, pp. 22-24) states that, in the absence of long-term monitoring data that documents bald eagle use of an area, the home range of bald eagle pairs should include all foraging habitat within 2.5 miles of a nest site. Bald eagle nests have been monitored for productivity, but spatial use of areas has not been monitored or documented to the extent that home ranges can be delineated. This buffer was used to identify all bald eagle pairs that have at least one home range that intersects the treatment units. The analysis area for effects on habitat within bald eagle home ranges consists of the area within 2.5 miles of all of these nests.

Affected Environment

Hebgen and Earthquake Lakes support a steadily growing population of breeding bald eagles. The Forest Service has monitored breeding bald eagles on these lakes for many years. The number of known territories associated with these lakes has increased from one in 1977 to up to 13 in 2015. There are five known territories whose home ranges overlap proposed treatment units. Two of the territories consist of two nests. Table 46 lists the bald eagle territories that have been occupied within the last five years within the analysis area, the years where a nest was known to be present on the landscape, the number and percent of the years that it was occupied, and the number and percent of years that the pair fledged young (referred to in the table as “successful”). The Parade Rest nest was discovered in the fall of 2015, and an eagle was seen perched on the nest during the summer of 2015, but no breeding activity was noted. Overall, in the Hebgen and Earthquake Lakes area, the bald eagle population and total number of chicks fledged per year has steadily increased since 1977.

Table 46: Bald eagle territories in the analysis area, # years present on the landscape, % years occupied, and % years successful

Territory	Years Present	# (%) Years Occupied	# (%) Years Successful
Parade Rest	2015	1 (100%)	0 (0%)
Narrows	1995-2015	19 (95%)	13 (68%)
Ridge	1994-2015	19 (90%)	12 (63%)
Horse Butte	1977-2015	38 (100%)	15 (39%)
Lonesomehurst	2010-2015	4 (80%)	4 (100%)

Disturbance

Any activity that disrupts breeding, feeding, sheltering, and roosting behavior and causes, or is likely to cause, nest abandonment or reduced productivity, is considered disturbance and is a violation of the BGEPA and state regulations (Montana Bald Eagle Working Group 2010 pg. 4). Disturbance can occur when the source is unusually loud or when it breaks from the normal pattern of activities within the vicinity of the nest (Montana Bald Eagle Working Group 2010 pg. 4). Responses of eagles may range from abandonment of nest sites to temporary avoidance of human activities. Responses may also vary depending on type, intensity, duration, timing, predictability and location of human activities. Individual pairs may respond differently to human disturbances because some bald eagles are more tolerant than others (Montana Bald Eagle Working Group 2010). Generally, eagles are most sensitive to human activities during the nest building, egg laying, and incubation period, which is normally from 1 February to 31 May. Human activities during this time are more likely to cause nest abandonment and reproductive failure (Montana Bald Eagle Working Group 2010). Once young have hatched, a breeding pair is less likely to abandon the nest (Montana Bald Eagle Working Group 2010). Bald eagles exhibit greater sensitivity to disturbance when activities occur within full view (Montana Bald Eagle Working Group 2010). Montana Bald Eagle Working Group (2010) recommends the use of visual and spatial buffers around nests, foraging, and roost sites to minimize disturbance to bald eagles.

Table 47 lists the territories in the analysis area and current sources of disturbance within 0.5 miles of the nest locations. As shown in the table, bald eagles within the analysis area currently show some tolerance for background levels of disturbance within 0.5 miles of their nests.

Table 47: Bald eagle territories and current sources of disturbance within 0.5 miles of the nest locations

Territory	Disturbance w/in 0.5 mi
Parade Rest	Highway 287, Whits Lake Road, Johnson Lake Trailhead, Private residences, Outfitter and Guide horseback tours
Grayling Arm	Improved road to Rainbow Point Campground, FS roads, boating
Narrows	Snowmobile trail, residential traffic, non-motorized recreation use
Ridge	Improved road to Horse Butte peninsula, snowmobile trail, non-motorized recreation use
Horse Butte	Subdivision, improved road to Horse Butte peninsula, snowmobile trail, non-motorized and motorized recreation use
Lonesomehurst	Lonesomehurst summer home area, Romsett summer home area, Lonesomehurst Campground, Denny Creek Road, Contour Road

Habitat

Bald eagle breeding surveys have been conducted every year since 1977 on the Hebgen Lake Ranger District to identify all breeding pairs and document breeding activity. Surveys will continue to be conducted on an annual basis, and all nest trees and perch trees will be identified in order to ensure their protection.

Nesting and perching habitat could be altered by the proposed treatments. All known bald eagle nest trees in the analysis area consist of mature, large-diameter Douglas fir live trees or snags that tend to be some of the largest trees in both diameter and height present on the landscape. Bald eagles also tend to use larger Douglas fir trees or snags as perch sites. Suitable nest and perch trees are available on Horse Butte, on the west side of Hebgen Lake, and on the south-facing slopes north of Hebgen Lake, particularly in the area around Whits Lake Road.

Direct, Indirect and Cumulative Effects

Disturbance - Alternatives 2, 3, & 4

Proposed activities have the potential to affect bald eagle breeding activities through disturbance. To minimize the risk of disturbance to breeding bald eagles, several mitigation measures would be implemented. No project-related activities would occur within 0.25 miles of an active nest during the time when bald eagles are most sensitive to disturbance in the vicinity of their nests, which is between 1 February and 15 August (as recommended in Montana Bald Eagle Working Group (2010)). Furthermore, no machinery will be used within 0.5 miles of an active nest during that time frame (as recommended in Montana Bald Eagle Working Group (2010)). This second restriction would not apply to hauling of materials on roads. Due to seasonal restrictions, there would be no logging traffic on temporary project roads, because these roads access units affected by the restrictions. Logging traffic would occur on existing roads that access units beyond the 0.5 mile restrictive buffer, but all of the bald eagle pairs already demonstrate tolerance to motorized traffic on these roads. As a final precaution, no helicopter activity would be allowed within 1,000′ of nests between 1 February and 15 August to further minimize risk of disturbing breeding activity from above the nest.

Indirect effects on bald eagle activity through disturbance could also result from building of roads in the vicinity of nests, which could increase access and result in increases in disturbance. To reduce this risk, no roads would be built within 0.25 miles of bald eagle nests.

If new nests are discovered, all mitigation measures would be implemented to minimize disturbance at the new site. With implementation of the mitigation measures required for this project, the effects of project activities on bald eagles would be minimal.

Given all of the activities that take place and will continue to take place within bald eagle home ranges and the fact that the population has been growing steadily since 1977 with an increasing trend in total number of chicks fledged per year, bald eagles in the analysis area appear to be tolerant of existing levels of human disturbance within their home ranges.

In addition to all of the other sources of disturbance that are present and ongoing within the home ranges of bald eagles in the analysis area, with the mitigation measures that would be implemented to minimize disturbance associated with this project, the cumulative effects of this project are expected to be minimal.

Habitat - Alternatives 2, 3, and 4

Project activities could alter bald eagle habitat through changes in forest structure. Mitigation measures would be implemented to ensure protection of bald eagle nesting habitat over time. To protect existing nest and perch trees, no trees that contain a bald eagle nest or trees in MA5 that are identified as a perch tree by a FS wildlife biologist would be removed. Within 0.25 miles of a nest, no temporary roads were proposed in order to protect bald eagle nesting habitat and behavior. Intermediate harvest for aspen enhancement is the only type of treatment proposed within 0.25 miles of bald eagle nests. No treatment is proposed within 0.25 miles of the Lonesomehurst nest. All treatments within 0.25 miles of bald eagle nests would be laid out with the assistance of a FS wildlife biologist. Within the buffer, potential nest trees would be retained, and recruitment of future nest trees would be ensured by designing treatments to

reduce risk of insect and/or disease and create conditions that would promote the continued growth and replacement of mature, large-diameter Douglas fir trees. Visual screening around nest trees would also be retained. Treatments around existing and potential nesting and perching habitat would help protect them from crown fire.

The home ranges of all five nests encompass much of the project area. Because treatments are designed to reduce the risk of high-intensity, stand-replacing wildfire and/or the risk of insect and disease outbreaks, they would reduce the risk of widespread losses of bald eagle nesting habitat within home ranges. Intermediate harvest in the Whits Lakes and Fir Ridge areas outside the 0.25 mile buffer may result in the removal of potential nest trees. While these treatments are designed to benefit wildlife through enhancement of aspen stands, there may be a slight negative effect on bald eagles with these small losses in potential nesting habitat.

If new nests are discovered, all mitigation measures would be implemented to protect the nest site and surrounding habitat as described above. With implementation of the mitigation measures required for this project, the effects of vegetation treatments on bald eagles would be minimal.

It was expected that effects from that project on bald eagles would be minimal. Ongoing developments on private land could have small effects on the availability of bald eagle nesting and perching habitat, but so few desirable nesting and perching trees are present on private lands that effects would be negligible.

Direct and indirect effects were considered in the context of current conditions on the landscape that have been shaped by past activities. The direct and indirect effects of this project on bald eagle nesting and perching habitat are expected to be minimal. These effects, in addition to the other future actions expected to occur on the landscape, will result in only slight alterations in bald eagle nesting habitat and may lead to enhancement of bald eagle nesting and perching habitat by increasing potential recruitment in treated stands.

Consistency with direction specific to bald eagle

Table 48: FP standards specific to bald eagle habitat management and how the project complies with those standards

Standard	Compliance
MA5: Maintain and enhance osprey and bald eagle feeding, perching, and nesting trees (e.g., Quake/Hebgen Lake Complex).	Mitigation measures for bald eagle would protect nesting pairs and nesting habitat in MA5.
MA7: Maintain and enhance bald eagle foraging areas around known nest sites.	Hebgen Lake is the primary foraging area for bald eagles in the vicinity of the project. The action alternatives would not have any effect on the lake or the food items provided by the lake. Areas around nest sites were protected and habitat enhanced through project design and mitigation measures.
Habitat for Regionally designated sensitive species on the Gallatin NF will be maintained in a suitable condition to support these species.	Nesting habitat around nest trees would be maintained and enhanced with implementation of the action alternatives.

Disturbance buffers recommended by Montana Bald Eagle Working Group (2010) were incorporated into project design. The disturbance buffers were incorporated to minimize the potential for a violation of the BGEPA which prohibits activities that disrupt breeding, feeding, sheltering, and roosting behavior or that causes or is likely to cause nest abandonment or reduced productivity.

Summary and Conclusion
Mitigation measures would minimize disturbance to nesting bald eagle pairs and project design features would maintain and enhance nesting habitat around nest trees. Bald eagle populations would not be affected at the planning unit scale. The action alternatives may, therefore, impact individuals or habitat but would not contribute to a trend toward federal listing.

Bighorn Sheep (Frost 2016, p. 87)

Bighorn sheep are a big game species that inhabit montane to alpine environments where cliffs, steep slopes and rocky outcrops serve as escape terrain. These animals have adapted to using steep, harsh environments to escape predation. Bighorns, particularly ewes and lambs, are rarely found more than 300 meters (~0.2 mile) from escape terrain. They tend to avoid densely forested areas, since open habitats with high visibility are important for detecting and avoiding predators, as well as access to forage (MT FWP 2010). The closest suitable bighorn sheep habitat to the project area is the southeast portion of Skyline Ridge and White Peak, which is over three miles from the units at the top of Tepee Creek Road. There is no suitable habitat in any of the proposed treatment areas, because they are located too far away (more than three miles) from escape terrain. Therefore, there would be no impact to bighorn sheep from proposed treatments, and this species was dismissed from further analysis.

Black-backed Woodpecker (Frost 2016, pp. 87-91)

Black-backed woodpeckers are a Forest Service Region 1 sensitive species. Vegetation management projects can influence the availability of existing and potential future nesting and foraging habitat for black-backed woodpeckers.

Effects to black-backed woodpeckers were evaluated by assessing the potential for proposed activities to affect nesting and foraging opportunities. There are no established thresholds for these indicators that the Forest uses as a target level for which to manage, and the FP does not contain any quantitative standards specific to these indicators. The conclusion of how changes in these indicators would affect black-backed woodpecker was, therefore, qualitative in nature.

Direct, Indirect and Cumulative Effects of the Action Alternatives

Project implementation under any action alternative would not cause direct impacts to black-backed woodpeckers. By reducing the potential for stand-replacing wildfire and beetle outbreaks in the project area, project implementation under all Action Alternatives would reduce the potential for black-backed woodpecker occupancy in the future in the project area. *Outside of treatment units large areas with high snag densities and ongoing mortality resulting from recent (and ongoing) insect activity would be available for this species and others requiring high densities of snags.*

Direct and indirect effects were considered in relation to how black-backed woodpecker currently exists on the landscape, which already takes into account past actions. No reasonably foreseeable actions are expected to occur within the project area that would also affect black-backed woodpecker habitat. For this reason, there are no cumulative effects of the action alternatives.

Consistency with FP direction specific to black-backed woodpecker

Table 49: FP standards specific to black-backed woodpecker habitat management and how the project complies with those standards

Standard	Compliance
Habitat for Regionally designated sensitive species on the Gallatin NF will be maintained in a suitable condition to support these species.	Given the vast amount of suitable habitat currently available on the CGNF due to recent large scale fires and ongoing insect infestations, combined with the hundreds of thousands of acres of potential habitat (i.e., mature, densely stocked fire-prone stands), the impacts from implementation of the action alternatives would be very minor in nature.

Summary and Conclusion
The action alternatives could reduce the potential for creation of black-backed woodpecker habitat within *treatment units*. Black-backed woodpecker habitat is not limited on the CGNF. The action alternatives, therefore, may impact individuals or habitat but would not lead to a trend toward federal listing.

Flammulated Owl (Frost 2016, p. 91)

Flammulated owls are small, migratory owls that inhabit dry, open forest types. These birds show a strong preference for yellow pines, particularly Ponderosa pine, for nesting habitat, although Douglas fir and aspen may be used as well (McCallum 1994 p. 22). Yellow pines, including Ponderosa pine, do not occur within the project area. Douglas fir and aspen are present, but the mature open structure preferred by flammulated owls is a relatively minor habitat component in the proposed treatment units. Nesting flammulated owls have not been documented anywhere on the Gallatin portion of the CGNF, and habitat conditions are marginal here. The species is not suspected to occur in the project area. Therefore, the project would have no impact on flammulated owls or their breeding habitat. No suitable flammulated owl habitat is found on the Hebgen Lake District and, therefore, this species was dismissed from further analysis.

Gray Wolf (Frost 2016, pp. 91-96)

Gray wolves are currently listed as a FS Region 1 sensitive species. The proposed project has the potential to affect gray wolves through disturbance and alterations in foraging opportunities.

Noise and human presence associated with timber harvest could cause disturbance and/or displacement of gray wolves and/or their prey species from the project area. Disturbance and alterations in foraging opportunities resulting from displacement of prey species were selected as the resource indicators for this analysis. There are no established thresholds for these indicators that are used by the Forest to serve as a target level for which to manage, and the FP does not contain any quantitative standards specific to these indicators. The conclusion of how changes in these indicators would affect gray wolf was, therefore, qualitative in nature.

Affected Environment
Gray wolves were once listed as a threatened species under the ESA. They were reintroduced into the GYE in 1995 and 1996 and now occupy habitat across much of the Gallatin portion of the CGNF. Gray wolves were removed from the Threatened and Endangered Species list in 2011, and, in Montana, they are currently managed as a game species.

Management emphasis for gray wolves is directed at maintaining sustainable populations of wolf prey species, primarily ungulates, and minimizing disturbance at den and rendezvous sites. There are no

known den or rendezvous sites within the project area and the project, therefore, would have no effect on either of these factors.

The nearest known wolf pack to the project area is the Cougar Creek pack, whose territory centers on the west side of YNP, northeast of West Yellowstone. Wolves and wolf sign have been reported frequently in and around the project area and are known to occur in the project area throughout the year.

The literature reports that wolves vary considerably in their response to human activity, but several studies have reported that wolves demonstrate avoidance of areas used by humans (Hebblewhite and Merrill 2008, Hebblewhite et al. 2005, Rogala et al. 2011).

Suitable prey within and adjacent to the project area and within the cumulative effects analysis area consists mainly of elk and mule deer. Gray wolves are habitat generalists and make use of a wide variety of habitat types throughout the course of their lives. Maintaining the health and productivity of big game winter range is key to managing for wolf recovery. Big game ungulates provide the primary prey base for wolves in the project area. The project area contains year-round habitat for elk, moose, and deer.

Direct, Indirect and Cumulative Effects of the Action Alternatives

Activities associated with implementation of the action alternatives would include increased human presence and operation of heavy machinery in the project area. This could result in disturbance to wolves within the project area. It is expected that wolves would relocate to nearby undisturbed habitat and resume their normal behavior. Although more activities would be associated with Alternative 2 and the least amount of activities would occur under Alternative 3, the differences between the alternatives with respect to wolf disturbance would not likely be discernable.

Under the action alternatives, big game could be displaced due to reductions in security areas, habitat effectiveness, and/or hiding cover in the project area. These factors are not limited across the analysis area, however, and big game would move into areas that provided these important elements. Wolves would seek out foraging opportunities where prey items were available. Long-term benefits to big game forage could be realized as openings in the forest canopy from timber harvest could result in more grasses and forbs. Aspen stand improvement could result in more suitable foraging habitat for elk, which would result in more foraging opportunities for gray wolf in the analysis area. These longer-term changes could be beneficial to wolves.

Implementation of the action alternatives would add to disturbance factors affecting wolves. Effects would be temporary, but wolves could, potentially, be displaced from the Lonesome Wood 2 Vegetation Management project area and from the North Hebgen project area simultaneously. Foraging habitat is widely available, so wolves would be able to adjust their patterns to meet their forage requirements. Effects would also be temporary.

Prey species could temporarily be displaced from both the Lonesome Wood 2 Vegetation Management project area and the North Hebgen project area, if implementation of both projects overlapped. Foraging habitat is abundant and widely available in the vicinity of both projects, so prey species would be able to adjust their movements to areas with less disturbance and suitable forage opportunities. Wolves would adjust their foraging patterns to meet energy requirements. Effects would be temporary. In the long-term improved forage in both project areas could enhance conditions for prey species across the analysis area, which would result in a long-term benefit for wolves.

Consistency with FP direction specific to gray wolf

Table 50: FP standards specific to gray wolf habitat management and how the project complies with those standards

Standard	Compliance
Habitat for Regionally designated sensitive species on the Gallatin NF will be maintained in a suitable condition to support these species.	Wolves may be displaced on a short-term basis from the project area. Long-term forage benefits for prey species would, in turn, benefit wolves.

Summary and Conclusion
The action alternatives may displace wolves from the project area through disturbance of both individual wolves and their prey. Long-term forage benefits for prey species could also benefit wolves. The action alternatives, therefore, may impact individuals or habitat but would not lead to a trend toward federal listing.

Harlequin Duck (Frost 2016, p. 96)

Harlequin ducks nest along remote, swift-moving, clear mountain streams with dense shrub habitat along the stream banks. Breeding habitat is typically located away from concentrated human use areas (Clark et al. 1989 p. 61). There is no potential nesting habitat in the project area, and no breeding harlequin ducks have ever been documented in the project area. Neither streamside vegetation, nor stream form or function would be adversely affected by proposed actions associated with this project. Therefore, the project would have no impact on harlequin ducks or their breeding habitat. Since there is no suitable harlequin duck habitat within the project area, this species was dismissed from further analysis.

Trumpeter Swan (Frost 2016, p. 96)

Trumpeter swans are sensitive to disturbance during nesting activities. Disturbance may cause increased mortality to eggs and chicks or cause nest abandonment. Nesting habitat includes marshes, shallow lake waters, beaver ponds, and occasionally oxbows or slow-moving river backwaters (Clark et al. 1989 p. 59). Breeding habitat is typically secluded, and must provide a large enough open water body for take-off and landings. Trumpeter swans do not nest in Hebgen Lake, nor does the lake contain suitable nesting habitat. Trumpeter swan wintering habitat includes slow-moving rivers and streams that remain ice-free and provide emergent vegetation year-round (USDA 1989 p. 28). Trumpeter swans winter in the Madison and South Fork Arms of Hebgen Lake. Project activities will have no impact on wintering habitat of trumpeter swans. Proposed actions would have no impact on this species, and it was dismissed from further analysis.

Townsend’s Big-eared Bat (Frost 2016, p. 96)

The Townsend’s big-eared bat occurs in a variety of habitats; although, its distribution is strongly correlated with the availability of suitable caves for roosting. Caves and abandoned mine shafts serve as daytime roosts and winter hibernacula (Kunz and Martin 1982). Females congregate in the warmer areas of the roost to form maternal colonies in spring (Finch 1992 p. 17). There are no large caves or abandoned mine shafts in the project area that would provide suitable roosting habitat for bats. There are no documented occurrences in Forest Service or Montana Natural Heritage databases of this species in the vicinity of the project area. The closest confirmed observation of this species was close to Ennis, MT, at a location just over 40 miles away (Montana Natural Heritage Program Map Viewer n.d. accessed on 2015-09-28). With no high-quality roosting habitat available and no known occurrences of this species in

proximity of the project area, it is unlikely that Townsend's big-eared bats inhabit the project area. This project would have no impact on Townsend's big-eared bats or their roosting habitat, and they were dismissed from further analysis.

Biological Determinations for Forest Service Region 1 Terrestrial Sensitive Species (Frost 2016 p. 96)

Table 51: Determination of effect[1] for FS R1 terrestrial sensitive species

Species	Alt 1	Alt 2	Alt 3	Alt 4
American peregrine falcon	NI	MIIH	MIIH	MIIH
Bald eagle	NI	MIIH	MIIH	MIIH
Bighorn sheep	NI	NI	NI	NI
Black-backed woodpecker	NI	MIIH	MIIH	MIIH
Flammulated owl	NI	NI	NI	NI
Gray wolf	NI	MIIH	MIIH	MIIH
Harlequin Duck	NI	NI	NI	NI
Trumpeter swan	NI	NI	NI	NI
Townsend's big-eared bat	NI	NI	NI	NI

Notes:
1. NI = No impact. MIIH = May impact individuals and habitat but will not lead to a trend toward federal listing.

Management Indicator Species (Frost 2016, pp. 97-141)

The Forest Service is required by NFMA to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives" [16 U.S.C. 1604(g)(3)(B)]. The 2012 Planning Rule makes it clear the intent of this direction would be met at the planning unit scale through implementation of the Forest Plan. The Forest Service's focus for meeting the requirement of NFMA and its implementing regulations is on assessing habitat conditions based on local information and knowledge, best available science, and/or habitat models to provide for diversity of animal communities. To aid in meeting this requirement, the FP identifies MIS. MIS are selected because their population changes are believed to indicate the effects of management activities (USDA Forest Service 2012).

The GNF FP Cleanup Amendment (USDA Forest Service 2015a) addressed MIS, where it states, "Indicator species, which have been identified as species groups, whose habitat is most likely to be affected by Forest management activities, will be monitored to determine population change.

Grizzly Bear	Threatened and Endangered Species (TES)
Bald Eagle	TES (*Note: this species is no longer listed under ESA*)
Elk	Big Game Species
Wild Trout	Coldwater Fisheries
Goshawk	Mature Forest related species
Marten	Mature Forest related species"

The monitoring section of the FP includes the following monitoring item relative to MIS on pg. IV-6, monitoring item #16, "Determine population trends of indicator species and relationships to habitat changes: Moderate precision; Moderate Reliability, 5 year intervals"

The GNF first published MIS monitoring results in its FP Monitoring Report, which summarized information for the period 2004-2006 (USDA Forest Service 2007b). That report, with respect to MIS, indicated stable to increasing population trends for Gallatin MIS wildlife species. The GNF published an updated monitoring report for MIS in 2016 (Canfield 2016b), which updated the best available information about population and habitat trends for Gallatin wildlife MIS species. The summary results of monitoring reported in that document are included in Table 52. Compliance with this Forest Plan standard occurs at the programmatic level. Canfield (2016b) details how these species are monitored according to FP requirements.

Table 52: Summary findings of MIS as reported in (Canfield 2016b)

Species	Monitoring Report Conclusions
Bald Eagle	Populations of bald eagles have increased state-wide and on the Gallatin National Forest. The effects of management activities on the Gallatin National Forest have been effectively mitigated through nest management plans that limit vegetation alteration and human disturbances.
Grizzly Bear	Management activities on the Gallatin National Forest have increased secure habitat for grizzly bears, which may be contributing to the increasing occupation and populations of grizzly bears on the Gallatin National Forest outside of the recovery zone.
Elk	Elk populations are managed by the FWP to include a harvestable surplus, but to be sensitive to the tolerances of private landowners as well. FWP adjusts harvest quotas to try and stay within an agreed upon population level for each EMU. These populations are influenced by multiple variables, but generally not by a lack of habitat. Habitat on the Gallatin National Forest includes many areas with high security (low road density) and abundant hiding cover. High quality foraging habitat appears to be very limited and management actions that create such habitat (prescribed burning; timber harvest), designed collaboratively with MDFWP could benefit elk and perhaps result in more elk available on public lands for wildlife viewing and hunting.
Goshawk	Globally, northern goshawks are well distributed and stable at the broadest scale. Based on broad-scale habitat and inventory and monitoring assessments conducted in R1 since 2005, breeding goshawks and associated habitats appear widely distributed and relatively abundant on National Forest lands. Based on a detection surveys, goshawks are present and well distributed across the Gallatin National Forest, with more goshawks nesting on the Yellowstone Ranger District compared to other Ranger Districts. Goshawk populations appear to be stable. Compared to natural events that have or could affect goshawk habitat, project level management activities on the Gallatin National Forest are relatively inconsequential. Project level surveys ensure that goshawk nests, if found, are protected by mitigation measures as outlined in the northern goshawk Northern Region Overview.
Marten	Although this species was selected as a MIS and is being monitored accordingly, there are many other factors influencing populations besides habitat change. Because it is a harvested furbearer, fur market prices, accessibility to populations by humans, and other factors related to trapping may be the most important population level determinants. Timber harvest has had a minor influence on pine marten habitat availability on the Gallatin National Forest. The travel plan decision may have had an indirect effect to reduce effective trapping pressure by reducing motorized access in some areas.

This section provides a summary of the effects on MIS *(Frost 2016)* that have not already been considered in earlier sections (i.e., grizzly bear and bald eagle). While monitoring of MIS and determinations of population change occurs at the forest planning level, an analysis of project level effects on MIS is included in this report to inform wildlife management decisions.

Elk (Frost 2016, pp. 98-121)

Elk are listed in the GNF FP as a MIS for big game species. Proposed activities have the potential to affect elk through changes in forage and their distribution across the landscape.

Resource Indicators and Measures
The proposed action alternatives have the potential to alter foraging opportunities for elk by changing the distribution and abundance of understory vegetation, affecting riparian areas, and altering the distribution and vigor of aspen stands. Effects of the alternatives on elk forage were, therefore, compared by measuring expected effects on forest understory vegetation, riparian areas, and aspen. There are no established thresholds for these indicators that can be used to serve as a target level for which the Forest Service should strive to manage, and the FP does not contain any quantitative standards specific to these indicators. The conclusion of how changes in these indicators would affect elk was, therefore, qualitative in nature.

The proposed action alternatives also have the potential to affect elk distribution through displacement and alterations in forested cover, particularly along important migration routes. Elk distribution is influenced by motorized route density. Motorized route density is used to calculate two measures used as indicators in this analysis: habitat effectiveness and elk security. The GNF FP defines habitat effectiveness as “the measure of how open roads prevent full utilization of habitat by elk. As road densities increase, habitat effectiveness declines”. Effects of the alternatives were compared by quantifying effects on habitat effectiveness expected with implementation of each alternative.

Elk are particularly vulnerable during hunting season, and their distribution during this time of year is largely dependent upon the availability of elk security areas. In this analysis, elk security areas were defined as those areas that are at least 0.5 miles from an open motorized route or project road and at least 250 acres in size. The project has the potential to affect elk distribution during hunting season by altering and/or reducing the amount of security areas available to elk within the analysis area. Effects of the alternatives were compared by quantifying these expected changes.

Elk distribution is also influenced by the amount of hiding cover on the landscape. Effects of the project on hiding cover were therefore compared between alternatives.

There are no established thresholds for elk security and/or habitat effectiveness that the Forest uses as a target level for which to manage, and the FP does not contain any quantitative standards specific to these indicators. The conclusion of how changes in these indicators would affect elk was, therefore, qualitative in nature. The FP does contain a quantitative standard specific to management of elk hiding cover, and that standard was considered in the effects analysis of this project.

Wildlife biologists from the Forest Service and Montana Department of Fish, Wildlife and Parks compiled recommendations, along with a discussion of their conversations and the relevant literature, for elk habitat management in a collaborative overview that was made available in 2013 (USDA Forest Service and Montana Department of Fish, Wildlife, and Parks 2013). The analysis presented here in this report relied on the recommendations and discussions presented in that paper. As recommended in that paper, analysis of project-level effects on elk habitat include consideration of forage, cover, motorized route density (modeled as Habitat Effectiveness), and security areas (USDA Forest Service and Montana Department of Fish, Wildlife, and Parks 2013).

Affected Environment
Elk are important as a hunted big game species and a major prey species for large carnivores. The shared goal of MFWP and the USFS is to maintain and provide habitat for big game wildlife species on NFS

land throughout the year (USDA Forest Service and Montana Department of Fish, Wildlife, and Parks 2013).

Elk are present across the analysis area; although their distribution varies spatially and temporally. For example, according to MFWP, elk collar data indicate that the Tepee Creek Basin is used to a lesser extent than other areas across the analysis area (Montana Fish, Wildlife and Parks 2015a). MFWP stressed that, although collar data do not show this area as being of high importance, elk are still likely to use the area at times throughout the year. Most of the project area intersects elk winter range, with the exception of the treatment units proposed at the end of Tepee Creek Road. The analysis area also contains important elk seasonal travel corridors. During the fall, elk tend to move out of the Hebgen Basin to avoid the harsh winter climate and spend the winter months in the milder Madison River Valley to the West. A well-used travel route is located along the south-facing slopes just to the north of Hebgen Lake. Elk move across Fir Ridge, along the slopes that include the Whits Lake Road area and Red Canyon and then move up and over Mount Hebgen as they head west to the Madison River Valley. A small resident herd remains and winters on Horse Butte and north of Hebgen Lake on the south-facing slopes that retain heat during the winter months.

Forage

Generally speaking, elk feed primarily on grasses in spring, with forbs becoming more important in summer. They switch back to grasses and also start to include browse species by fall and into winter (Peek 2003:881). While forage is important year-round, forage quality is particularly important to elk in the summer when animals accumulate fat reserves that influence winter survival (Canfield et al. 1999). Summer forage also influences pregnancy rates.

Most of the project area consists of forested areas. While there is some forage available under denser forest canopies, the amount and quality of such forage is limited by reduced exposure to sunlight, competition for water and nutrients from conifers, and unfavorable soil conditions resulting from high concentrations of conifer needles. More open forests provide more foraging opportunities for elk. Riparian areas provide important food sources for elk. Studies in Montana indicate that elk show a preference for moist sites during summer months. These sites are selected based on juxtaposition with other habitat components such as forest cover, and are generally associated with forest habitat types in the subalpine fir and spruce series (Lyon et al. 1985:12). Riparian areas in the vicinity of the project area are abundant and include ponds and wetlands in the upper Tepee Creek area; smaller, high-gradient alpine streams that connect with the larger tributaries of Hebgen Lake; and the shores and sloughs around Hebgen Lake, itself.

Aspen stands provide a particularly nutritious and palatable food source for elk, who prefer to forage on the young, regenerating shoots. In the project area, elk rely on the aspen stands in the Whits Lake and Red Canyon areas year-round for forage and thermal and hiding cover. Elk also use the aspen stands on Horse Butte on a year-round basis, but use of this area is heaviest in the summer and fall seasons. Finally, aspen stands on Fir Ridge are of particular importance to elk as they move through this migration corridor during the fall months. Heavy browse on aspen is evident in this area. Field observations indicate that aspen sustainability in the project area is threatened by competition with encroaching conifers, primarily Douglas fir. This is true for all aspen stands, with the exception of at least two small stands on Fir Ridge. In that location, these two stands appear to be limited by a combination of conifer encroachment and heavy browse, likely due to the importance of this area as a migration corridor for elk. It is impossible to confirm this without experimentally excluding some aspen saplings from browse pressure, but the height and shape of aspen saplings in these two stands on Fir Ridge suggest that the terminal leaders of the aspen plants have gotten browsed repeatedly over time, leading to a hedged appearance and limited growth heights in some cases.

Distribution

Habitat Effectiveness

Habitat effectiveness is defined as the percentage of available habitat useable by elk outside the hunting season, and can be directly correlated with open route density (Lyon and Christensen 1992, Lyon 1983). For areas intended to benefit elk summer range and retain high elk use, habitat effectiveness related to motorized routes should be 70% or greater. For areas where elk are one of the primary resource considerations, habitat effectiveness should be 50% or greater. Christensen and others (1993) stated that if habitat effectiveness is maintained at 50% (about 2 miles of open motorized routes per square mile), then elk use potential is adequate. In situations involving elk summer range where habitat effectiveness is less than 50%, these areas must be recognized as making only minor contributions to elk management goals (Christensen et al. 1993)

Table 53 summarizes the data for each EAU such that the proportion of each EAU that is above 50% habitat effectiveness is shown. This is the portion of the EAU that would be considered adequate for elk use potential (Christensen et al. 1993). Habitat effectiveness is greater than 50% (meaning that those areas are at a habitat effectiveness sufficient for supporting elk as a primary resource consideration) in 98% of the Buffalo Horn YNP, 94% of the Cabin Creek EAU, and 79% of the Henry's Mountains EAU.

Table 53: Percent of each EAU that is currently greater than 50% habitat effectiveness

EAU	% of EAU >50% HE
Buffalo Horn YNP	98%
Cabin Creek	94%
Henry's Mountains	79%
Total	88%

Security Areas

"Security" for elk is the result of a combination of factors that allow elk to remain in a specific area while under stress from hunting (Christensen et al. 1993). "Security area" (the structural constituent of security) is the area that will, during periods of hunting stress, hold elk because of geography, topography, vegetation, or a combination of these factors (Lyon and Christensen 1992). Security areas are intended to reduce elk vulnerability during the elk hunting season, and to provide animals the opportunity to meet their biological needs without making large range movements (e.g., to private land where hunting is not allowed) (Lyon and Canfield 1991).

Table 54: Acres and percent of elk security areas in the EAUs that make up the analysis area

EAU	Elk Security		Not Elk Security		Total
	Acres	%	Acres	%	
Buffalo Horn YNP	207,769	88%	29,073	12%	236,842
Cabin Creek	144,546	73%	52,887	27%	197,432
Henry's Mountains	186,615	51%	182,066	49%	368,682
Total	538,930	67%	264,026	33%	802,956

Hiding Cover

Forested cover is important to elk for bedding, foraging, thermal relief, wallowing, and other functions year-round. Cover may influence the way animals use habitat and the ability of habitat to meet big game needs for growth and welfare requirements (Christensen 1993). This analysis focused on effects of the project on seasonal cover, including, both, 1) winter cover, and, 2) spring, summer, and fall (SSF) cover.

According to USDA Forest Service (2013b) on pg. 11, when cover on winter range is removed through stand-replacing events (e.g., clearcutting or high intensity fire), the screening function of forested cover may be recovered in 15-20 years; however the structural conditions that provide for snow interception may take 60 years or more to re-establish. Mixed severity fires and/or intermediate timber harvest would be expected to result in stand conditions that function for snow interception more quickly. Some timber harvest prescriptions (e.g., thinning in very dense pole stands) may even expedite the time required to develop a multi-storied stand structure that provides both cover and foraging during the winter.

Winter range in the analysis area is present around the South Fork of the Madison River, the flats to the north and south of the Madison Arm of Hebgen Lake, the flats on the east side of Horse Butte, the south facing slopes north of Hebgen Lake, the west side of the Madison Range, and the south side of the Gallatin River Valley where it emerges from the northwest corner of Yellowstone National Park. The function of cover during spring, summer, and fall may include thermal regulation (keeping animals cooler); lengthening the season of succulence and palatability where adequate understory forage exists and the overstory provides shade, seclusion, or protection from human disturbance (hiding cover); and buffering special features such as licks and moist areas (Christensen et al. 1993). Summer range in the analysis area is scattered across the analysis area and is generally located in intermediate elevations.

USDA Forest Service and Montana Department of Fish, Wildlife and Parks (2013) concluded that a specific quantifiable cover recommendation was not supported by the scientific literature. While Lyon et al. (1985) speaks to “good cover” as being two-thirds of the total area, and Thomas et al. (1979) recommended managing for 40% cover and 60% forage for elk, these recommendations have never been empirically tested. Blocks of forested cover were not a strong predictor of elk distribution in a recent study in Montana (Proffitt et al. 2012). While disturbance can eliminate hiding cover function in forested stands, this is not always the case. Forested stands impacted by disturbance such as fire or insects and disease that had at least 40% green canopy cover, but which also had a high proportion of standing dead, may still function as hiding cover (USDA Forest Service 2013b pg. 9).

Table 55: Existing and currently affected (i.e., “potential”) hiding cover by EAU that currently characterizes the analysis area

EAU	Existing – currently provides hiding cover			Potential – has been affected by disturbance		
	SSF	Winter	Total	SSF	Winter	Total
Buffalo Horn YNP	47,860 (74%)	14,272 (22%)	62,132 (96%)	2,354 (4%)	45 (<1%)	2,399 (4%)
Cabin Creek	17,296 (34%)	28,827 (57%)	46,123 (92%)	3,960 (8%)	119 (<1%)	4,079 (8%)
Henry’s Mtns	70,696 (74%)	21,739 (23%)	92,435 (97%)	1,120 (1%)	1,788 (2%)	2,908 (3%)
Total	135,852 (65%)	64,838 (31%)	200,690 (96%)	7,434 (4%)	1,953 (1%)	9,387 (4%)

Direct and Indirect Effects

Forage - Alternatives 2, 3, and 4

Under the action alternatives, treatments would open up the forest canopy and allow increased sunlight to reach the forest floor and stimulate growth of grasses, forbs, and shrubs that provide forage for elk (Lyon and Christensen 2002, page 564). Timber harvest would damage individual plants and shrubs, but there would be an overall net gain of understory vegetation.

A FP standard requires that the integrity of key habitat components such as wallows or moist meadows be protected through project design. The only key habitat components identified for elk in the project area are riparian areas. Riparian areas such as these would be protected through project design and mitigation measures that would be applied during implementation. Treatments were reduced, altered, or eliminated, in many cases, to avoid impacts to riparian areas. Riparian areas that fall within treatment boundaries would be protected with the application of streamside protections, which restrict the types of activities within a designated distance from streams, lakes, and wetlands. See Appendix A for water quality, riparian, and aquatic habitat design features and mitigation measures. These design features and mitigation measures would protect riparian habitats for elk and also ensure that treatments are in compliance with the FP standard.

Increases in elk forage would be particularly evident in treatments that increase the health and extent of aspen. As shown in Table 2. Alternative 2 – Proposed Action and Preferred AlternativeAlternative 2 would result in the highest number of acres of aspen enhanced (a total of 752 acres), while Alternative 3 would result in the least amount of aspen enhanced (a total of 138 acres). Alternative 4 would result in 471 acres of aspen enhanced. Browse pressure appears to be an issue for aspen recovery in only once location in the project area, and this is on Fir Ridge. While many stands in this area have released successfully in recent years, at least two stands appear to be limited due to a combination of lack of sunlight and browse pressure. While the proposed treatments would likely provide enough sunlight penetration to allow these stands to successfully release (as adjacent stands have), if it appears that recovery of aspen stands continues to be limited by browse pressure from ungulate use, fencing may be used as a tool to exclude ungulates temporarily until aspen saplings reach a sufficient height that would preclude further browse pressure. Such fencing would not exclude ungulates from all aspen stands on Fir Ridge – just those where browse pressure appears to be a limiting factor. It would, therefore, not conflict with wildlife species' need for browse. Fencing would be also be temporary and would only be employed for as long as necessary to allow aspen to exceed browse height. This may be as little as three years.

Distribution - Alternatives 2, 3, and 4

Habitat Effectiveness

The action alternatives would result in reductions in habitat effectiveness. These reductions would be temporary in nature and would return to current conditions once project roads are decommissioned. Reductions in habitat effectiveness would not take place all at once across the project area, but, instead, would be staggered in space and time as the project gets implemented across the landscape over time.

All three action alternatives would result in no more than 1% reduction in habitat effectiveness in any of the defined categories greater than 50%. In all cases, this reduction in habitat effectiveness is very small when considered at the scale of the EAU and is likely to have very little effect on elk across the EAU.

Across the analysis area, the changes resulting from implementation of any of the alternatives are very small and are likely to have a minimal effect on elk use at this scale. Much of the work that is proposed in this project would be conducted in areas that are already below 50% habitat effectiveness, which would minimize additional effects on elk.

Locally, the action alternatives would alter habitat effectiveness in areas known to be important to elk. Reductions would occur in the migration corridor that includes Red Canyon. This would occur with all three action alternatives. In the Whits Lake Road area, Alternatives 2 and 4 would reduce habitat effectiveness markedly more than Alternative 3. In the Fir Ridge area, a slight decrease would occur with Alternative 2 but not with the other two action alternatives. All three of these areas (Red Canyon, Whits Lake Road, and Fir Ridge) are also important to elk because they provide winter range for a small

resident herd. Horse Butte, which is important for elk on a year-round basis, would experience a decrease in habitat effectiveness with Alternatives 2 and 4. The Flats, also important to elk, year-round, would experience a decrease with Alternative 2. Habitat effectiveness on Tepee Creek Road and Upper Tepee Creek Road would be reduced with all three action alternatives. These changes are summarized in Table 56.

Table 56: Relative changes in habitat effectiveness greater than 50% (elk use potential) in localized areas within the project area along with the importance of those areas with respect to elk

Area	Importance to Elk	Change in Habitat Effectiveness >50%		
		Alt 2	Alt 3	Alt 4
Red Canyon	Migration Route Winter Range	Reduction	Reduction	Reduction
Whits Lake Road	Migration Route Winter Range	Larger reduction	Some reduction	Larger reduction
Fir Ridge	Migration Route	Small reduction	No change	No change
Horse Butte	Winter Range	Most reduction	No change	Some reduction
The Flats	Winter Range	Reduction	No change	No change
Tepee Creek Road	Summer range	Reduction	Reduction	Reduction
Upper Tepee Creek Road	Summer range	Reduction	Reduction	Reduction

Design features that were included in the alternatives to reduce impacts on grizzly bear secure habitat would also reduce impacts on elk habitat effectiveness, because both of the indicators are defined by the placement of roads. Under Alternatives 2 and 4, all roads that would impact grizzly bear secure habitat in the Madison BMS #2 would be in place, collectively, no more than three consecutive years. This would minimize impacts of reductions in habitat effectiveness in the Horse Butte and Flats areas (described in Table 56) by constraining the time period that habitat effectiveness would be reduced. Alternative 3 was designed so as not to have any effect grizzly bear secure habitat in the Madison BMS #2. This would also result in the least impact of the three alternatives on habitat effectiveness for elk. To further minimize effects of project roads on habitat effectiveness, for all alternatives, public motorized use of project routes would be effectively restricted during project implementation. Following implementation, motorized route density would return to current conditions, as all project roads would be closed and decommissioned. *Habitat effectiveness would also return to current levels as activities are completed and temporary project roads are decommissioned.*

Elk Security Areas

As a reminder to the reader, elk security areas were defined in this analysis as those areas that are at least 0.5 mile from an open motorized route or project road and at least 250 acres in size.

The action alternatives would result in reductions in elk security areas. All reductions would be temporary in nature and last only as long as the temporary road is in place on the landscape. Reductions would also not occur all at one time, as implementation of the project would not all occur at once.

Under Alternative 2, there would be a reduction in elk security acres totaling 929 acres in the Buffalo Horn YNP EAU, 935 acres in the Cabin Creek EAU, and 186 acres in the Henry's Mountains EAU. The loss of security areas in the Cabin Creek EAU would amount to 1%. The losses in the other EAUs amount to less than 1%. Across the three EAUs, a total of 2,051 acres of elk security areas would be affected. This would amount to a less than 1% loss across the EAUs.

Alternative 3 was designed, in part, to minimize effects on elk security. No mechanical equipment or logging traffic would take place in the Fir Ridge and Red Canyon areas during hunting season to reduce activity along that important elk seasonal travel corridor. Units in Fir Ridge were dropped in this alternative to eliminate any project-related activity in that area, which is also an important seasonal travel corridor for elk. As a result of these and other design features, Alternative 3 would have the least effect of the action alternatives on elk security areas in the analysis area. Under Alternative 3 there would be a reduction of 797 acres of elk security areas in the Buffalo Horn YNP EAU and a reduction of 340 acres in the Cabin Creek EAU. There would be no changes in elk security areas in the Henry's Mountains EAU. The losses in the Buffalo Horn YNP and Cabin Creek EAUs would be small enough in proportion to the size of the entire EAUs that the changes would amount to less than 1%. Across the three EAUs, a total of 1,136 acres of elk security areas would be affected. This would amount to a loss of less than 1% across the EAUs.

Alternative 4 would have a slightly greater effect on elk security areas than Alternative 3 but less of an effect than Alternative 2. Under Alternative 4 there would be a reduction of 960 acres of elk security areas in the Buffalo Horn YNP EAU and a reduction of 443 acres in the Cabin Creek EAU. There would be no changes in elk security areas in the Henry's Mountains EAU. The losses in the Buffalo Horn YNP and Cabin Creek EAUs would be small enough in proportion to the size of the entire EAUs that the changes would amount to less than 1%. Across the three EAUs, a total of 1,402 acres of elk security areas would be lost. This would amount to a loss of less than 1% across the EAUs.

Across the analysis area, the changes in elk security areas are very small (no more than 1% in any EAU) in relation to the size of the analysis area boundary and would have a very minimal effect on distribution of elk at that scale.

Locally, the action alternatives would reduce elk security in areas known to be important to elk for migration in the fall during hunting season. In the Whits Lake Road area, Alternatives 2 and 4 would reduce elk security areas, while Alternative 3 would not have an effect in this area. In order to enhance a sense of security for elk in this migration corridor, a timing restriction would be in place that would prevent project activities from occurring on Fir Ridge or in Red Canyon from 1 September through 30 November each year. Therefore, even though project roads would be in place, no activities related to timber harvest would occur in those areas during hunting season.

Design features that were included in the alternatives to reduce impacts on grizzly bear secure habitat would also reduce impacts on elk security areas. Under Alternatives 2 and 4, all roads that would impact grizzly bear secure habitat in the Madison BMS #2 would be in place, collectively, no more than three consecutive years. This would minimize the amount of time that elk security areas would be reduced where the effect on elk security areas is a result of the same roads. Alternative 3 was designed so as not to have any effect grizzly bear secure habitat in the Madison BMS #2. This would also reduce impacts on elk security areas. To further minimize effects of project roads on elk security areas, for all alternatives, public motorized use of project routes would be effectively restricted during project implementation, and project routes would be effectively closed to all motorized use after project completion.

Hunters are still likely to use project routes for non-motorized travel. This may result in slight increases in hunting pressure on elk where these roads have been built. Under Alternative 2, this may be of particular concern in Fir Ridge, which is a narrow corridor through which elk travel in the fall as they move out of the Hebgen Basin towards wintering grounds over in the Madison River Valley. Roads in this area would be minimized with Alternatives 3 and 4. *Elk security would also return to current levels as activities are completed and temporary project roads are decommissioned.*

Cover

To be most conservative in analyzing potential effects of the action alternatives on elk cover, it was assumed that all treatments would entirely eliminate cover within the treatment units. This is not actually what would be expected, as some treatments, such as group selection or daylighting, would leave a large portion of the treatment units intact, and hiding cover would be retained to a great extent across these units. Regardless, all action alternatives would result in some losses of cover for elk. The FP requires that, on National Forest System lands, vegetation treatment projects will maintain at least 2/3 of Douglas fir, lodgepole pine, and subalpine fire conifer forest cover types with at least 40% canopy cover to function as hiding cover for elk at any point in time across an EAU (FP, II-18).

Alternative 2 would result in loss of 1% of the SSF and 2% of the winter hiding cover in the Buffalo Horn YNP EAU. In the Cabin Creek EAU, no SSF cover would be affected, while 3% of the winter cover would be affected. In the Henry's Mountains EAU, there would be no change in SSF hiding cover, while 1% of the winter hiding cover would be affected. Across the analysis area, 1% of the SSF hiding cover would be affected, and 2% of the winter hiding cover would be affected. Under Alternative 2, a total of 93% of the hiding cover in the Buffalo Horn YNP EAU, 88% in the Cabin Creek EAU, and 96% in the Henry's Mountain EAU would still be present following implementation. All of these levels of hiding cover are well above the 2/3 requirement.

Under Alternative 3, the changes would be slightly less as compared with Alternative 2. Alternative 3 would result in loss of 1% of the SSF and 1% of the winter hiding cover in the Buffalo Horn YNP EAU. In the Cabin Creek EAU, no SSF cover would be affected, while 3% of the winter cover would be affected. In the Henry's Mountains EAU, there would be no change in SSF hiding cover, while 1% of the winter hiding cover would be affected. Across the analysis area, 1% of the SSF hiding cover and 1% of the winter cover would be affected. Under Alternative 3, a total of 93% of the hiding cover in the Buffalo Horn YNP EAU, 88% in the Cabin Creek EAU, and 97% in the Henry's Mountain EAU would still be present following implementation. All of these levels of hiding cover are well above the 2/3 requirement.

Under Alternative 4, the changes would be slightly less than Alternative 2 and slightly more than Alternative 3. Alternative 4 would result in loss of 1% of the SSF and 2% of the winter hiding cover in the Buffalo Horn YNP EAU. In the Cabin Creek EAU, no SSF cover would be affected, while 3% of the winter cover would be affected. In the Henry's Mountains EAU, there would be no change in SSF hiding cover, while 1% of the winter hiding cover would be affected. Across the analysis area, 1% of the SSF hiding cover and 2% of the winter cover would be affected. Under Alternative 4, a total of 93% of the hiding cover in the Buffalo Horn YNP EAU, 88% in the Cabin Creek EAU, and 96% in the Henry's Mountain EAU would still be present following implementation. All of these levels of hiding cover are well above the 2/3 requirement.

Locally, the biggest difference in losses in hiding cover between the alternatives would be on Horse Butte, in units east of Highway 191, on Fir Ridge, and along Whits Lake Road. The stands on Horse Butte, Fir Ridge, and around Whits Lake Road that account for these differences would generally be treated to enhance aspen. Aspen generally regenerates quickly, in comparison to conifer species. In the absence of browse pressure that could inhibit the response of aspen, hiding cover in these areas would be replaced in a much shorter time frame than in stands where conifers would be expected to return. Aspen stands in the Whits Lake Road and Horse Butte areas have experienced a release in the last 10-15 years and are regenerating successfully. Saplings in most of these areas have exceeded elk browse height and will successfully grow into mature trees, barring other limiting factors. In at least one aspen stand on Fir Ridge, however, saplings have been unable to exceed elk browse height. This is likely due to browse pressure experienced by in the fall when large numbers of elk move through this relatively narrow landscape corridor. This stand would be treated for enhancement under Alternative 2. The return of hiding

cover to the stands treated on Fir Ridge where browse pressure may be limiting, could be delayed unless browse pressure on these stands is relieved. Fencing may be required in this area to protect aspen saplings from browse pressure. This would only occur under Alternative 2, and the need for this modification would be determined over time.

Under Alternatives 2 and 4, elk may reduce their use of Horse Butte, due to expected losses of hiding cover in this area until aspen regenerates enough as to provide adequate cover. *This would be most likely to occur during high use periods like rifle hunting season; at other times of the year, elk would utilize this area for foraging.* This may also be true of the area around Whits Lake Road. Aspen stands are expected to quickly respond in these areas, however, and hiding cover would be replaced rapidly as aspen seedlings and saplings fill in within a few years. Due to the high forage quality of the aspen stands and quick recovery of these stands with respect to hiding cover, elk use of the area would be expected to return to, and eventually exceed, current levels within a few years. Prolonged loss of hiding cover on Fir Ridge may cause elk to alter their migration routes to avoid this area in the fall. Surrounding topography and vegetation may restrict their ability to alter their migration route in a substantial way which could increase elk vulnerability to hunting pressure in the fall in this area.

Cumulative Effects of the Action Alternatives

Forage

The current forage conditions described for the analysis area are a result of past and present actions that have occurred across the analysis area landscape. These have included timber harvest on public land, past wildfires *(including the 2016 Maple and Boundary Fires),* past prescribed burns, noxious weed control, subdivisions and commercial activities on private lands, grazing activity, and bison management. *Recent fires will likely improve forage for elk due to fire-caused mortality in dense regenerating conifers (allowing grass and forb production) and consumption of above-ground litter (stimulating sprouting of grasses, forbs, and shrubs).*

The action alternatives, in addition to all of the past, present, and reasonably foreseeable actions in the analysis area, would result in an overall benefit to elk forage. In addition to the two vegetation management projects, both of which would enhance elk forage, this project would result in even more elk forage being enhanced. Foreseeable actions may have mixed effects on elk forage, as described above, but the action alternatives would result in a net gain in elk forage across the analysis area.

Distribution

Habitat Effectiveness

Cumulatively, these two projects would have the same level of habitat effectiveness as would be expected with implementation of Alternative 2, because the change expected with Lonesome Wood 2 is so minimal. Implementation of Lonesome Wood 2 may overlap at least in part with implementation of this project. These effects would be distributed across the analysis area in space and time. Effects on elk across the analysis area due to these small losses in habitat effectiveness are expected to be minimal.

Elk Security Areas

The direct and indirect effects described for these alternatives included the effects of current and past actions in the EAUs. The Lonesome Wood 2 Vegetation Management project is also located within the Henry’s Mountains EAU. This project will have no effect on elk security areas; therefore, there are no cumulative effects of this project on elk security areas.

Cover

In addition to the 2,327 acres treated with Lonesome Wood 2 and the Rendezvous Trails projects, the cumulative effects of these treatments could, therefore, result in, at most, a total reduction of 2,369 acres of SSF hiding cover, or 3% of the capable hiding cover in the EAU. This would result in 72% of the EAU remaining as hiding cover upon completion of all of these vegetation management projects. These treatments are well distributed across the analysis area landscape. This small reduction in hiding cover across the analysis area would have a minimal effect on how elk are distributed across the EAUs.

Consistency with FP direction specific to elk and/or big game

Table 57: FP standards specific to elk and big game habitat and how the project complies with those standards.

Standard	Compliance
Big game habitat (summer and winter range) will be managed to meet the forage and cover needs of big game species in coordination with other uses.	The project would have long-term beneficial effects on elk and big game forage by removing the forested overstory and increasing understory production and/or enhancing aspen production in the project area. Cover is abundant across the EAUs and the action alternatives would have minor effects on cover.
Vegetation treatment projects (e.g. timber harvest, thinning and prescribed burning) shall maintain at least two-thirds (2/3) of Douglas fir, lodgepole pine, and subalpine fir conifer forest cover types (on National Forest System lands) with at least 40% canopy cover (on National Forest System lands), to function as hiding cover for elk at any point in time. Hiding cover will be assessed for an elk analysis unit (EAU) which is based on a collaborative mapping effort between the local state (MDFWP) wildlife biologist and the local Forest Service wildlife biologist. In designing vegetation treatment projects protect the integrity of key habitat components, such as wallows or moist meadows, through project design or mitigation (e.g. no cut buffers).	The total amount of existing cover following implementation of each alternative would be well above the 2/3 (67%) criterion. Riparian areas would be protected through project design and development of mitigation measures that would be applied during implementation. Treatments were reduced, altered, or eliminated, in many cases, to avoid impacts to riparian areas. Riparian areas that fall within treatment boundaries would be protected with the application of Streamside Management Zone rules, which restrict the types of activities within a designated distance from streams, lakes, and wetlands. See White (2015) and Roberts (2015) for water quality, riparian, and aquatic habitat design features and mitigation measures.
MA15: Big game habitat improvement such as prescribed fire, planting, and fertilization may be scheduled where the need is identified.	Aspen enhancements scheduled in MA15 would improve habitat for elk

Summary and Conclusion

The action alternatives will increase elk forage by increasing understory production and enhancing aspen stands. Habitat effectiveness and elk security areas will be reduced temporarily, but the effects for all action alternatives are very small at the scale of the t*hree EAUs that make up the analysis area*, and that there would be no effect on elk at the population level. Elk hiding cover will be reduced, but hiding cover is widely abundant across the analysis area and elk would be able to adjust their movements and use of the landscape to seek out hiding cover. Local effects would be minimized with the use of mitigation measures designed to limit effects on elk during hunting season. Displacement would be temporary, and proposed treatments would be limited in scope and intensity which would minimize effects on elk.

Northern Goshawk (Frost 2016, pp. 122-137)

Northern goshawk is listed in the GNF FP as a MIS for mature forest related species. Proposed activities have the potential to affect goshawk through changes in nesting habitat, alterations of foraging habitat within a PFA or home range of a known breeding pair, or through displacement of individuals across the project area.

Affected Environment
The northern goshawk has a conservation status rank of G5 (Montana Natural Heritage Program n.d.). This indicates the species is globally secure – meaning it is common, widespread and abundant. The species is not considered a "species of greatest conservation need" by the state of Montana. Sampson (2006) concluded that northern goshawks in the Northern Region on USFS lands constitute one connected population. Based on habitat analysis and goshawk surveys completed in 2005, breeding goshawks and their habitat appear abundant and well distributed across the USFS Northern Region (Kowalski 2006).

Goshawks use large landscapes, integrating a diversity of vegetation types over several spatial scales to meet their life-cycle needs (Squires and Ke nnedy 2006). Goshawk home ranges or territories consist of at least three levels of habitat during the breeding season: 1) the nest area (about a 40-acre stand), 2) a post fledging area (PFA), and 3) some amount of general habitat used for foraging, with the diversity of forest vegetative composition, age and structure increasing beyond the nest area (Brewer et al. 2009). These components are generally thought to encompass 1,400-8,650 acres (Brewer et al. 2009). Home ranges of adjacent pairs may overlap; however the PFA is the area that is defended and thus dictates the spacing of breeding pairs.

It should be noted that vegetation data collected from a Region-wide goshawk survey in 2005 supported the conclusions of Squires and Kennedy (2006) that goshawks use habitats proportionally to what is available – partitioning space wherever there is suitable nesting habitat within a habitat matrix that provides sufficient foraging opportunity.

Nesting Habitat
Nesting habitat includes the immediate area surrounding the nest. Goshawks may use the same tree for consecutive years, or establish one or more alternate nest sites. *In general, the best available science indicates that the nest area has a narrower range of structural characteristics than the surrounding PFA and foraging area, i.e., more mature forests, relatively closed canopies, and open understories (Squires and Reynolds 1997, Samson 2006, and Squires and Kennedy 2006 in Brewer et al. 2009). No evidence exists that the goshawk is dependent on large, unbroken tracts of "old growth" or mature forest (USDI 1998) or specifically selects for öld growth'forest (McGrath et al. 2003).*

Based on the Eastside goshawk nest habitat analysis, a total of 23,194 acres of nesting habitat is present in the analysis area, which accounts for 39% of the analysis area. Of this total, 21,734 acres (94% of the nesting habitat) currently provide nesting habitat, while 1,459 acres (6% of the nesting habitat) have been affected by fire or timber harvest and have not yet recovered the stand structure that provides nesting habitat (considered "affected" for the purposes of this analysis). Nesting habitat is abundant at all spatial scales analyzed. *Refer to the wildlife specialist report for information regarding the one known nest in the vicinity of the North Hebgen Project.*

Foraging Habitat
Goshawks use a broad-range of habitat conditions for foraging, which reflects their opportunistic, generalist diet (Brewer et al. 2009). Salafsky et al. (2006) found that alternate prey species are commonly substituted for one another as a function of prey habitat. Habitat requirements of primary prey species (tree squirrels, ground squirrels, hares, song birds, woodpeckers, and grouse) include a mosaic of young

forest, mature forest, and openings (Squires and Kennedy 2006). Goshawks have been reported to hunt a variety of conditions including edges of forest and openings (riparian/clear-cut/grasslands-sage); non-forested openings a long distance from cover; dense, close-canopied forest; and open canopied forest (Reynolds et al. 2007, Samson 2006a, Squires and Kennedy 2006).

In determining habitat estimates for maintaining viable populations, Sampson (2006b) used the goshawk PFA as the critical amount of habitat since goshawks actively defend the PFA. Sampson calculated that 30,147 acres of PFA habitat would maintain a minimum viable amount of habitat for northern goshawks in the Northern Region. Modeling results indicate that a total of 109,169 acres of northern goshawk PFA habitat are present on the Gallatin portion of the CGNF, alone (Brewer, et al. 2009 pg. 28 Table 4). This is well above the minimum threshold necessary to support a minimum viable population of northern goshawks across Region 1 (Samson 2006).

A total of 6 acres of Unit 109 are in the PFA boundary, while 1 acre of Unit 215 is in the PFA boundary.

As shown in Table 58, the foraging habitat available at the analysis area scale has a diverse array of size classes.

Table 58: Acres and percent of foraging habitat at three scales within the analysis area along with recommendations from Reynolds et al. 1992, and from Brewer et al. 2009

	Analysis Area		**Home Range**		**Red Canyon PFA**		***Recommended Levels***			
	Acres	**% of Total Area**	**Acres**	**% of Total Area**	**Acres**	**% of Total Area**	**Reynolds et al. (1992)[1]**	**Brewer et al. (2009)[2]**	**Differ-ence from Reynolds et al. 1992**	**Within Brewer et al. 2009 Range?**
Shrub or herbaceous	15,853	27%	876	18%	23	5%	10%	7-11%	-5%	Below
Tree size class 0-4.9″ dbh	2,773	5%	6	<1%	0	<1%	10%	4-17%	-10%	Below
Tree size class 5-9.9″ dbh	10,295	17%	222	4%	19	4%	20%	6-66%	-16%	Below
Tree size class ≥10″ dbh	21,305	36%	3,881	78%	389	90%	60%	11-66%	+30%	Above
Tree size class ≥5″ dbh and canopy cover ≥40%	27,857	47%	3,299	66%	344	80%	60%	37-69%	+20%	Above

Notes:
1 Amount recommended in Reynolds et al. (1992)
2 Range reported in Brewer et al. (2009)

Disturbance

At the local level, human disturbance near nests, particularly during incubation, can cause nest failure (Boal and Mannan 1994). For example, heavy equipment operation (i.e., log loading and skidding) 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. In addition, recreation activities that occur near nests, such as camping, have been reported to cause nest failures (Squires and Kennedy 2006). On the other hand, Zirrer (Squires and Kennedy 2006 pg. 1947) noted repeated renesting attempts by goshawks despite extreme disturbance. In northern Idaho, Moser and Garton (2009) found that clearcutting in the nest area after breeding season (after 15 August) in goshawk PFAs had no short-term effects (1 to 2 years after treatment) on breeding area re-occupancy as long as adequate nesting habitat was available. However, Moser and Garton (2009) recognized that because of a number of confounding factors (such as variation in weather), long-term monitoring may be necessary to detect changes in occupancy rates relative to forest management (also see Reynolds et al. 2007, Woodbridge and Hargis 2006). McGrath et al. (2003) found that goshawks in central Washington and northeastern Oregon 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.

Direct, Indirect and Cumulative Effects for Action Alternatives

Nesting Habitat

The action alternatives would result in short-term losses of nesting habitat. Nesting habitat would be replaced over time, as treated stands mature and again provide the appropriate forest structure.

Table 59: Effects on goshawk nesting habitat as a result of implementing Alternative 2-4

Scale	Acres of Existing Nesting Habitat to be Treated	Total Currently Affected	Total Affected after Implementation	Total Potential Nesting Habitat	% Affected After Implement
Alternative 2					
Analysis Area	4,515	1,459	5,974	23,194	26%
Home Range	132	23	155	2,034	8%
PFA	6	0	6	280	2%
Alternative 3					
Analysis Area	3,599	1,459	5,058	23,194	22%
Home Range	120	23	143	2,034	7%
PFA	6	0	6	280	2%
Alternative 4					
Analysis Area	4,071	1,459	5,530	23,194	24%
Home Range	132	23	155	2,034	8%
PFA	6	0	6	280	2%

In all cases, northern goshawks would still have abundant nesting habitat available across the analysis area. *In several areas (Horse Butte and Rainbow Point area) the majority of existing nesting habitat would be affected to some degree. As the area is not known to provide high densities of nesting pairs and species-specific surveys have not found nests or individuals in these areas, this is not expected to appreciably impact this species or its distribution in the analysis area.*

Reynolds and others (1992) recommend maintaining 6 nest areas, each at least 30 acres in size, totaling 180 acres per 5,000-acre northern goshawk foraging area in the southwestern United States. In west-central Montana, Clough (2000) found nest areas averaged 40 acres in size. Using this estimate for Montana results in a conservative minimum of 240 acres of nest area per 5,000 acre home range to provide adequate nesting habitat for this species. As this analysis area would support approximately 12 home ranges (based solely on the number of acres available and not composition, structure, size, and distribution of habitat and other environmental and landscape factors), a minimum of 2,880 acres of nesting habitat would be required to support this number of home ranges. Post-implementation, there would be at least 17,220 acres of nesting habitat distributed across the analysis area, which is well in excess of this minimum.

With only one known pair in the analysis area, it is not known to provide high densities of nesting pairs. Project activities would affect only a small portion of the Red Canyon home range and PFA, regardless of alternative, and the structure and composition of the nest area would be completely unaffected by any project activities. It is unlikely that the project would have a noticeable effect on goshawks or affect nesting behavior at the Red Canyon nest due to impacts associated with project activities.

Direct and indirect effects were considered in the context of these actions. No other reasonably foreseeable activities are scheduled to occur that would affect nesting habitat. For this reason, there are no additional cumulative effects on nesting habitat.

Foraging Habitat

All alternatives would alter the composition of habitat components that make up goshawk foraging habitat.

Under Alternative 2, treatments would take place across the analysis area in all forested habitat components. No more than 26% of any habitat component would be treated. Following treatment, the analysis area would consist of a well-represented range of habitat components. Across the home range, most treatments would occur in stands with a tree size class of at least 10″ dbh or in stands with a tree size class of at least 5″ dbh and 40% canopy cover. This is true for all action alternatives. No more than 4% of any habitat component would be treated at the home range scale. Following treatment, 75% of the home range would consist of stands with a tree size class of at least 10″ dbh. Within the PFA, there would be a slight increase in the proportion of stands in a tree size class of less than 5″ dbh, from 0% to 2%. There would be no change in how the PFA compares to the Reynolds et al. (1992) recommendations or to the range of values reported in Brewer et al. (2009). This is true for all action alternatives.

Under Alternative 3, treatments would take place across the analysis area in all forested habitat components. No more than 24% of any habitat component would be treated. As with the other action alternatives, the analysis area would consist of a well-represented range of habitat components after treatment. Across the home range, most treatments would occur in stands with a tree size class of at least 10″ dbh or in stands with a tree size class of at least 5″ dbh and 40% canopy cover. This is true for all action alternatives. No more than 3% of any habitat component would be treated at the home range scale. Following treatment, 75% of the home range would consist of stands with a tree size class of at least 10″ dbh. Within the PFA, there would be a slight increase in the proportion of stands in a tree size class of less than 5″ dbh, from 0% to 2%. There would be no change in how the PFA compares to the Reynolds et al. (1992) recommendations or to the range of values reported in Brewer et al. (2009).

Under Alternative 4, treatments would take place across the analysis area in all forested habitat components. No more than 25% of any habitat component would be treated. As with the other action

alternatives, the analysis area would consist of a well-represented range of habitat components after treatment. Across the home range, most treatments would occur in stands with a tree size class of at least 10″ dbh or in stands with a tree size class of at least 5″ dbh and 40% canopy cover. This is true for all action alternatives. No more than 4% of any habitat component would be treated at the home range scale. Following treatment, 75% of the home range would consist of stands with a tree size class of at least 10″ dbh. Within the PFA, there would be a slight increase in the proportion of stands in a tree size class of less than 5″ dbh, from 0% to 2%. There would be no change in how the PFA compares to the Reynolds et al. (1992) recommendations or to the range of values reported in Brewer et al. (2009).

The past, present, and reasonably foreseeable actions are so minimal that the combined effect with the proposed actions would be immeasurable.

Disturbance

Project activities are not likely to affect the long-term survival of goshawks at the population level (USFWS 1998). Disturbance from project activities does have the potential to affect breeding activity in the Red Canyon territory, as some harvest is proposed within the PFA of that nest. To minimize the potential impact of disturbance on breeding goshawks at the Red Canyon nest site, no ground disturbing activities would occur within the PFA between 15 April and 15 August of each year, as long as the nest is occupied. This would be true for all action alternatives. No nest buffer is necessary for this nest, as proposed activities are more than 0.4 miles away from the nest location.

The Red Canyon pair may build a new nest within its territory, or a new breeding pair may establish a nest in proximity of proposed activities prior to completion of the project. If that were to occur, the project has the potential to impact goshawks at those new nest sites. To minimize impacts of the project on breeding activity around new nests, a series of mitigation measures would be implemented. No ground disturbing activities would take place at any time of the year within 745′ of a nest tree that has been active within five years. Within any PFA around an active nest, no ground disturbing activities would occur within the PFA between 15 April and 15 August of each year.

Summary and Conclusion

The action alternatives would have small effects on goshawk nesting and foraging habitat, but these effects would be minor and not affect goshawk at the population level. At most, with Alternative 2, within the analysis area, the amount of affected nesting habitat would move from 6% to 26%. That means that 74% of the nesting habitat within the analysis would remain and be available to goshawks following treatment. Within the home range of the Red Canyon nest, the project would affect 7% of the nesting habitat. In addition to the 1% that is currently affected, a total of 8% of the nesting habitat within the home range would be affected. This would leave 92% of the nesting habitat in a condition suitable for nesting. Within the Red Canyon PFA, a total of 98% of the available nesting habitat would remain following treatment. Effects with Alternatives 3 and 4 would be less than those for Alternative 2. In all cases, the amount of nesting habitat available to goshawks would be abundant following treatment, and goshawks would not be affected at the planning unit scale. Effects on foraging habitat would also be minimal. In no case, would the alternatives move the amount of foraging habitat into the range of habitat values identified for different vegetation categories identified in Brewer et al. (2009). Proposed treatments would move the amount of foraging habitat closer to the values recommended by Reynolds et al. (1992). Changes would be very small, and effects on goshawk would be minimal. *While treatment would create more open stands, it is not expected that competition from other raptors that favor these conditions would appreciably impact this species due to amount of nesting and foraging habitat that would be affected when compared to what would continue to be available in the analysis area.* The action alternatives would also have the potential to disturb individual goshawks, but mitigation measures would reduce the potential for such effects to impact breeding pairs and effects would, therefore, be minor.

Pine Marten (Frost 2016, pp. 137-141)

Pine marten is listed in the GNF FP as a MIS for *mature forest related species*. Marten use moist forest types and mature forests that may not meet the Green et al. (1992) definition for old growth. The proposed action alternative have the potential to result in alterations to habitat composition or structure resulting in losses of pine marten habitat. The amount of pine marten habitat affected by the project alternatives was, therefore, the indicator used to compare effects of the alternatives on pine marten. There are no established thresholds for these indicators that the Forest uses as a target level for which to manage, and the FP does not contain any quantitative standards specific to these indicators. The conclusion of how changes in these indicators would affect pine marten was, therefore, qualitative in nature.

Marten are present throughout the forested areas of the Hebgen Lake Ranger District. The analysis area contains 2,788 acres of preferred marten habitat and 3,856 acres of suitable marten habitat for a total of 6,644 acres of habitat. All of the preferred habitat occurs north of Hebgen Lake, while suitable habitat is present north of the lake and on portions of the Horse Butte peninsula and along Cougar and Duck Creeks.

Direct and Indirect Effects for Action Alternatives

The proposed treatments would alter preferred and suitable pine marten habitat to a lower quality condition by simplifying forest structure. However, the project would retain downed and woody debris and snags to meet FP standards. Also, some amount of forest cover would be retained in all units with the exception of those where regeneration harvest is proposed, and martens would still be able to travel through treated areas.

Proposed treatments under all action alternatives would likely cause individual pine martens to expand or alter their home ranges in order to meet foraging requirements and find denning areas. The analysis area would likely support fewer martens until treated stands mature, but enough habitat would remain so that marten would continue to occupy the analysis area.

Table 60: Effects of the action alternatives on pine marten habitat

	Alt 2		Alt 3		Alt 4	
Habitat Type	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Preferred	185	7%	181	6%	181	6%
Suitable	836	22%	494	13%	725	19%
Total	1,021	15%	675	10%	906	14%

Cumulative Effects of the Action Alternatives

Past and current actions that have affected pine marten habitat include timber harvest on public land, past wildfires and prescribed burns, and subdivision and commercial activity on private lands. These actions have reduced the amount and quality of pine marten habitat in the analysis area in the past. No other timber harvests are proposed within the analysis area on FS lands. Very little suitable pine marten habitat exists on private land, and it is not expected that timber harvest or forest alterations would occur in these small and isolated areas.

In addition to the past activities described above, proposed activities would further reduce availability or quality of pine marten habitat in the analysis area. The description of current conditions took these actions into account, so the characterization of the amount of habitat that would be affected in comparison to what is available within the analysis area was based on alterations or losses of habitat that have already occurred.

Summary and Conclusion
The action alternatives would have small effects on pine marten preferred and suitable habitat, but these effects would be minor and not affect pine marten at the population level.

Other Species or Issues

Bison (Frost 2016, pp. 141-145)

Bison were identified as an issue of concern through public scoping. The project has the potential to affect bison through disturbance and alterations in foraging habitat.

Effects of the project on bison were evaluated by considering how project activities could disturb bison and how treatments would alter foraging habitat. There are no established thresholds for these indicators that the Forest uses as a target level for which to manage, and the FP does not contain any quantitative standards specific to these indicators. The conclusion of how changes in these indicators would affect bison was, therefore, qualitative in nature.

Direct, Indirect and Cumulative Effects for Action Alternatives
Activities associated with implementation of the action alternatives would include increased human presence and operation of heavy machinery in the project area. This could result in disturbance to bison and disrupt foraging behavior or cause displacement from the project area. In the context of the current human activity in the area where bison migrate and forage the additional project activity would be minimal. Foraging areas are abundant, and bison should be able to move and find alternate areas, so effects could be minimal. Disturbance is of particular concern in the migration corridor that bison use to move from Yellowstone National Park out to Horse Butte for calving. To minimize effects of project activities on this migration pattern, no mechanized operations would take place in Units 1 – 12, and 17 between 1 April and 15 May, which are the units that intersect the main bison migration corridor. Some of these units were dropped in Alternatives 3 and 4, so the restrictions would not be relevant. See Appendix A for timing restrictions related to bison migration common to all action alternatives.

The action alternatives would create openings in the forest canopy which would allow sunlight to penetrate to the ground and enhance understory vegetation. Bison would benefit from these enhanced foraging opportunities.

Cumulative Effects of the Action Alternatives

Past and present actions that cause disturbance to bison include traffic on Highway 191 and other private, county, and FS roads; hunting; snowmobile use; recreation; subdivision and commercial activity; activities associated with Rainbow Point Campground; and, hazing of bison. These actions are expected to continue into the future. This project would add to the disturbance factors already affecting bison on the landscape. Because disturbance resulting from the action alternatives is expected to be minimal, the cumulative effect of the proposed actions, in addition to the other disturbance factors affecting bison is also expected to be minimal.

Past and present actions that have contributed to the distribution and availability of bison forage in the analysis area include past timber harvest on public land, past wildfires, noxious weed control, subdivisions, and grazing activity. The cumulative effect of this project, in addition to all the other past and current actions listed above, would be that the project would add to the other factors that have created bison foraging habitat on the landscape. Creation of openings in the forested canopy in areas used by

bison would create additional forage opportunities by enhancing understory grasses. The additive effects would be limited given he amount of area available for forage.

Summary and Conclusion
The action alternatives may disturb bison and displace them during implementation, but alternate habitats are widely available and mitigation measures will minimize effects on an important migration route. Forage opportunities would be enhanced.

Wildlife Vehicle Collisions (Frost 2016, pp. 145-149)

Motor vehicle collisions with wildlife result in annual mortalities of a variety of species on Highways 20, 191, and 287 outside of West Yellowstone. The project was designed, in part, with the intent of reducing the risk of collisions and encounters with wildlife.

Affected Environment
Montana Department of Transportation (MDT) maintains a database of the number of wildlife mortalities that have occurred each year along various stretches of highway, including the stretch of Highway 191 between West Yellowstone and the Yellowstone National Park boundary. Other sources of collision information include the West Yellowstone Police Department, Forest Service Law Enforcement, Madison County Sheriff, and MFWP. All observations are incidental and there has been no attempt to conduct a complete census of wildlife collisions. Collectively, accounts of WVCs include mortalities of and injuries to grizzly bear, bison, moose, elk, mule deer, wolf, fox, coyote, and porcupine, among others.

A Federal Highways Administration (FHA) Wildlife-Vehicle Collision Reduction Study (Federal Highway Administration 2008) recommended vegetation removal along highways as one of many possible mitigation measures that could be used to increase visibility of animals to drivers, and, thus, reduce WVCs. The report explained that once a driver sees a road hazard, it may take 0.7 to 1.5 seconds to move their foot from the accelerator to the brake. With a speed limit of 70 mph on Highway 191, a collision with wildlife could easily occur before a driver has a chance to brake. The sooner a driver sees an animal, the better the chances are that the driver has enough time to react and avoid a collision (Federal Highway Administration 2008 pg. 92).

Visibility of animals to drivers may be improved by removing vegetation from the side of a highway (Federal Highway Administration 2008 pg. 92; IDOT 2014). Several studies support this conclusion. Puglisi et al. (1974) as cited in Federal Highway Administration (2008) found that deer collisions occurred less where vegetation was more 75′ from the highway. Lavsund and Sandegren (1991) as cited in Federal Highway Administration (2008) reported that deer collisions decreased as distance between the highway and forest cover increased. Meisingset et al. (2014) found that vegetation clearance resulted in fewer deer collisions in the winter season. Moose-vehicle collisions were reduced by 20% by clearing vegetation from the highway Lavsund and Sandegren (1991) as cited in Federal Highway Administration (2008). Andreassen et al. (2005) as cited in Federal Highway Administration (2008) found that forest clearing resulted in a 49% reduction in wildlife collisions. Thiss ame concept applies to potential grizzly bear encounters near Rainbow Point campground .

Federal Highway Administration (2008) reported that a potential concern with clearing forest vegetation from highway corridors is that it may result in growth of forage that promotes use of the highway corridor by wildlife, thus, increasing the potential for collision. Native grass and shrub species are already abundant along the Highway 191 corridor, and forage is not limited such that increased grazing/browsing would be expected with more grasses/shrubs.

In 2014 the Greater Yellowstone Coordinating Committee (GYCC) ranked USFS recreation sites in the GYE according to their relative risk to grizzly bears (2014 GYE campground risk and infrastructure survey). This ranking was based on a number of factors, including grizzly bear occupancy, availability of food storage containers, information boards, trash receptacles and service, and others. Evidence indicates that independent (age ≥ 2 yr) grizzly bears tend to die in areas where potential for conflict with humans is high. When combined, the risk for grizzly bear mortality and the relative measure of grizzly bear presence can be viewed as a surrogate measure for potential conflict. Rainbow Point Campground ranked 3rd in risk to grizzly bear of the 164 USFS recreation sites assessed for the GYE. Past human-bear interactions at the campground (leading to grizzly bear and human mortalities) and the dense nature of vegetation in and around the campground prompted inclusion of the area in the vicinity of the campground as a potential treatment unit.

Direct, Indirect and Cumulative Effects for Action Alternatives

The action alternatives all have the potential to reduce the risk of WVCs along Highway 191. Clearing vegetation from the highway would increase the visibility of wildlife to drivers and give drivers more time to react when wildlife attempt to cross the highway. The potential loss of or injury to wildlife would be reduced. Increased sunlight may increase understory vegetation, making these areas more desireable to ungulates, and reversing the benefit of increasing visibility along the corridor.

Other factors affecting the risk of WVCs along Highway 191 include bison management, which increases the risk by pushing bison across the highway. Law enforcement generally directs traffic during hazing operations, so the risk to bison getting injured by oncoming traffic is minimized. Speed limit is another factor identified as contributing to the risk of WVCs in Federal Highway Administration (2008). Higher speed limits, such as the 70 mph speed limit along Highway 191, increase risk of collisions with wildlife. It is important to note that speed limits on state highways are not within the jurisdiction of the Forest Service. There are no reasonably foreseeable actions that would alter the current risk.

Direct and indirect effects of the action alternatives were described in the context of conditions as they currently exist on the landscape. *Emergency speed limit reductions are planned in Spring 2016 along the Highway 191 corridor in an attempt to reduce WVCs with bison along the portion of Highway 191 that would be affected by the proposed highway clearing and thinning. When these activities are combined, there is the potential to* reduce the risk of WVCs along Highway 191. *Uncertainty regarding whether ungulates may be attracted to this forage make it unclear whether WVCs will be reduced so the treatments werr dropped from the decision*

Commercial thinning treatments in the vicinity of Rainbow Point Campground were designed in part to reduce the likelihood of negative grizzly bear encounters with humans. By thinning the vegetation around the campground and reducing cover in the understory, hiding cover for grizzly bears would be reduced and sight distances from the campground would be increased, which will, in turn, reduce the likelihood of a surprise encounter between bears and humans..

Summary and Conclusion

The action alternatives *would reduce the risk of grizzly bear encounters near Rainbow Point Campground and could*reduce the risk of wildlife vehicle collisions by increasing sight distance and reaction time for drivers along Highway 191; *however, uncertainty whether ungulates may be attracted to this forage make it unclear to what degree WVCs will be impacted. The treatments are removed from the selected alternative this uncertainty is inconsequential.*

Migratory Bird Species (Frost 2016, pp. 149-154)

Migratory birds are a very diverse group, which includes raptors, waterfowl, shore birds, upland game birds and songbirds. Migratory bird species are protected under the IMBTA. Executive Order 13186 requires agencies to ensure that environmental analyses evaluate the effects of federal actions and agency plans on migratory birds, with emphasis on s*pecies of concern. The Montana Natural Heritage Program (MNHP) Environmental Summary Report (Montana Natural Heritage Program 2017), 2008 Birds of Conservation Concern (BCC) report (US Fish and Wildlife Service 2008), and the online iPaC Resource (US Fish and Wildlife Service) were* used to identify focal species for this project. The MNHP serves as the state's information source for animals, plants, and plant communities with a focus on species and communities that are rare, threatened, and/or have declining trends and as a result are at risk or potentially at risk of extirpation in Montana. Montana Animal Species of Concern (MTSOC) are native Montana animals that are considered to be "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution. *The iPaC resource was used to identify which BCC are potentially present in the project area.*

Migratory bird s*pecies of concern considered in this analysis include those that have been documented in the vicinity of the project area and for which the project area contains suitable habitat. A number of species on these lists would not be affected by the proposed activities because appropriate habitat is not present in proposed treatment locations; these species will not be considered further. A number of migratory bird species of concern* were previously addressed under separate headings and will not be analyzed in this section. These *include the American peregrine falcon, bald eagle, flammulated owl, harlequin duck, trumpeter swan,* and black-backed woodpecker (all of which are FS Region 1 sensitive species) and northern goshawk (MIS). Migratory bird species of concern (collectively SOC), *including MTSOC and BCC*, that could potentially be impacted by the proposed treatments and that have not yet been analyzed in this report include brown creeper, Cassin's finch, Clark's nutcracker, evening grosbeak, *calliope hummingbird, Williamson's sapsucker, and olive-sided flycatcher. Great gray owl was identified as an issue of concern during public scoping, so analysis of that species was included in this section. Effects of the proposed alternatives on migratory Birds of Conservation Concern (BCC) and Montana's Species of Concern (MTSOC) were compared by evaluating disturbance factors and expected alterations in habitat.*

Table 61: Migratory bird SOC analyzed for the North Hebgen Project and preferred habitat and nesting habits

Species	MTSOC/ BCC	Preferred Habitat and Nesting Habits
Brown creeper	MTSOC	Found in dense, moist coniferous forest types. They are more common in old growth than mature forest, and are rarely found in logged areas in the Northern Region (USDA 1999 pg. 38). Brown creepers nest under the flaking bark of coniferous trees, and forage primarily on insects, nuts and seeds (Ehrlich et al. 1988 pg. 434).
Cassin's finch	MTSOC	Found in most conifer forest types in the Northern Region, but are most frequently detected in post-fire and partial cut areas (USDA 1999 pg. 66). They build a cup nest in coniferous trees and feed on seeds, insects, buds and berries (Ehrlich et al. 1988 pg. 644)
Clark's nutcracker	MTSOC	Broadly distributed across conifer forests of the Northern Region and are thought to be tied to areas of high conifer seed production (USDA 1999 pg. 31). This species builds a cup nest in conifer trees, and feeds primarily on pine nuts and other conifer seeds, but will also take fruits, insects, invertebrates, bird eggs and small nestlings (Ehrlich et al. 1988 pg. 410).

Species	MTSOC/ BCC	Preferred Habitat and Nesting Habits
Evening grosbeak	MTSOC	The Evening grosbeak builds a cup nest, generally in conifers but sometimes in deciduous tree species as well. They feed primarily on seeds, fruit and insects gleaned from foliage (Ehrlich et al. 1988 pg. 646).
Great gray owl	MTSOC	In Montana, found in relatively dry, montane forest types. They often nest in abandoned hawk or raven stick nests, but will also use natural depressions on broken top snags or tree stumps for nest sites. Nest sites are often selected based on proximity to open areas, where they hunt for small mammals, primarily rodents (USDA 1994 pp. 163-164, 166).
Calliope hummingbird	*BCC*	*Habitat includes open shrubby montane forest, mountain meadows, second-growth, and willow and alder thickets. Nests are in trees (frequently conifers) at meadow edges or in canyons or thickets along streams, at heights from <1 to 21 meters above ground (usually low, with branch or foliage above) (Nature Serve Explorer 2017).*
Williamson's sapsucker	*BCC*	*Habitat includes middle to high elevation montane and subalpine coniferous forest, including spruce-fir, Douglas-fir, western larch, lodgepole pine, and ponderosa pine, and also mixed deciduous-coniferous forest with quaking aspen. Nests in cavities excavated in dead and live trees (Nature Serve Explorer 2017).*
Olive-sided flycatcher	*BCC*	*Breed in various forest and woodland habitats including subalpine coniferous forest, mixed coniferous-deciduous forest, burned-over forest, and along the forested edges of lakes, ponds, and streams. Most nesting sites contain dead standing trees, which are used as singing and feeding perches. Nests are placed most often in live conifers (Nature Serve Explorer 2017).*

Direct, Indirect and Cumulative Effects for Action Alternatives

FP Snag Management direction would be followed so that at least 30 snags (standing dead trees at least 10 inches dbh and 18 feet tall) would be retained per 10 acres of treatment (i.e. on average, 3 snags per acre), with additional live replacement trees retained where necessary (e.g. in areas with shallow, rocky soils, where snags are more likely to fall). In addition, 15 tons of coarse woody debris per acre would be left in treatment units. Due to ongoing insect infestations and other natural processes, snag habitat is not limited within treatment units, throughout the project area, or across the surrounding landscape, and following snag management direction would help retain some important habitat components within treatment units.

For all treatments, the habitat of individual birds, breeding pairs, or family groups might be affected, but these effects (positive or negative) would be too minor to have impacts to any species at the population level. Project activities that occur during the migratory bird breeding season could result in the physical destruction of occupied nests, which would likely result in egg/nestling mortality. Disturbance associated with project activities during the nesting season could cause reduced parental care and/or nest abandonment, which could affect nestling survival rates, and possibly result in reproductive failure for some breeding pairs. Birds may change nest locations in response to human disturbance. Alternate nest sites may be less suitable in terms of security and thermal cover, availability of foraging habitat, perch sites, and other important habitat components. Disturbance outside the breeding season can influence a bird's energy balance, and consequently affect survival rates (Knight and Gutzwiller 1995 pp. 52, 55, 73). Since some of the proposed logging operations would occur during spring and summer, it is possible that some migratory birds may already be nesting in the project area, and could therefore be disturbed and/or

displaced each year by project activities. Project activities that occur after July 15 would have the least impact on breeding birds, since most young birds have fledged and are independent of the nest by that time.

Treament activities would promote a mosaic of structural stages and stand compositions in affected areas following treatment. Project design criteria would be implemented that would potentially reduce impacts by altering the season of the proposed activities (winter harvest versus summer implementation for a portion of the area), protecting known, long term breeding sites for some species (bald eagle, goshawk, peregrine falcon), and retaining dead standing wood for wildlife and other ecosystem functions.

The FS does not know of any additional future actions that would take place in the project area that would also contribute to disturbance of migratory birds. For this reason, there are no cumulative effects of the action alternatives

Summary and Conclusion

Project activities have the potential to affect migratory birds by altering habitat and displacing birds through disturbance *in the short and long term.* In areas where activities are ongoing, breeding birds may avoid or abandon habitats to avoid human activities and disturbance. Activities would be limited in time and spatial extent, so effects would be temporary and would affect migratory birds at a small scale. Proposed activities would not affect migratory bird *populations* at the planning unit scale.

Compliance with Forest Plan Direction

Table 62. Forest-wide wildlife standards from the GNF FP that were not listed in species specific compliance discussion. Includes the rationale for how this project complies with them (Frost 2016, pp. 156-165).

Page[1]	Species [2]	Language	Rationale or Compliance
II-18	n/a	The Gallatin National Forest will coordinate management of the wildlife and fish resources with the Montana Department of Fish, Wildlife, and Parks; the U.S. Fish and Wildlife Service; Yellowstone National Park; private landowners; and other agencies.	Coordination with FWP, NPS, and USFWS occurred throughout project development and analysis. Input from the public (including private landowners) was incorporated through outreach efforts and scoping.
II-19	n/a	Standards for snag management and for dead and down woody material will be utilized. These standards are detailed in Gallatin FP Amendment 15	See Appendix A (Design Features Common to Action Alternatives).
II-19	n/a	Emphasis will be given to the management of special and unique wildlife habitats such as wallows, licks, talus, cliffs, caves, and riparian areas.	No wallows, licks, talus, cliffs, or caves would be affected by project activities. Riparian areas were protected through project design and mitigation measures. See Appendix A.
II-19	n/a	Habitat for waterfowl, shorebirds, and wading birds will be maintained and improved through coordination of land use activities and direct habitat improvements.	Project design features and mitigation measures incorporated to protect riparian habitat will maintain and protect habitat for waterfowl, shorebirds, and wading birds

II-19	n/a	Roads and forest cover will be managed to provide habitat security and diverse hunting opportunity	Effects of the project on grizzly bear security were considered in project design. Grizzly bear security will be maintained according to GBCS and FP standards. Effects of the project on elk security were considered in project design. Alternative 3 was designed to have the least effect on elk security areas. Alternatives 3 and 4 were designed to provide a range of potential effects at Fir Ridge, which is an important elk migration corridor and popular hunting area. Mitigation measures were included to provide elk security areas along the migration corridor that extends from Fir Ridge to Red Canyon. Diverse hunting opportunities would be available because there is no change to existing roads. The landscape would retain a variety of forest cover conditions also.
II-20	n/a	A biological assessment will be completed prior to implementation of activities that have potential to affect threatened and endangered species. Formal consultation with the U.S. Fish and Wildlife Service will be completed if a "may affect, likely to adversely affect" determination is made.	Consultation requirements will be fulfilled and documented as part of the final decision for this project.
II-24	n/a	Standing snags will be provided for dependent wildlife species. (See Forest Plan Amendment 15 for more specific direction.)	Direction for management of snags is specified in Amendment 15. See Appendix A for inclusion of this standard in alternative design.
II-24	n/a	Maintain sufficient down woody debris habitat components to accommodate the needs of wildlife species. (See Forest Plan Amendment 15 for more specific direction.)	See Appendix A for inclusion of this standard in alternative design.
Notes 1. Refers to page # in the GNF FP (USDA Forest Service 2015b). 2. Indicates if a standard was discussed in a species-specific section earlier in the document.			

Table 63: Wildlife standards for the management areas affected by the NHMRP and how the project is in compliance with each

MA	Page[1]	Species[2]	Standard	Compliance
1	III-3	n/a	Habitat improvement projects that are compatible with developed recreation use may be scheduled.	Treatments in MA1 include those proposed around Rainbow Point Campground. See Figure 13 These treatments are designed to reduce negative grizzly/human encounters around the campground by increasing sight distance and reducing hiding cover. Many negative grizzly bear encounters result from surprise encounters between humans and bears. These treatments would reduce the likelihood of this occurring. The treatments are compatible with developed recreation use in that they will increase public safety at the campground.
2	III-7	n/a	Habitat improvement projects consistent with management area goals may be scheduled.	This project does not conflict with any MA 2 goals.
5	III-21	n/a	Habitat improvement projects consisted with management area goals may be scheduled.	This project does not conflict with any MA 5 goals.
7	III-28	n/a	Maintain suitable habitats for those species of birds, mammals, and fish that are totally or partially dependent upon riparian areas for their existence.	Riparian areas were protected through project design and mitigation measures.
13	III-54	n/a	Use vegetative management practices to maintain and improve the quality and quantity of big game forage and provide for a diversity of habitat for other wildlife species.	The action alternatives would enhance elk forage by allowing more sunlight to penetrate to the ground, which enhances understory vegetative growth. Effects on other big game species would be similar. Treatments would enhance structural diversity and vegetative complexity across the landscape as discussed in the Forest Vegetation Specialist's Report (Konen 2015).
	III-55	n/a	As appropriate, when site specific timber sales are scheduled and designed, the criteria developed in consultation with the U.S. Fish and Wildlife Service will be used.	Consultation requirements will be fulfilled and documented as part of the final decision for this project.
	III-65	Grizzly Bear (pg. 80)	The GYA Grizzly Bear Conservation Strategy will provide the basis for managing other resource uses.	This affects treatments on the south side of Mount Hebgen, in the Whits Lakes area, at the bottom of Tepee Creek Road and on Horse Butte. See Table 22 for Ccomplaince discussion.. GBCS standards were amended to the FP with the 2015 Cleanup Amendment. All proposed alternatives are in compliance with the GBCS.

Notes
1. Refers to page # in the GNF FP (USDA Forest Service 2015b).
2. Indicates if a standard was discussed in a species-specific section earlier in the document.

Preparation and Consultation

Interdisciplinary Team Members

- Bergstrom, Mike Archeology Technician
- Brey, Jason District Ranger
- Canfield, Jodie Forest Biologist
- Dzomba, Thomas Regional Air Quality Specialist *(Dzomba, 2015)*
- Erickson, Mary Responsible Official
- Frost, Courtney Terrestrial Wildlife Biologist *(Frost 2016)*
- Gebert, Krista Regional Economist
- Hancock, Bryce GIS Specialist
- Jones, Fred Fire-Fuels *(Jones 2015)*
- Keck, Tom Soils *(Keck 2016)*
- Konen, Keith Forest vegetation *(Konen 2015)*
- Lamont, Susan Invasive Weeds *(Lamont 2015)*, Range *(Lamont 2015a)*, Sensitive Plants *(Lamont 2015b)*
- LaPoint, Halcyon Cultural resources *(LaPoint 2015)*
- McMurray, Jill Air Quality Specialist
- Morrison, Grant Transportation Planner *(Morrison 2016)*
- Motzko, Nate Economics, Timber Planning
- Ng, Kawa Regional Economist
- Nosal, Johanna Silviculturist
- Roberts, Bruce Aquatic Species *(Roberts 2015)*
- Scarlett, Randy Wildlife Biologist
- Stiles, Todd Recreation (*Stiles and Seth 2015*) and Scenery *(Stiles T. and T. Seth 2015*)
- Seth, Teri Interdisciplinary Team Leader & Climate Change (*Seth 2015)*
- Slacks, Mark Planner, Roadless (*Slacks 2016)*
- Stein, Colleen GIS Specialist
- Thompson, Brian Recreation and Scenery Specialist
- White, Dale Forest Hydrologist Hydrology *(White 2015)*
- Wooding, R. Regional Project manager, *Economics (Wooding et. al 2015)*

Federal, State, and Local Agencies:

The Forest Service consulted the following individuals, Federal, State, and local agencies; tribes and during the development of this environmental assessment:

Federal, State and Local Agencies
Gallatin County Commissioner(s)
Hebgen Basin Rural Fire Department (HBRFD)
MT Fish, Wildlife and Parks
Madison County Commission
Montana State Department of Natural Resources and Conservation (MT DNRC)
Montana Department of Livestock
US Fish and Wildlife Service
USFS Region 1 Forest Health Protection
West Yellowstone City Council
Yellowstone National Park

Tribes:
Cheyenne Nation
Confederated Salish Kootenai Tribe (CSKT)
Crow Apsaalooke Chairperson
Crow Nation
Eastern Shoshone Tribe
Nez Perce Tribe
Northern Cheyenne President
Shoshone Bannock Chairperson
Shoshone business Council

Others:
Barta Enterprises
Custer Gallatin Working Group (CGWG) - The twenty-four designated seats on the collaborative include County Commissioners, representatives of Conservation NGO's, the Skiing industry, Agriculture and Ranching, Quiet and Motorized Recreation, Hunters, Anglers, Outfitters, Mining, Recreation and Economic Development, and the Timber industry.
Defenders of Wildlife
Fall River Rural Electric Cooperative
Greater Yellowstone Coalition
Interagency Bison Management Committee (IBMC)
Interagency Grizzly Bear Study Team (IGBST)
Madison Gallatin Trout Unlimited
National Parks and Conservation Association
Natural Resource Defense Council
Parade Rest Guest Ranch
R-Y Timber

Sierra Club
The Wilderness Society
West Yellowstone Chamber of Commerce
Wildlife Conservation Society

References and Literature Cited

Citations for references cited are available on the Gallatin Forest Webpage /Project Webpage at http://www.fs.usda.gov/project/?project=45491 or upon request:

- *Refer to* ***References Cited in EA*** for references that were cited in the following sections: Introduction, Purpose and Need for Action and Alternatives.
- Refer to the ***Specialist Reports*** *cited in the* Environmental Effects portion of the EA for references used in those summaries.

Appendix A –Design Features Common to Action Alternatives

This Appendix includes:

- **Table A-1. DRAFT[12] Design Features or Protections that are Common to All action Alternatives.** ***Monitoring activity is highlighted in bold blue text throughout the design features.***
- **Table A-2. DRAFT[13] Road Management and Treatment by Route**
- **Table A-3. Incremental Mitigation that led to the Proposed Action from the Scoping Alternative**

Table A-1: DRAFT Design Features or Protections that are Common to All Action Alternatives

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
Air Quality 1. Any burning associated with this project will be conducted in accordance with the Forest Service Open Burning Permit from MTDEQ, and in compliance with Montana open burning regulations, this includes the use of BACT to minimize smoke impacts. Burning conducted during the fall burning season will be coordinated through the MT/ID Airshed Group, which makes go/no go recommendations based on forecasted meteorology and air quality conditions, along with consideration for any additional major open burning occurring near the area. The Montana/Idaho Airshed group coordinates burning activities during the fall burning season directly with MTDEQ. Should burns need to be conducted during the winter burn season, burning will be coordinated directly with MTDEQ.		**X**	

[12] These design features are DRAFT until the Decision is issued in order to allow for changes resulting from public comment.
[13] Same as Footnote 1.

<table>
<tr><th>Design Feature or Protection applicable to all alternatives</th><th>Forest Plan or Travel Plan Standard</th><th>Other standard operating procedure</th><th>Recommendation from another source</th></tr>
<tr><td>2. Pile burning constraints:
<table>
<tr><th>Pile Type</th><th>Pile Size (w h l)</th><th># burned /day</th><th>Min. btwn Starts</th></tr>
<tr><td>Landings</td><td>50w20h75l</td><td>5</td><td>30</td></tr>
<tr><td>Grapple</td><td>10w8h10l</td><td>50</td><td>10</td></tr>
<tr><td>Hand</td><td>10w8h10l</td><td>100</td><td>5</td></tr>
</table>
Effectiveness: these practices to be incorporated in the burn plan will ensure compliance with the protections required under the Clean Air Act and related regulations.</td><td></td><td></td><td>X</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>AMPHIBIAN and MUSSEL Protections (Aquatic Species)

1. Fence off all large landing slash piles within 1/3 mile of the listed breeding sites prior to October 15 to prevent toads and toadlets from hibernating within said piles.

2. Pile project generated slash as far as reasonable possibly (minimum 200 feet) away from riparian areas associated with old river owbows near treatment unties 77, 84, 87, 96 and 226.

Objective: Reduce mortality of western toads and toadlets from fire that choose to use slash piles as their winter hibernacula adjacent to the Rainbow Point, Savage Bay, and Horse Butte Peninsula breeding sites (Sestrich 2006).

3. Restrict public use of temporary roads constructed or opened for this project during dusk and dawn hours.</td><td></td><td>x</td><td>x

x</td></tr>
</table>

Design Feature or Protection applicable to all alternatives	**Forest Plan or Travel Plan Standard**	**Other standard operating procedure**	**Recommendation from another source**
Objective: Reduce the amount of involuntary vehicular Bufocide. Western toads use road prisms during dusk and dawn hours for basking and foraging. This practice is a standard operating procedure under the Gallatin Travel Plan. Temporary road use is limited to administrative traffic. *These practices would be incorporated in the contracts and provisions.*			
Cultural Resource Protections 1. If, in connection with operations under this decision, any unanticipated historic or prehistoric resources are encountered, activities must cease in the vicinity of the find and the District Ranger and Forest Archeologist notified. Plans designed to avoid or reduce further disturbance or to mitigate existing disturbance would be formulated in consultation with the MT SHPO, affected tribes, and the Forest Service. The discovery must be protected until notified in writing to proceed by the authorized officer (see 36 CFR 800.100, 112:43, CFR 10.4). *The Custer Gallatin NF is following Wildland Urban Interface and Large Scale Hazardous Fuels Reduction Site Identification Strategy (SIS) to address the effects that large scale, landscape level hazardous fuel reduction projects may have on cultural resources and identify measures to reduce or eliminate those effects. The SIS was approved as part of the programmatic agreement between the USDA-Forest Service-Northern Region, the Advisory Council on Historic Preservation and the Montana State Historic Preservation Officer (MT SHPO). The SIS protocol is followed for this project in compliance with the NHPA. Under the SIS the following measures will be taken to mitigate the effects of this undertaking.* 2. Temporary road and landing locations would avoid heritage sites. Field inventories would be completed for temporary roads, and landing locations at the implementation stage, prior to construction to assist in protecting the locations. **3. All heritage sites within ground disturbing units would be reviewed by the Forest Archaeologist and sale preparation personnel/implementation team, who will assign individual heritage site treatment during sale preparation.**	**x**	**X** **X** **X**	

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
4. Forest Archaeologist or a representative would monitor all approved site treatments. Forest Archaeologists will be notified prior to conducting the approved treatments. 5. All activity fuels would be piled outside the perimeter of heritage sites. No mechanized equipment would be allowed to operate within the heritage site boundaries unless specifically allowed by the prescribed site treatment. *Objective: to avoid damage to cultural sites while implementing the Wildland Urban Interface and Large Scale Hazardous Fuels Reduction Site Identification Strategy (SIS). All sites within or near ground disturbing units were reviewed by the Forest Archaeologist and individual treatment prescriptions were assigned. Eleven known sites would be avoided or protected with these design features.*		**X**	
Fisheries (Aquatic Species) & Water Quality *Objective: Minimize sediment in streams.* 1. *Standard timber sale protection provisions would be applied to the commercial harvest activities to protect against soil erosion and sedimentation. Standard Best Management Practices for Forestry in Montana (DNRC 2006) including Montana SMZ compliance rules (DNRC 2006) would be applied during design and implementation of commercial harvest activities. The State of Montana requires that BMP's be applied to all activities to comply with State Water Quality standards.* *2. Vehicles and logging machinery would not be operated within wetland areas.* *3. Materials would not be deposited in streams or wetland areas.* *4. All required water quality permits, including 124 permits and Nationwide 404 permit compliance validations for stream crossings, would be acquired by the Gallatin NF prior to any ground disturbance. It is not currently expected that the proposed actions would include activities requiring such permits.* *Objective: Eliminate impacts to coldwater fisheries (Little Tepee Creek discussed individually) by providing stable streambanks, adequate overhead vegetation for both cover and thermal regulation and continuous long-term source of large woody debris recruitment.* 5. No trees would be cut within 15 feet of the Ordinary High Water Mark along any fish bearing Class 1 or Class 2 stream segment within commercial and non-		**X** **X** **X** **X** **X**	X

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
commercial treatment units. Removal of lower branches (or ladder fuels) of larger trees within this 15 foot no cut zone would be allowed if removal would not result in mortality to that tree.			
6. The fisheries biologist would be allowed the discretion to widen the 15 foot no cut zone to insure stream bank stability in rare situations where 15 feet were deemed inadequate.		**X**	X
7. Retain all bank-edge trees maintaining stable stream banks and trees leaning toward streams that can provide large woody debris within commercial and non-commercial treatment units.		**X**	X
8. A fisheries biologist would be present during marking of all commercial and non-commercial treatment unit boundaries adjacent to streams and marking of leaning leave trees outside the 15 foot no cut zone.		**X**	**X**
9. Locate all burn piles at a minimum 50 feet away from any streambanks ephemeral, intermittent or perennial. *Objective: Eliminate potential for new sediment delivery to Little Tepee Creek along FSR #986 from Pika Overlook to Little Tepee Creek Trailhead Switchback (350 yards above the existing gate).*		**X**	
10. Minimize disturbance to road cut slopes by avoiding skidding on and/or down to FSR 986 from units 180, 181, 187 and 198. Temporary roads to these units that are planned to avoid skidding on cut slopes would be minimized.			**X**
11. The sale administrator would work with the District fisheries biologist and/or Forest Hydrologist, during approval of temporary roads into treatment unit #180, to ensure that the road location is away from Road Cut Springs, Tributary A, and Tributary B to prevent sediment delivery. *Objective: Reduce sediment delivery from existing sources to extent possible. The only known sediment source is the existing road at the identified spot gravel locations.*		**X**	

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
12. *Prior to implementation,* spot gravel existing sediment delivery reaches of FS Road # 986 at four locations: 1) Road Cut Springs, 2) Tributary A, 3) Tributary B, and 4) Little Tepee Creek crossing. *These aquatic and water quality protections would be incorporated during prescription preparation, presale layout, contract preparation and in contract provisions.*			**X**
Forest Vegetation *Objective: To avoid impacts to old growth stands in the Henry's Mountain Range analysis area*. This was completed in June 2016 by an agency crew. 1. Surveys would be conducted in potential old growth stands prior to treatment to assess Old Growth and if a treatment unit is determined to currently meet minimum Old Growth criteria the proposed treatment(s) would not occur. There are four units with potential old growth stands. All other potential old growth stands in the Henrys Mountain Range that were in proposed treatment units were surveyed and do not meet old growth criteria. *Objective: To maintain mature forest structure at levels consistent with the Forest Plan within MA 13 areas in Compartment 703.* 2. Within MA13 areas of Timber Compartment 703, in proposed Commercial Thin treatments Units 39, 49, and 96 where over-mature forest structure exists limit tree removal to trees less than 10" DBH on 64 acres of treatment in Alternatives 2 and 4 and 12 acres of treatment in Alternative 3. *Objective: Ensure consistency with the Amendment 15 in the Forest Plan while providing for nutrient cycling, large tree retention. A minimum of fifteen tons per acre of three-inch diameter or larger debris (if available) would be left scattered after machine site preparation and/or hazard reduction within harvest units.* 3. An average of 30 snags (greater than 18 ft. in height and greater than 10 inch DBH) per 10 acres within harvest units would be designated for leave. If there are not sufficient dead trees meeting these size criteria, the largest available dead trees will be left as snags. 4. In general, retain large trees across the project area as unique ecological legacies by not cutting/harvesting trees >= 30" DBH. Some incidental cutting of trees of this size may be needed to accommodate transportation systems or	**x** **X** **X** **x**		**X**

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
treatment operations. If the silviculturist determines that a different diameter is more appropriate due to stand composition, that is acceptable, but the intent is to leave the larger trees for snags. Some stands would indicate that a lower diameter is more appropriate eg. 20" dbh.			
Objective: Ensure that project objectives and design concerns are incorporated during implementation.			
5. A detailed site specific silvicultural prescription would be prepared for all treatment areas requiring vegetation manipulation. Windthrow reduction guidelines would be incorporated as needed.	**X**	**X**	
6. Silviculturist would be consulted where treatment deviations are required during contract execution, as a result of changed or unidentified conditions that materially affect the intended treatment as described in the detailed site specific silvicultural prescription. As needed, the silvicultural prescription would be modified and re-approved by a certified silviculturist.	**X**	**X**	
7. Leave Tree Protection: Contractor would take all reasonable care to avoid damage to the roots, bole, and crown of trees to be reserved from cutting. No more than 5 percent of the trees designated to be reserved should be damaged beyond recovery by the Contractor's operations. Any tree damaged beyond recovery, (will die within one year due to damage), can be removed or otherwise treated by the Contractor as instructed by the Forest Service.		**X**	
8. White Bark Pine Protection: If encountered and where feasible, protect mature/cone bearing whitebark pine trees from mechanical damage. In mechanical situations, take precautions to avoid damage from machinery or felling of trees.		**X**	**X**
Practices 1-8 would be completed during prescription preparation and unit layout.		**X**	
9. Size of tree openings created by even-aged silviculture will be no larger than 40 acres in size. (FP, II-25).	**X**		
Monitoring – *completed by agency personnel during preparation, implementation and post treatment.*			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
• ***Develop NEPA to Implementation Crosswalk during contract development to ensure compliance with NEPA decision.*** • ***Assess marking guide compliance during and post marking to ensure compliance with silvicultural prescription.*** • ***Monitor and oversee vegetation treatments through implementation ensure activities comply with contract specifications.*** • ***Implementation monitoring would be planned to review compliance with the NEPA decisions and to ensure implementation of the contract meets specifications.*** • ***Reforestation surveys would be scheduled in conifer regeneration and aspen regeneration units to determine regeneration success and needs. Typically this is done prior to reforestation activities and first, third and fifth year after harvest.*** • ***Post treatment exams are planned to determine project effectiveness.***			
Invasive Weed Protections 1. Avoid existing weed patches by leaving an approximate 30 foot or greater buffer of trees to provide shade that would help contain the weeds and minimize disturbance. Do not drive through weed patches, do not thin trees within 30 feet of the weeds, do not pile slash in an existing weed patch, and do not build temporary roads in areas with existing weed patches. The intent of this practice is to leave shade to contain the weeds. 2. The following units are exempt from the 30 foot buffer mitigation measure: Units 16, 33, 34, 35, 52, 59, 100, and 106 (total 360 acres). In these areas the weeds are currently scattered along the power lines, next to Hwy 191, campgrounds, and the intersection with Rainbow Point road; leaving buffers in these areas would mean most of the trees would need to be left which would not meet the purpose of the project. These areas are accessible by truck or ATV weed sprayers, and would be pretreated with herbicide prior and post disturbance.		**XX (All)**	**X**

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
Feasibility and effectiveness: Avoiding existing weeds and leaving a buffer of 30 feet would help slow the spread of weeds. Monitoring data has shown that yellow toadflax prefers to grow in sunlight and not in full shade (LaMont, 2015(a)). Since this mitigation measure is readily implemented and reasonably effective, it is incorporated into all action alternatives. Avoiding existing weed patches is a recommended practice for noxious weed prevention activity in the FSM 2080-Noxious Weed Management (page 2081.2(1.b.1)). Completed during unit layout by agency crews. 3. Pre-treat weeds along roads at least one full year prior to starting soil disturbance. Then treat the roads every year during the project and for five years following final reclamation. *Feasibility and effectiveness: This mitigation would help to reduce weeds along road sides. The herbicide application is usually very effective at killing the plants, however weeds are often missed (too small to see, or dormant seeds germinate after treatment). Sometimes the herbicide treatment is applied late in the season, at full bloom or after seed set, resulting in viable seeds that can remain dormant in the soil for many years. Repeated application of herbicides for many years is usually required before the patch is eradicated. With large patches the herbicide treatment reduces the density of the weeds but does not eradicate the patch.* *The feasibility of this mitigation depends on available funding. Since it is very likely that additional funding would become available (for example, a stewardship contract would help offset the cost for a few years) and since this is an effective method for reducing the spread of weeds, this mitigation measure is incorporated into all action alternatives. This is a required noxious weed prevention activity in the FSM2080-Noxious Weed Management (page 2081.2(1.a.2)).* 4. Power-wash and inspect all off-road vehicles prior to entering Forest land *Feasibility and effectiveness: This mitigation measure is a common practice on the Forest. A recent study from Montana State University looked at the effectiveness of different types of washing equipment and found they remove 66 to 95 % of the soil (Taylor et al. 2011). Wash duration seemed to be as important as the type of washing equipment, with longer durations removing more soil than shorter durations. Clearly*			**X**

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
the effectiveness of this mitigation is dependent of the thoroughness of the implementation. This suggests that cleaning equipment does help to reduce the spread of invasive weeds but is not 100 % effective. This is a required mitigation measure in the FSM 2080-Noxious Weed Management (page 2081.2(6.a.1.b)). 5. Power-wash and inspect all off road vehicles between units if a new invader species (for example orange hawkweed or leafy spurge or other invasive species as determined by the weed specialist) is found within a unit. Also, power wash and inspect equipment that has operated in units exempt from the 30 foot buffer mitigation (units 16, 33, 34, 35, 52, 59, 100 and 106) prior to moving to other units. *Feasibility and Effectiveness: Cleaning equipment after working in contaminated sites and prior to moving to new locations within the project area would help to reduce the spread of weeds. Effectiveness depends on thoroughness of cleaning. This is a required mitigation measure in the FSM2080-Noxious Weed Management (page 2081.2(6.a.1.c)).* **6.** Re-vegetate all disturbed soil (temporary roads, skid trails, landings and burned areas) by seeding native grass species (certified noxious weed seed-free). Recognize that establishment of native grasses on disturbed sites may occur quickly but sometimes can take several years. **Monitor the site to verify that grass becomes established. Re-seed the site if necessary until successfully regenerated.** *The following is an example of seed mixtures for the dry obsidian flats and for the Red Canyon/Whits lake/Tepee Creek areas.* *Obsidian Flats* / *Whits Lake /Tepee Creek area:* *Bluebunch wheatgrass* / *Slender wheatgrass* *Idaho fescue* / *Mountain brome* *Sandberg bluegrass* / *Big bluegrass* *Thickspike wheatgrass* / *Thickspike wheatgrass* *The precise seed mixtures could be modified based on the availability and cost of the seed.*			**X** **X**

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
Feasibility and Effectiveness: Planting desirable native grasses on disturbed soil would help displace invasive weeds. Seeding the site at least one time is a common practice. This is a required mitigation measure in the FSM 2080-Noxious Weed Management (page 2081.2(6.a.2)). 7. If gravel or pit-run is used on this project, the rock would need to be from a clean source that does not contain noxious or invasive weeds. *Feasibility and Effectiveness: The Gallatin County Weeds supervisor inspects gravel pits for weeds and keeps a list of clean sources. The mitigation measure is reasonably effective at reducing the spread of invasive weeds and is a recommended practice in the FSM2080-Noxious Weed Management (page 2081.2(1.b.3))* **8. Annually survey and treat all weeds (both new and existing) for five years following final reclamation (grass seeding of burned slash piles) in the treatment units. To be most effective surveys and treatments should happen in years 1, 2, 3, 4 and 5 after reclamation. It takes time for weeds to become established and grow large enough to be noticed so delaying surveys for a few years (waiting until after piles burned and grass seeded) would reduce the amount of missed weeds while still having effective herbicide treatments. The weed patches would still be small enough to be easily controlled with herbicide application. Funding for weed treatment and early detection surveys would be included in the stewardship contract and other sources (grants, timber sale appraised required activity, appropriated funds).** *Feasibility and Effectiveness: Follow up survey and herbicide treatment would help control weed patches. Although the current funding for weed control cannot cover this additional workload without forfeiting weed treatment in other areas, it is reasonable to assume that additional funding would be available to implement this mitigation. This mitigation measure is recommended by the USFS Northern Region Risk Assessment Rating protocol for high risk projects.* *These practices would be incorporated in agency program of work during project layout, in the contract provisions and post treatment program of work.*		**X**	**X**

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
Inventoried Roadless Area Protections – units within the IRA include 121, 135, 136, 150, 151, 218 1. Harvest would be limited to generally small diameter trees within the IRA. 2. No road or temporary road construction would be proposed in the IRA. 3. Minimize stump heights visible from the trails up to distance of 50 from each side of System trails #75 and #90. Stump heights are subject to timber sale and service contract provisions. This applies in units 135 and 218 4. Within the IRA, in view of trails (unit 35, 36 Trail #75 and unit 218 Trail l#90), slash would be scattered away from immediate vicinity and piles in units would be placed out of view or 50 feet or more from the trail tread. If in view, during burning, piles would be "chunked-in" to consume as much material as possible and reduce unburned or partially burned material. After pile burning, unburned material would be scattered, not left in a pile. *Effectiveness: These practices would meet the intent of the Roadless Rule and would minimize the visual impacts in the IRA reducing impacts to roadless characteristics such as apparent naturalness. They would be incorporated during proescripion preparation, in contract provisions and as in the overall design.*			**X (ALL)**
Public Safety & Transportation See the Road Management and Treatment by Route Table at the end of this Table for Road Management details. *Incorporated through the Traffic Control Plan and road package in the contract.*		**X**	**X**
Recreation and Scenery **Groomed snowmobile routes:** 1. Groomed snowmobile routes would not be plowed 12/1 to 4/15 to correspond with the grooming season. Exceptions to this may be Cougar Creek Rd. east of Highway 191. It would be possible to plow FSR 1780 East Cougar Creek Road and 6778 East Cougar X Road, as long as a bypass groomed route utilizing the power line corridor was authorized and not plowed (FSR 6777 East Cougar Creek C Road).	**X**	**X**	**X** **X**

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
2. In units 1-10 on Horse Butte, winter logging may be conducted to minimize ground disturbance and provide for scenery retention as well as protection of other resource areas. In the event this occurs, road 6106 would not be plowed to allow for continued access to Horse Butte Lookout as a groomed snowmobile trail. A groomed snowmobile trail would be made parallel to FSR 610 on the section from its junction with 6697 up to 6106. This would allow a groomed route all the way up to the lookout with it only crossing the plowed route once at the 610, 6106 junction. From the 610/6106 junction up to where the trail leaves the roadbed in section 15, plowing could be done with a blower, blowing the snow to the uphill side of the road. The grooming equipment could then groom that snow to make a groomed route parallel to the plowed road bed. This would still allow use of the entire Horse Butte Loop Trail since the proposed temporary roads in units 1-9 are not on the snowmobile trail. The intent of this criteria is to allow continued use of the Horse Butte Loop Trail.			
3. The portion of Big Sky Trail on Tepee Creek Road (FSR986) would not be plowed from 12/1 to 4/15 since it is a heavily used groomed snowmobile trail that provides access to a very popular backcountry riding area.	**X**		
System Trail Protections (System trails - Johnson Lake #90, Whits Lake #75, Old Tepee Trail #236, Skyline Trail #151, Mount Hebgen Trail #111)			
4. Trailheads, infrastructure and parking areas would be restored to original condition post project. (Skyline, Whit's Lake, Johnson Lake, Red Canyon, Mount Hebgen and Fir Ridge).		**X**	
5. Trailheads and trails for system trails would not be encumbered with a landing pile or landing operations that preclude access to the summer trail or snowmobile trail. This includes Trail #75, 90, 205, 236 and Fir Ridge.		**X**	
6. System trails would be protected and restored to single track tread (24" width upon completion of logging). Clearing limits of system trails (#75, #90 and #236) would be maintained or restored. Clearing limits are 4' width from height clear centerline and 10' of obstructions such as down logs and any large rocks brought to surface as a result of the project. Minimize cutting within 20 feet of system trails. System trails would not be authorized to be used as skid trails unless otherwise approved.		**X**	

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
7. In the vicinity, (line of sight) of Johnson Lake Trail #90, Whits Lake Trail #75, and Old Tepee Trail #236, stumps would be cut as low as practical. Generally speaking, cuts with a hot saw are low enough and would not require further treatment.		**X**	**X**
Fir Ridge Trailhead parking and vicinity			
8. If used in the winter, parking for snowmobile users must be available to the public in winter months as this serves as a primary access to the Big Sky Trail and Cabin/Tepee Basin backcountry areas.			**X**
9. Winter logging is encouraged in Fir Ridge Units 147, 148, and 149 to minimize impacts to scenery from Highway 191, Fir Ridge Cemetery, trail that accesses Yellowstone National Park, and the trailhead facility itself.			**X**
Tepee Area		**X (All)**	
The Skyline Trail #151 is a heavily used motorized and non-motorized trail. In winter it is a secondary snowmobile trail from Cabin Creek/Tepee Basin backcountry riders.			**X**
10. Skyline Trail 151 and Led Zeppelin FSR 2527 would not be closed at the same time, unless otherwise approved.			**X**
11. Minimize the duration of logging operation in units accessed from the Skyline Trail (197, 198, 205, 206 and 208) to extent practical so that trail closure is minimized. The trail must be usable for snowmobiles by 11/1			**X**
12. Restore Trail 151 to ATV trail standards after use of the temporary road is complete including appropriate width, clearing, and drainage structures.			**X**
13. Coordinate landing locations with Recreation Staff to minimize impacts to dispersed campsites along Tepee Creek Road 986.		**XX (All)**	
Whits Lake Road and Trailhead parking and accessory trails			**X**
14. The agency encourages winter logging of this area consistent with Bald Eagle nest restrictions to avoid impacts to Parade Rest Ranch day use horseback rides			

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during the shoulder season as well as to avoid considerable hunting use during modern rifle season.			**X**
15. No logging operations would occur in the units south of the Whits Lake Road (FSR 971) from June 1-Labor Day to minimize disturbance to Parade Rest Ranch main operating season.			**X**
16. No weekend log hauling would occur from Labor Day to the end of general hunting season.			**X**
17. The trailhead at the end of Whits Lake Road is in inventoried roadless area and serves a popular trail for horseback riders, hikers, mountain bikers, and Parade Rest Ranch. If needed in this area, the landing should be north of FSR 971 and visually screened from the trailhead parking area and trail.			
Red Canyon FSR 681 and Trailhead parking		**X**	**X**
18. Winter logging is encouraged to minimize disruption to recreation users.			**X**
19. Coordinate landing locations with Recreation Staff to minimize impacts to dispersed campsites.			
Rainbow Point campground			**X**
20. To avoid disruption of campground visitors and concession campground manager, all project related activity would occur between October 1 and April 15 within ½ mile of the campground, unless otherwise approved. Unit 100 must be left in a condition that allows full operation of the campground during the operating season. Winter logging is encouraged.			**X**
21. There would be no landings in the campground to ensure that slash piles do not encumber the campground. Landings for unit 100 will be south of the power line; this also helps protect western toad hibernacula (see amphibian section).			**X**
22. Protect improvements including campground/picnic area infrastructure, toilets, the dock, signs, picnic tables, water infrastructure, bollards and electrical hookups, bulletin boards, gates, and parking areas.		**X**	**X**

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23. Use "cut tree" marking in unit 100 and unit 101 to minimize residual paint; or coordinate with the Recreation specialist with other ideas that meet the intent to minimize residual paint impacts in the campground vicinity. **Flats/Horse Butte** 24. Winter logging is encouraged in units (consistent with Bald Eagle Nest Restrictions) that are accessed from Rainbow Point Road and FSR 695 to the Campground to minimize conflicts with summer users and Horse Butte area residents. 25. Minimize residual paint post-harvest either through marking schemes such as cut tree marking or other methods in the picnic area in unit 10 south of the 6106 road and in unit 86 near homes in order to limit longevity of paint on trees. *Effectiveness: These provisions would ensure recreation access and minimze long term impacts to trail infrastructure. They would be incorporated during prescription preparation, contract preparation, in sale administrator notes and contract provisions.*			**X** **X**
Scenery *The intent of scenery mitigations / design features is to create transitions between a unit and adjacent forest and vegetative patterns that appear natural when viewed from a distance, from along roads, recreation sites and Hebgen Lake. Timely restoration of landings and temporary road approaches is also important. For the most part this would be achieved through tree marking guidelines and timely restoration of temporary roads, landings and skid trails.* ***The landscape architect would work closely with the silviculturist and presale foreman to ensure objectives are met.*** *As long as the end result of the project meets these goals, the quality of the scenery would be maintained whether these or similar practices are incorporated.* • *These design features would apply to the areas visible from the highway and Lake that have a VQO of "retention" and "partial retention" near Horse Butte, Fir Ridge, south of the Witts Lake Road and from the Red Canyon Road.*			**All Practices XX**

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
• *They would also apply to the foreground views in the Flats along Rainbow Point Road, Highway 191 and the campground access road. Due to the lack of topography, only the foreground views are discernable.* 1. Leave trees: In all areas except regeneration harvests, selected trees with the largest and healthiest crowns would remain, so they more resemble areas with open-grown trees. Where there are no large crowned trees, such as in areas of small diameter dense lodgepole pine, small tree clumps of sizes varying from 5 trees to more would be left in shapes that also vary. When possible irregular spacing for leave trees and grouping would be used. 2. Forest Cover Transitions – Visual transitions would be created where needed between treated and untreated areas if the prescription or existing condition results in an abrupt visual difference when viewed from the critical observation areas (Highways 191 and 287, Horse Butte Lookout, Rainbow Point County Road, Cougar Creek, Whits Lake and Red Canyon Road and recreation sites. This would help avoid abrupt visual differences that could make a unit discernible to the degree of becoming visually dominant. This would be accomplished when marking trees for removal or leave, by applying the following techniques: • Where the unit is surrounded by denser forest, the percent of thinning would be progressively reduced towards the outside edge of the unit in a transition zone band of varying width. This is important in all units and especially between units 11, 12, 13, 15, 18, 76, 91, 100, 102 (along Rainbow Point County Road and the Campground Access Road), 62, 65, 69 (Cougar Creek Road visible from the lake) 57, 58, 59, 44, 39 (visible from 191), 121, 116, 117, 216, 215 (Visible from Red Canyon Rd), 153, 157, 176 (Tepee Creek Rd). These are areas with critical observation areas along Highways 191 and 287, main roads or within one mile across the lake. To improve the effectiveness of this mitigation the transition could extend slightly into the buffer around the treatment unit. • Where the unit is next to an already-open area (either natural meadow or an already-logged area), the percent of thinning would be progressively increased toward the open area in a transition zone band of varying widths. In areas next to open areas, trees with large full crown would be selected to leave in order to appear more open grown. This is applicable for units 1-10, 11, 13, 15, 86, 56, 140, 148, 149, 109, 141,			

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142, 155, and 210. Unit 34, which is the highway clearing unit for wildlife visibility, would follow this model as well so that the straight opening associated with the parallel power line corridor east of Highway 191, does not become visually dominant from the Highway view corridor. • Thinning and edge treatments would be applied to large landings. In view corridors. 3. Aspen Treatment Transition - Where openings of approximately 100 feet would be created around aspen clones to stimulate and encourage their growth, those openings would feather and grade out into the thinned areas in the rest of the unit and should be irregularly shaped. This means that trees with full crowns would be left along the edges of the opening and the percent of thinning would progressively decrease outside the opening. 4. Thinning between recreation residences just east of Rainbow Point Campground in unit 100 and the lake would be designed to avoid making structures significantly more visible from the lake. 5. Thinning of conifers between the Rainbow Point Road (FSR 695) and the lake in the area adjacent to Rainbow Point Campground/Boat Launch, would be designed to avoid making the road prism significantly more visible to viewers on the lake. This is the case where a narrow band of conifers currently exists between the road and the lake, in unit 100. 6. During sale preparation/tree marking of units adjacent to homes, Forest Service would meet with property owners to address concerns related to tree marking and their immediate view, if property owners request a consultation. *The second group of practices addresses foreground impacts in view corridors. Soils and water best management practices and invasive weed mitigation would provide for effective and timely revegetation of skid corridors, slash piles, landings and temporary roads, as well as closure. These practices apply to all temporary roads, skid corridors, burn piles if needed and landings so that timely restoration from key observation points in retention and partial retention areas would be assured. Scenery mitigation would ensure thoughtful placement thereby minimizing exposure. These practices would be applied in foreground views along all main access roads.*			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
7. Whenever feasible, landings would be located out of view of key observation points including Highways 191, 287 and Rainbow Point County Road, as well as FSR 601, 6106 and 695. It is recognized that without temporary roads or other access routes this is not feasible. 8. Whenever feasible, access roads would be designed or created to not run perpendicular to the main road view corridor so they do not run in visibly straight lines which create straight view-line openings. 9. Winter logging would be encouraged but not required in the Campground, along Rainbow Point Road, on Horse Butte, Fir Ridge and the Whits Lake units below the FSR. There are other timing restrictions in these areas that limit operations so this recommendation would not be required. 10. The treatment prescription in unit 26 would incorporate group selection and thinning close to the Rainbow Point Road corridor to maintain a vegetation distribution that blends with adjacent treatments 11. The treatment prescription for unit 27 would incorporate sanitation salvage and precommercial thin close to the Rainbow Point Road corridor to maintain a vegetation distribution that blends with adjacent treatments. **Monitoring** **12. Landings and temporary road approaches immediately adjacent to main Forest Service Road view corridors or private land would be monitored for success of restoration actions to ensure that landings, skid trails and temporary road approaches blend with the characteristic landscape within one year of completing project related activities. If necessary, the FS would follow up by removing or scattering large, visually dominant un-burned material, mulching and re-seeding soil under the burn pile, and placing some slash to further naturalize the area consistent with the soil and invasive weed practices.** **13. After completion of the project, District Staff would monitor visually conspicuous stumps and take action to make them less visible within 50 feet of recreation sites including Horse Butte Picnic Area, Rainbow Point Campground, Whit's Lake and Red Canyon, and Skyline Trailheads, and the two recreation residences near Rainbow Point Campground. Contractual limits on stump height combined with the expected use of mechanized**			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
harvester would limit stump heights. Mechanized harvesters typically leave stumps close to ground level decreasing the likelihood that they would be visible once vegetation flushed.			
Sensitive Plants 1. Avoid the known population of sensitive plants (except for whitebark pines). Leave an approximate 30 foot buffer or greater around plants where no equipment or ground disturbance activities would occur. There is one known location of a past population in Red Canyon. *Effectiveness: This is an effective avoidance mitigation measure for protecting the known populations.* 2. If new plants or populations (other than whitebark pine) are discovered during the design or implementation of the project, protect the plants with a buffer (no equipment or ground disturbing activities) around the plants unless otherwise agreed. *Effectiveness: The effectiveness of this mitigation measure relies heavily on the ability to find and identify the new plants; otherwise, it is very effective at protecting the plants.* 3. Where possible leave healthy whitebark pine trees when thinning or harvesting trees. *Effectiveness: This mitigation measure would be incorporated into the silviculture prescription and tree marking guides, so it would be easy to incorporate into the project design.* 4. For units 159, 191, 196, and 199 consider leaving a buffer of tall trees adjacent to the snowmobile trail (20 to 50 feet width) to help protect young whitebark pine from snowmobile trampling. *Effectiveness: This mitigation measure can be incorporated into the design of the units. The buffer of trees would discourage snowmobiles from entering the area.* *These practices are incorporated during unit layout and sale administration.*		**X** **X**	**X** **X** **X**

Design Feature or Protection applicable to all alternatives	**Forest Plan or Travel Plan Standard**	**Other standard operating procedure**	**Recommendation from another source**
Soils		**XX (All)**	**XX**
1. Design Features – Skid Trails • Require a systematic skid trail pattern during logging. ***Application:*** *All treatment units where whole tree yarding (WTY) will be used.* • Ground-based harvest systems will only be used on slopes having sustained grades less than 35 percent. ***Application:*** *All treatment units where whole tree yarding (WTY) will be used.* • Maintain an average of at least 75 feet between skid trails in partial cuts and an average of at least 100 feet in clearcuts. Skid trails may be closer than this spacing where converging so long as overall spacing averages 75 and 100 feet, respectively. ***Application:*** *All treatments where whole tree yarding will be used.* • Lay out skid trails in a pattern that minimizes, to the extent reasonable, continuous grades steeper than 15% in variable slope units. ***Application:*** *All treatments where whole tree yarding will be used on variable slope units.* • Avoid placing skid trails or temporary roads over convex knobs or along narrow, rocky ridges where possible. These areas, although frequently armored by surface rock, are often the least able to recover from soil disturbance. ***Application:*** *All skid trails and temp roads.* • Skid trails will be constructed with water erosion control and drainage measures installed as required by standard timber sale provisions. ***Application:*** *All skid trails* 2. Design Features – Temporary Roads • Minimize the depth of blading in construction of temporary roads within the constraints of Forest Service standards for temporary road construction. Temporary roads should be built to the road standard needed for safe and efficient transport of harvested wood products out of the stand while not removing any more of the surface, mineral soil material than is necessary. ***Application:*** *All temporary roads constructed for the project.*			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
• Avoid locating temporary roads in wetland areas. Avoid to the extent possible locating temporary roads over convex knobs or along narrow, rocky ridges or in riparian areas. Temporary roads shall be routed through riparian areas only where necessary to cross through a riparian area, and shall be routed so as to minimize disturbance in the riparian area. ***Application:*** *All temporary roads constructed for the project.* 3. Design Features – Landings • The following commercial treatment units would **not** have a landing located within the treatment unit boundary: Units 58, 69, 70, 152, and 209. It is assumed the landing for these units will be located within an adjacent treatment unit or on a pre-existing hardened surface. ***Application:*** *Identified units.* • Avoid, <u>to the extent possible</u>, locating landings on convex knobs or along narrow, rocky ridges, areas of shallow or very shallow soils, and other extremely rocky sites as well as wetland and riparian areas. ***Application:*** *All landing areas* • Areas best suited for locating landings include most forested sites, except on those landscapes areas noted above, and open meadow areas with slightly concave to linear slopes that do not currently support big sagebrush. ***Application:*** *All landing areas* 4. Use of Ground Based Equipment off Skid Trails - Soil Moisture Restrictions • Ground based skidding equipment may be used off skid trails but only to the extent necessary to harvest the available timber based on judgement of the timber sale administrator and only when soil conditions in the top six inches of mineral soil are sufficiently dry to not create excessive resource damage. Suitable soil moisture conditions exist when the top 6 inches of mineral soil cannot be ribboned easily between the thumb and forefinger or forms only a weak ribbon that will not support its own weight. In addition, the sample does not form a soft ball when squeezed in the palm of the hand and no free water appears on the soil surface after squeezing or shaking. *Criteria integrates soil texture and soil moisture effects – see USDA Technical Guide for Estimating Soil Moisture (USDA-NRCS 1998).* **Application:** *All commercial harvest units*			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
• Feller/buncher and other mechanical harvesting equipment may be used off established skid trails to the extent necessary to harvest available timber based on judgement of the timber sale administrator, **except** during periods of wet soil conditions when a sample taken from the top 6 inches of mineral soil forms a soft ball when squeezed in the palm of the hand and/or free water can be seen on the surface of the sample when squeezed or shaken. Harvesting during wet surface soil conditions (top 6 inches) can create Excessive and Unreasonable Soil Resource Damage. The criteria used integrates both soil texture and soil moisture effects – see USDA Technical Guide for Estimating Soil Moisture (USDA-NRCS 1998). Repeat passes over the same ground should be minimized. **Application:** *All commercial harvest units where whole tree yarding will be used, except those sites where the mitigation can be waived due very rocky soils. Very rocky soils are defined as having 50% or more of the ground surface is covered by rock fragments 3 inches in size or larger; or the top 6 inches of soil contains greater than 50% rock fragments (all sizes) on a volume basis.* • Ground-based mechanical equipment would not be allowed to operate in forest stands during extremely dry soil conditions. Excessive soil and vegetation resource damage can occur when the upper most mineral soil horizon(s) are so dry that they have a consistency of powdery dust and understory or grassland vegetation gets pulled out of the ground by just one or two passes of ground based equipment. This design feature both eliminates a potential source of excessive soil resource damage during extremely dry conditions and reduces the threat of unintentional fire starts during critical times. **Application:** All treatment units where ground-based, mechanical equipment is proposed for use. 5. Design Features - Use of Ground Based Equipment in Pre-existing High DSD Areas • Light weight, ground based equipment can be used for masticating jack-pot burn piles or piling slash into comparable, small-sized burn piles in pre-commercial thinning and daylight treatment units **but** only in those areas where past-activity caused scarification has resulted in the prior removal of most of the topsoil resource, i.e.: areas already 100% detrimentally disturbed, or during winter months when the frozen ground or settled snow depth criteria			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
are met. Equipment use, during non-winter conditions, will be restricted to Bobcat sized or comparable ground based equipment and will only be allowable when soil conditions in the top six inches of mineral soil are sufficiently dry to not create excessive soil resource damage. See criteria provided under "use of skidding equipment off skid trails" for the description of field criteria used to determine when "soil conditions are sufficiently dry…" **Application:** *All treatment units with high, pre-existing levels of DSD that exceed the Region One standard.* • Use of lightweight, ground based equipment will be allowed in areas of high, pre-existing DSD for retrieving cut logs from old soil piles, shallow ripping exposed substrate materials, and topsoiling land-restoration test sites, provided the top six inches of mineral soil is sufficiently dry to not create excessive soil resource damage. See criteria provided under "use of skidding equipment off skid trails" for the description of field criteria used to determine when "soil conditions are sufficiently dry…" **Application:** *All treatment units with high, pre-existing levels of DSD that exceed the Region One standard.* **6.** Design Features - Jackpot Burn Piles **in Pre-existing High DSD Areas** • Burn piles in high prior DSD areas where pre-commercial thinning or daylight treatments are proposed, regardless of whether constructed by hand or small, ground based equipment, will be kept small along the lines of jack-pot burn piles. **Application:** *All treatment units with high, pre-existing levels of DSD that exceed the Region One standard. These are applicable to the precommercial thin units and daylight units as described in the Soils resource report.* • Jackpot burn piles <u>where feasible</u> should be preferentially constructed in areas of pre-existing DSD, adjacent to soil mounds or in the surrounding area from which mineral soil and forest litter in the pile was removed during ground scarification after clearcutting. This design feature will greatly enhance landscape restoration efforts to follow in these areas. *An appropriate goal during non-winter periods would be to place approximately 80% of the burn piles on previously scarified areas.* These areas are abundantly distributed throughout the past clearcut, forest stands. **Application:** *All treatment units with high, pre-existing levels of DSD that exceed the Region One standard.*			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
• Jack-pot burn piles in pre-existing, high DSD areas, should be burned during winter months, when possible, however, burning is not restricted to winter months only. 7. Design Features - Winter Harvesting • Tractor harvesting over snow or frozen ground in the winter would be limited to periods when there is a minimum of 8 inches of settled snow depth covering the ground surface or when the top 4 inches of mineral soil is frozen. Winter harvesting must not be conducted if ponding or excessive wetness occurs at the surface due to partial thawing of an underlying frost layer. Previously noted limitations to equipment use off skid trails based on soil texture and moisture conditions and the need for a systematic skid trail system do not apply to winter harvested units provided the settled snow depth and/or frozen ground criteria are met. **Application:** Encouraged but not required in *areas in view corridors and the campground.* • Winter harvesting may be allowed to occur during times when neither the snow depth nor frozen ground thickness criteria are met during winter months provided all standard design features timber for harvesting at other times of year are followed, including use of a systematic skid trail system and surface mineral soil moisture restrictions. The separate winter harvesting provision that winter harvesting must not be conducted if ponding or excessive wetness occurs at the surface due to partial thawing of an underlying frost layer applies in all instances. **Application:** *Units selected by the contractor for winter harvest.* 8. Mitigations – Landings All site prep mitigations for landings proposed here fit within the standard timber contact umbrella language for the entire landing area to be scarified after all timber harvesting activities have been completed to *"effectively prepare the ground for seeding"*. If the entire landing area were scarified and seeded, that mitigation alone would satisfy all of the mitigation requirements provided below. For the most part, the mitigations presented here reduce the amount of work required by the contractor while also reducing the level of additional, mitigation caused disturbance created. Embedded in the mitigation descriptions below are some nuances of land restoration that will increase the effectiveness of remediation			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
actions taken, such as treating the area from beneath the burn pile separately from the surrounding donut area. • Area Outside the Burn Pile Perimeter – The portion of the landing area outside the burn pile perimeter will be scarified (shallow ripped) to a depth of 6 to 8 inches in all areas where obvious soil compaction or rutting has occurred. Surface indicators of detrimental soil compaction include bare ground, completely flattened ground vegetation, and shallow ruts or tire tracks. Areas of largely undisturbed ground vegetation, or beneath a brush piles or covered by accumulated coarse woody debris are not likely to not be detrimentally compacted and do not need to be ripped. **Application:** *All commercial harvest units where whole tree yarding will be used, except those sites where the mitigation is waived due very rocky soils. (Very rocky soils are defined as having 50% or more of the ground surface covered by rock fragments 3 inches in size or larger; or the top 6 inches of soil contains greater the 50% rock fragments by volume, regardless of rock size.)* • Area Within the Burn Pile Perimeter - that portion of the landing within the burn pile perimeter will be systematically shallow ripped (scarified) to a depth of 6 to 8 inches with an objective of exposing mineral soil over at least 50% of the burn pile area. It is estimated that a single pass of a toolbar with ripping shanks spaced 12 to 15 inches apart should accomplish the desired result but a second pass at a right angle to the first may be needed. After ripping, the ground surface should be left as rough as possible for broadcast seeding. **Application:** *All landing areas.* • Re-contouring Landings – Recontouring of landings will be required at landings consistent with standard provisions that allow for recontouring of cut and fill banks as needed. The goal is to create smooth continuous slopes, not necessarily re-establish original contours and to re-spread any topsoil removed back over the ground surface. **Application:** A*ll landing areas as needed.* • Seeding – Seed all shallow ripped/scarified areas at landings, along temporary roads, and skid trails after site preparation has been completed using an appropriate native seed mix either provided by or approved by the Custer-Gallatin National Forest. In all cases, the ground surface should be left rough prior to seeding. Broadcast seeding is recommended. **Application:** *All*			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
areas of ground disturbance at landings, along temporary roads, and on skid trails as needed. 9. Mitigations – Temporary Roads and Skid Trails • Temporary Roads - The road prism will be shallow ripped (scarified) to a depth of 6 to 8 inches along the entire road length except where the requirement is waived as noted below. This requirement may be waived on very rocky sections road defined as having greater 50% of the ground surface covered by rock fragments 3 inches or larger in size or more than 50% rock fragments of any size by volume in the top 6 inches of soil. **Application:** *All temporary roads built specifically for the North Hebgen Restoration Project.* • Temporary Roads - Cut and fill slopes along sections of road may be re-contoured based on management objectives and the suitability of site conditions. All ripped and/or recontoured areas will be seeded with the appropriate seed mix either provided by or approved by the Custer-Gallatin National Forest. Some modified versions of partial recontouring or partial ripping may be considered depending on site conditions, such as when abundant rock fragments or noxious weed issues are present. *Note: See below for slashing requirements.* **Application:** *All temporary roads built specifically for the North Hebgen Restoration Project.* • Skid Trails - Ripping along skid trails, at the completion of timber harvesting, will only be required where detrimentally compacted mineral soil is exposed at the surface, or where wheel ruts have formed at least 2 inches deep on grades of 15% or greater or continuous to grades of 15% or greater. Periodic cross ripping should be used on grades steeper than 15%, as needed to control soil erosion. After ripping, these areas will be revegetated by appropriate methods, either by broadcast seeding with a native grass seed mix where substantial bare soil exists and/or ripping has occurred or by natural recovery of native species from propagules in the soil and encroachment from plants growing adjacent to the trail. *Note: See below for slashing requirements.* **Application:** *All skid trails as noted above.* 10. Mitigations – Slash and Coarse Woody Debris • Slashing along Skid Trails, Landings and Temporary Roads – All skid trails, landings and temporary roads would be constructed with water erosion control and drainage measures installed as required by standard timber sale provisions.			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
After timber harvesting is completed for an area, slash all temporary roads at an approximate rate of 5 to 15 tons per acre along those portions that run through closed canopy or partially closed canopy forest stands. Slash left should be oriented at primarily right angles to the road corridor and to maximize direct contact made between slash and the ground surface. Locations where slashing should be considered include unwanted access points to the road or trail, sections of moderately steep (15-30%) or steeper skid trail, and areas of bare ground along skid trails. **Application:** *Skid trails, landings and temporary roads.* • Coarse Woody Debris - The retention of coarse woody debris (CWD) on the ground is an important component of maintaining soil fertility and site productivity after timber harvesting in all coniferous forests. Relative to coarse woody debris, the soils standard will defer to the current Wildlife CWD standard on the Gallatin portion of the Custer-Gallatin Forest as established by Forest Plan Amendment 15 (1994). The wildlife standard requires a higher level of CWD (15 tons/acre) be left behind "where available" for all timber sales. To clarify, this is the level of coarse woody debris to be left on the ground in all treatment units where timber harvesting has occurred, provided at least that amount was present prior to harvesting. If less than 15 tons/acre of CDW is on the ground prior to timber harvesting then all of the down CWD present on the site prior to timber harvesting should be retained. 11. Mitigations – Jackpot Burn Piles Without Soil Spreading in Areas of High Pre-existing DSD Areas • Hand Scarification of Ground Surface – All jackpot burn piles associated with pre-commercial thinning or daylight treatments in areas of high, pre-existing that will not have additional remediation steps taken will be scarified by hand after burning, just enough to expose mineral soil over 50% of the ground surface while leaving the surface rough, followed by broadcast hand seeding of an appropriate native seed mix and spreading of accumulated forest litter, brush and woody debris from around the burn area perimeter in from the edge. 12. Land Restoration Sites in Areas of High pre-existing DSD. These conditions are present in the daylight and precommercial thinning units identified in the soils Resource Report.			

Design Feature or Protection applicable to all alternatives	**Forest Plan or Travel Plan Standard**	**Other standard operating procedure**	**Recommendation from another source**
• Proportional Land Restoration Work – Land restoration treatments will be completed adjacent to existing soil mounds that are scattered throughout the areas of high, pre-existing DSD at a rate proportional to the area **of pre-commercial thinning or daylighting c**onducted on a yearly basis. The approximate ratio will be 40 to 1 or one acre of cumulative restoration area per 40 acres of thinning or daylight treatments. This work would be completed through Stewardship funding, service contracts, Forest Service force accounts or other means on a yearly basis as an ongoing part of the North Hebgen Project. • Land Restoration Work Proposed – Proposed treatments in areas of DSD caused by excessive land scarification in the past would involve the selective spreading of soil material from the existing soil mounds that are scattered throughout the high DSD areas to an approximate depth of 3 to 4 inches using local micro-topography to direct appropriate locations for soil placement in patches across the landscape. 13. Mitigation - Soil Excavations of Limited Extent • There is no expectation in this project that any soil disturbances associated with excavations, such as for continuous burn pits. This could occur during land restoration in sites in areas of high pre-existing DSD. If backhoe or dozer excavations that do occur they would be subject to the current Custer-Gallatin National Forest - Best Management Practice for Soil Excavations of Limited Extent (Keck 2012). This mitigation requires removal and placement of the top 6 to 12 inches of mineral soil (actual depth dependent on site conditions) to be separated from underlying soil and substrate material removed. This topsoil material will then be spread over the surface at the end of backfilling or re-contouring. The net effect of this mitigation provides a substantial benefit from a weed control perspective, more so than an overall soil disturbance perspective. *Design features 1-13 would be incorporated during sale preparation, through contract provisions, contract administration and by forest employees post treatment.*			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
General Wildlife			
1. Use of project roads would be limited to administrative purposes associated with project activities. *No public motorized use of temporary roads constructed for this project would be allowed. During project implementation gates, barricades or other closure devices would be used to prevent public use.*	X		
Bald Eagle			
To reduce impacts on bald eagle and to comply with applicable Bald Eagle Direction the following mitigation measures would be implemented. At this time active nest are present near units 4, 6, 10 and 142.		X	
1. No roads would be constructed within 0.25 miles of a nest tree.		X	
2. No trees that contain a bald eagle nest would be removed.		X	
3. In MA 5, no trees identified by a FS wildlife biologist as a bald eagle perch tree would be removed.			
4. Proposed activities within 0.25 miles of a nest would be designed for maintaining and enhancing bald eagle habitat by protecting and enhancing important habitat components (e.g., nest trees, perch trees, visual screening). This will be accomplished by a wildlife biologist during project layout.		X	
5. No project related activity would occur within 0.25 miles of an active nest from 1 February to 15 August.		X	
6. No machinery would be used within 0.5 miles of an active nest from 1 February to 15 August. This restriction does not apply to hauling of materials on roads.		X	
7. No helicopter activity would be allowed within 1,000 feet of occupied nests (~0.2 miles) between February 1 to August 15.		X	
Grizzly and Black Bear			
1. *To prevent grizzly bear and black bear incidents, all attractants (food, garbage, etc.) will be stored in compliance with the Custer Gallatin National Forest food storage order. Contractors will be informed of possible risks associated with working in grizzly bear habitat, and will be required to comply with the Custer Gallatin National Forest Food Storage Order. The order will be enforced through contract administration.*		X	

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
Northern Goshawk			
To reduce potential impacts on northern goshawk, the following mitigation measures would be implemented. There is one known nest in the vicinity of treatment units at this time.			**X**
1. No ground-disturbing activities may occur at any time of the year within 745 feet (~40-acre buffer) of an occupied nest. A nest is considered unoccupied when it has been monitored during the breeding season and determined to have been inactive every year for at least five years.			**X**
2. No ground-disturbing activities will occur within an active post-fledging area (PFA) from 15 April to 15 August. An active PFA is one in which goshawks are exhibiting breeding behavior that year. The PFA will be determined by a FS biologist.			
Great Gray Owl			
To reduce potential impacts on great gray owl, the following mitigation measures would be implemented. There are no known nests near treatment units at this time.			**X**
3. No trees that contain a great gray owl nest would be removed.			**X**
4. No ground-disturbing activities would occur within 645' (~30 acre buffer) of an active nest from 1 March to 31 July. An active nest is one that is being used by owls in a given year.			
Osprey			**X**
To reduce potential impacts on osprey, the following mitigation measures would be implemented. There are no known nests near units at this time.			**X**
5. No trees that contain an osprey would be removed.			**X**
6. In MA5, no trees identified by a FS wildlife biologist as an osprey feeding or perch tree will be removed.			
7. No ground-disturbing activities may occur at any time of the year within 165 feet (~50 meters) of an occupied nest. Based on the definition of an occupied nest in Brewer et al. (2009), a nest is considered unoccupied when it has been monitored during the breeding season and determined to have been inactive every year for at least five years.			**X**
8. No mechanized project related activity would occur within 165 feet (~50 meters) of a nest from 1 April to 31 August.			

Design Feature or Protection applicable to all alternatives	Forest Plan or Travel Plan Standard	Other standard operating procedure	Recommendation from another source
Peregrine Falcon 9. To reduce potential impacts on peregrine falcon, the following mitigation measures would be implemented. There are no known nests near units at this timeNo project related activity would occur within 0.5 miles of an eyrie from 1 March to 15 August. *These design features such as tree protection are implemented during tree marking, through timing restrictions in contract provisions and during administration.*			**X**
Big Game ***Elk Migration Routes –*** Mechanized operations (i.e. feller bunchers, clippers, processers, loaders skidding, hauling) would be restricted during *hunting season* in Fir Ridge units 147-149 and the Red Canyon Units (to minimize displacement of elk along a migration route. *Hunting season* is the general rifle season which is usually the last Saturday in October to the Sunday after Thanksgiving. ***Bison Calving*** No mechanized equipment would be used in units 1-12 and 17 from April 1 to May 15 to minimize impacts to bison during calving season *These timing restrictions would be implemented through contract provisions and during contract administration.*			**X** **X**

Table A-2. DRAFT Road Management and Treatment by Route	
<u>Tepee Creek Road #986</u> From MP 0.0 at Highway 191 to MP 7.2 at the end of the road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently Maintenance Level (ML) 3 to the Tepee Creek Trailhead MP 6.19- maintained for passenger car vehicles at reduced speeds and comfort levels. • Maintenance Level (ML) 1 from the Trailhead to the end of the road -for Administrative highway traffic only. Open to motorized trail vehicles ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily ▪ Bladed routinely by the Forest Service as far as Tepee Creek Trailhead ▪ Open to the public up to Tepee Creek Trailhead between 4/1 to 12/1 ▪ Used as snowmobile trail 12/2 to 3/31 ▪ MP 6.19 to MP 7.2 used as ATV trail 7/16 to 12/1
Pre-Project Required Road work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts ▪ Lower speed limit during hauling to account for mixed traffic. ▪ Restrict truck hauling between March 30 and May 15 for road protection during spring breakup. ▪ Do not allow snowplowing due to snowmobile trail ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance on other work ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Road work	▪ Final surface blading – purchaser performance ▪ Roadside cleanup – purchaser performance ▪ Rebuild up to 10 drainage dips (majority on last portion of road)
Possible Stewardship Road work	▪ None proposed
<u>Led Zepplin Road #2527</u> From MP 0.00 at Tepee Creek Road to MP 2.44 at the end of the road.. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	

Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily ▪ Bladed intermittently by the Forest Service. ▪ Open to the public between 6/16 to 12/1, used as snowmobile trail 12/2 to 3/31
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage ▪
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Do not allow snowplowing due to snowmobile trail ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Road work	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance ▪ Rebuild up to 8 drainage dips
Possible Stewardship work	▪ None proposed
<u>Graycroft Ridge Rd #2527A</u> From MP 0.00 at junction with Led Zepplin Road to MP 1.37 at the end of the road and the beginning of the temporary road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 1 – Closed to public travel ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily ▪ Not maintained by the Forest Service ▪ Not plowed in the winter.
Pre-Project Required Rd work	▪ none

Road Management during Project Activities	▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup.
Post-Project Required Roadwork	▪ Decommission to meet Gallatin National Forest Travel Plan Decision.
Possible Stewardship work	▪ None

<u>Whits Lake Road #971</u> From MP 0.00 at Highway 287 to MP 2.28 at the end of the existing road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.

Current Management	▪ Currently ML 3 – maintained for passenger car vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily. ▪ Bladed intermittently by the Forest Service. ▪ Designated winter snowmobile route ▪ Open to the public between 4/1 to 12/1
Pre-Project Required Rd work	▪ Road surface grading
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Road work	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None

<u>Red Canyon Road #681</u> From MP 0.00 at Highway 287 to MP 2.76 at the end of the road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.

Current Management	▪ Currently ML 3 – maintained for passenger car vehicles at reduced speeds and comfort levels. ▪ Medium duty road, aggregate surface, not capable of supporting heavy loads during spring breakup or very wet conditions. ▪ Bladed intermittently by the Forest Service. ▪ Designated winter route ▪ Open to the public between 4/1 to 12/1
Pre-Project Required Rd work	▪ Road surface grading
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Road work	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship Road work	▪ None
<u>Fir Ridge Road #2524</u> From MP 0.00 at Highway 191 to MP 0.2 at the beginning of the temporary road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily ▪ Bladed intermittently by the Forest Service ▪ Winter use for snowmobile parking at Trailhead ▪ Open to the public yearlong without restriction – except for loads managed by the County on entrance roads and the FS.
Pre-Project Required Rd work	▪ none

Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Snowplowing when required for performance of project activities. Require a (or multiple) plowed public parking area near the end of the plowing to minimize parking congestion. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None
<u>Duck Creek Road #2523</u> From MP 0.0 at highway 191 to MP 0.8 at the end of the road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 3 – maintained for passenger car vehicles at reduced speeds and comfort levels. ▪ Paved road surface ▪ Bladed infrequently by the Forest Service. ▪ Open to the public yearlong without restriction – except for loads managed by the County on entrance roads and the FS. ▪ Not plowed in the winter.
Pre-Project Required Road work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance

Possible Stewardship work	▪ None
Duck-A Road #2523-A From MP 0.0 at junction with Duck Creek Road to MP 0.3047 at the end of the road at junction with North Cougar Creek Road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles. Road is currently used as a power line access road.	
Current Management	▪ *Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels.* ▪ *Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily.* ▪ *Not maintained by the Forest Service.*
Pre-Project Required Rd work	▪ *Road grading to reestablish surface drainage.*
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Snowplowing when required for performance of project activities. *Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performancectivity signing on all entrances, exits, and approaches.*
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ *Final surface blading – purchaser performance Road*
Possible Stewardship work	▪ None
North Cougar Creek Road #2521 From MP 0.0 at Highway 191 to MP 0.533 at the planned landing area. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily. ▪ Bladed infrequently by the Forest Service. ▪ Open to the public between 5/1 to 12/1 ▪ Not plowed in the winter.
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage

Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Snowplowing when required for performance of project activities. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None
<u>East Cougar Creek Road #1780</u> From MP 0.0 at Highway 191 to MP 3.03 at the other intersection with Highway 191 and end of the road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily. ▪ Bladed infrequently by the Forest Service. ▪ Groomed winter trail south of intersection with East Cougar X Road #6778 ▪ Open to the public between 5/1 to 12/1 ▪ Not plowed in the winter.
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict snow plowing of groomed portion unless groomed trail temporarily rerouted to powerline corridor. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance

Post-Project Required Road work	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None

East Cougar C Road #6777 From MP 0.00 at junction with East Cougar Road to MP 2.96 at the junction with Road #6794. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.

East Cougar X Road #6778 From MP 0.0 at junction with East Cougar C to MP 0.712 at the junction with East Cougar Creek Road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.

Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily ▪ Bladed intermittently by the Forest Service ▪ Groomed winter trail south of intersection with East Cougar Creek Road #1780. FSR #6778 groomed wnter trail. ▪ Open to the public between 5/1 to 12/1
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts ▪ Restrict snow plowing of groomed portion unless alternate temporary route established. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Snowplowing when required for performance of project activities. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None

East Cougar CD Road #6793 From MP 0.0 at Highway 191 to MP 0.45 in Unit 35 . Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily ▪ Bladed intermittently by the Forest Service ▪ Open to the public between 5/1 to 12/1
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Snowplowing when required for performance of project activities. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None
East Cougar CB Road #6794 From MP 0.0 at intersection with East Cougar CD Road to MP 0.15. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Paved road Surface ▪ Bladed intermittently by the Forest Service ▪ Access plowed to transfer station ▪ Open to the public between 5/1 to 12/1
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage

Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Snowplowing when required for performance of project activities. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None
<u>Rainbow Point Road #695</u> From MP 0.0 at intersection with Rainbow Point County Road to MP 2.2 at Rainbow Point Campground. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 4 – maintained for passenger car vehicles at reasonable speeds and comfort. ▪ Medium duty road, native surface with some aggregate surfacing, not capable of supporting heavy loads during spring break-up or very wet conditions. ▪ Bladed routinely by the Forest Service. ▪ Open to the public ▪ Not plowed in the winter.
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Snowplowing when required for performance of project activities. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance

Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None
<u>Whiskey Bay Camp Road #6697</u> From MP 0.0 at Highway 191 to MP 0.1 at the intersection with the proposed temporary road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily. ▪ Bladed infrequently by the Forest Service. ▪ Groomed snowmobile trail ▪ Open to the public between 5/1 to 12/1 ▪ Not plowed in the winter.
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Install (snowmobiles only) signs and leave sufficient snow for snowmobiles if plowed during winter. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Road work	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None
<u>Horse Butte Road #610</u> From MP 0.00 at junction with Rainbow Point Road to MP 5.06 at the beginning of the proposed temporary road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	

Current Management	▪ Currently ML 4 to the intersection with Road #6106 - maintained for passenger car vehicles at reasonable speeds and comfort. ▪ ML 3 beyond Road #6106 - maintained for passenger car vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring break-up or very wet conditions, ruts easily ▪ Bladed intermittently by the Forest Service ▪ Groomed winter trail after intersection with Whiskey Bay Camp Road #6697 ▪ Open to the public between 5/1 to 12/1
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring break-up. ▪ Restrict snow plowing of groomed portion unless alternate temporary route established\ ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None
<u>Horse Butte Lookout #6106</u> From MP 0.0 at junction Horse Butte Road to MP 1.8 at the end of the road in unit 10. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 3 - maintained for passenger car vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring brea-up or very wet conditions. ▪ Bladed intermittently by the Forest Service ▪ Groomed winter trail ▪ Open to the public between 5/1 to 12/1

Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring break-up. ▪ Restrict snow plowing of groomed portion ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None
<u>Horse Butte BA Road #6106-A</u> From MP 0.0 at Junction with Horse Butte Lookout Road to MP 0.56 at the beginning of the temporary road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring break-up or very wet conditions, ruts easily ▪ Bladed intermittently by the Forest Service ▪ Groomed winter trail ▪ Open to the public between 5/1 to 12/1
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring break-up. ▪ Restrict snow plowing ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance

Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None

<u>Cougar Creek Road #1781</u> From MP 0.0 at Highway 191 to MP 2.98 at end of road at intersection with Rainbow Point Road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles. **<u>Whiskey Bay G Road #6697-G</u> From MP 0.0 at intersection with Whiskey Bay Camp Road to MP 0.91 at the other intersection with Rainbow Point Road and end of the road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.**

Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring break-up or very wet conditions, ruts easily ▪ Bladed intermittently by the Forest Service ▪ Groomed winter trail ▪ Open to the public between 5/1 to 12/1
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring break-up. ▪ Restrict snow plowing unless alternate temporary route established ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship Road work	▪ FSR #1781 route being considered as possible alternative evacuation route, would entail higher maintenance standard

Cougar V Road#1781-V From MP 0.00 at junction with Cougar Creek Road to MP 0.83 at the end of the Road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.

Savage Bay Road #6950 From MP 0.0 at intersection with Rainbow Point Road to MP 0.31 at end of road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.

Savage Bay B Road #6953 From MP 0.0 at intersection with Savage Bay Road to MP 0.55 at end of road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.

Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring break-up or very wet conditions, ruts easily ▪ Bladed intermittently by the Forest Service ▪ Open to the public between 5/1 to 12/1 ▪ Not plowed in the winter.
Pre-Project Required Rd work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring break-up. ▪ Snowplowing when required for performance of project activities. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship Road work	▪ Portion of FSR 1781-V route being considered as possible alternative evacuation route, would entail higher maintenance standard. None for other routes

Cougar W Road #6955 From MP 0.0 at junction with East Cougar C to MP 1.25 at the junction with East Cougar Creek Road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.

Current Management	▪ Currently ML 2 – maintained for high clearance vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring break-up or very wet conditions, ruts easily ▪ Bladed intermittently by the Forest Service ▪ Open to the public between 5/1 to 12/1 ▪ Not plowed in the winter.
Pre-Project Required Rd Work	▪ Road grading to reestablish surface drainage
Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring break-up. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship Road work	▪ Route being considered as possible alternative evacuation route, would entail higher maintenance standard and road improvements to increase sight distance and improve roadbed.
<u>Rainbow Point Campground #6952</u> From MP 0.0 at intersection with Rainbow Point Road to MP 0.4 at the end of the road. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 3 - maintained for passenger car vehicles at reduced speeds and comfort levels. ▪ Light duty road, native surface, not capable of supporting heavy loads during spring break-up or very wet conditions. ▪ Bladed intermittently by the Forest Service ▪ Open to the public ▪ Not plowed in the winter.
Pre-Project Required Rd work	▪ none

Road Management during Project Activities	▪ Activity signing on all entrances, exits, and approaches ▪ Weekend project-related traffic restrictions to reduce recreational conflicts. ▪ Restrict truck hauling between March 30 and June 1 for road protection during spring break-up. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance ▪ Road surface replacement (log hauling) - purchaser deposits for future FS performance
Post-Project Required Road work	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None
<u>Private Access #695-P</u> From MP 0.00 at junction with Rainbow Point Road to MP 0.77 at the end of the road at the forest boundary. Anticipated project-related traffic will be composed of crew, service, log-hauling and administrative vehicles.	
Current Management	▪ Currently ML 1 – Closed to public travel ▪ Light duty road, native surface, not capable of supporting heavy loads during spring breakup or very wet conditions, ruts easily ▪ Rarely maintained by the Forest Service ▪ Not plowed in the winter.
Pre-Project Required Rd work	▪ none
Road Management during Project Activities	▪ Restrict truck hauling between March 30 and June 1 for road protection during spring breakup. ▪ Road maintenance (log hauling) – purchaser performance on blading, deposits for future FS performance
Post-Project Required Roadwork	▪ Roadside cleanup – purchaser performance ▪ Final surface blading – purchaser performance
Possible Stewardship work	▪ None

Table A-3. Incremental Mitigation that led to the Proposed Action from the Scoping Alternative

Changes from the Scoping Alternative improve consistency with Forest Plan direction and intent, increase overall efficiency and effectiveness while reflecting sensitivity to valuable wildlife habitat along the riparian buffer. The following modifications were made to the Scoping Alternative in developing Alternative 2.

- Modified treatment in units 180 -187 to minimize impacts to westslope cut throat trout (WCT) habitat in Tepee. Unit 185 was eliminated to protect riparian habitat also.
- Eliminated the prescribed burn (unit 221) because of inconsistencies with current Lynx Direction.
- Established an expanded riparian/migration buffer along the Lake and Cougar/Duck riparian. The following proposed units were dropped: 60, 61, 97, 98, 107, 108. Proposed units 50, 86, 88, 110, 111, and 113 were reduced in size. The prescription in unit 87 was changed to group selection rather than clear cut in order to maintain hiding cover while the thinning prescriptions in proposed units 48, 49 and 96 would be tailored to maintain hiding cover within the approximate 500 feet of buffer.
  The riparian buffer generally recognizes about 500 feet of undisturbed area along the riparian areas identified. However due to presence of structures, the campground and some features such as roads, the buffer varies as shown on the Alternative 2 map. While this expanded buffer is not a Forest Plan requirement we felt that it was important to maintain the effectiveness of the travel route for wildlife.
- Eliminated unit 14 and the boundaries for 13 and 15 were modified to avoid weed spread along Rainbow Point Road by retaining a shaded buffer around existing weeds.
- To improve consistency with Forest Plan visual quality objectives (VQO's) the following changes were made:
  - Unit 16 – the prescription was changed to Intermediate harvest /sanitation salvage from regeneration harvest.
  - Between units 34 and 35, thinning would be transitioned to more dense stocking to ensure that the powerline does not become more visible to highway users. Unit 34 is a wildlife corridor unit adjacent to a powerline corridor unit.
- Eliminated unit 39 (between Hwy 191 and the Park) which reduces the risk of weed spread from the highway and more effectively addresses the revised primary purpose and need which is forest health
- Changed the treatment to commercial thin rather than group select in part of unit 43 (By Hwy 191) to more effectively reduce risk of mountain pine beetle infestation. The unit number for #39 is reassigned to the commercial thin portion of this unit because of the split in the prescription. The remaining portion of #43 would remain group selection which more effectively improves the stand health in dwarf mistletoe infested areas.
- Eliminated unit 146 (Whit's Lake) to minimize impacts to the Inventoried Roadless Area because the treatment would alter roadless character in an area that is a large contiguous roadless block. The treatment method was expensive and marginally effective.
- Eliminated unit 126 and a portion of unit 127 that included treatment methods that were very expensive to implement and marginally effective.
- Eliminated the temporary road associated with unit 55 to minimize the risk of weed spread and the amount of temporary road overall.
- The alternative discussion acknowledges the goal of providing a sustained yield of timber products and improving the productivity of timber growing lands based on comments during field trips with the public during the summer of 2015. This discussion improves the agencies clarity as it relates to the Forest Plan implementation.

APPENDIX B Description of Proposed Treatments (DRAFT)

The description includes general detail about the different categories of treatment. There are three categories of treatment with the different prescriptions that meet the category. Intermediate and Regeneration treatments are shown by category on the Alternative Maps and in the legend. Each specialized treatment is represented on the map and in the legend.

- Intermediate Treatments = commercial thin, improvement cut and sanitation salvage with precommercial thin.
- Regeneration Harvests = clearcut, seed tree harvest, overstory removal and group selection harvest.
- Specialized Treatments = whitebark pine daylight, Powerline treatment and hand treatment.

INTERMEDIATE TREATMENTS were designed to meet the following objectives: Wildland fuel reduction for the wildland urban interface, evacuation routes, fuel breaks and aspen enhancement.

Commercial Thin Whole Tree Yard: This intermediate harvest treatment would reduce existing tree densities from current levels to a target residual density ranging from 60 to 100 square feet of basal area per acre. This equates to approximately 50 to 200 trees per acre (30ft to 15ft spacing) depending on tree species, tree size, and other site variables. Residual tree distribution is expected to be variable and include even spacing and clumping. Long lived, fire resistant species (Douglas-fir) would be favored for retention where available. The purpose of this treatment is to address high priority wildland urban interface (WUI) fuels reduction (e.g. evacuation routes, adjacent to private lands, etc.), Aspen enhancement and/or forest health concerns (mountain pine beetle, western spruce budworm, etc.). These areas would be harvested with ground based equipment or skyline cable systems. Activity related fuels would be whole tree yarded to landings and then burned. Landings are expected to be relatively large at approximately ½ to 1 acres each. There would be a landing for every 10-20 acres of harvest depending on the fuel loading. Natural and activity created fuels would be kept to 15 tons per acre (3 inch or larger diameter). All excess residual fuels would be lop and scattered, trampled, masticated, chipped, piled and/or burned. Burning of landing and hand piles would occur when site conditions and local weather permits limited risk of escape, generally in the Fall. This treatment implements WUI, Evacuation Route, Aspen Enhancement and Forest Health objectives.

Figure B-1: Dense Lodge pole pine stand with ladder fuels.

Figure B-2: Lodge pole pine stands after commercial thinning to reduce ladder fuels and crown density.

Figure B-3: Existing Condition – Douglas fir stand after insect activity.

Figure B-4: Desired Future Condition: On the left - Looking toward a recently thinned Douglas fir stand (background in photo). Landing piles (mid-ground in photo) were burned in the late fall to limit potential of escape. On the right – shows a thinned Douglas Fir stand similar to the desired condition for this forest type in North Hebgen.

Figure B-5: On the left - Existing condition in many lodgepole pine stands in the Basin. This shows continuous ladder and crown fuel. On the right is the same stand after a commercial thin treatment (desired condition).

Improvement Cut/ Whole Tree Yard: These intermediate harvest treatments are designed to promote and enhance aspen communities. Encroachment of aspen communities by conifers appears to be the limiting factor to aspen sustainability. Treatments would focus on removal of conifer components within aspen communities. Removal of the conifer component could range from removal of all conifers to thinning (as described above). *In most treatment units, conifers will be removed within 100-200' of existing, healthy aspen. Outside of these areas, conifers could be thinned to 20-60 ft^2/acre of basal area if there is a secondary objective. Typically, the largest and healthiest conifers will be left in the thinning areas, but this may vary depending on forest health condition.* These areas would be harvested with ground based equipment. Activity related fuels would be whole tree yarded to landings and then burned. Landings are expected to be relatively large at approximately ½ to 1 acres each. All excess residual fuels would be lop and scattered, trampled, masticated, chipped, piled and/or burned. Natural and activity created fuels would be kept to 15 tons per acre (3 inch or larger diameter). Burning of landing and hand piles would occur when site conditions and local weather permits limited risk of escape. *Aspen response will be monitored and if additional disturbance to stimulate response or protection from browse is needed that will be implemented.* This treatment implements Aspen Enhancement and Forest Health and Resiliency Objectives.

Figure B-6: These four photos represent different conditions that exist in Aspen Stands in the project area.

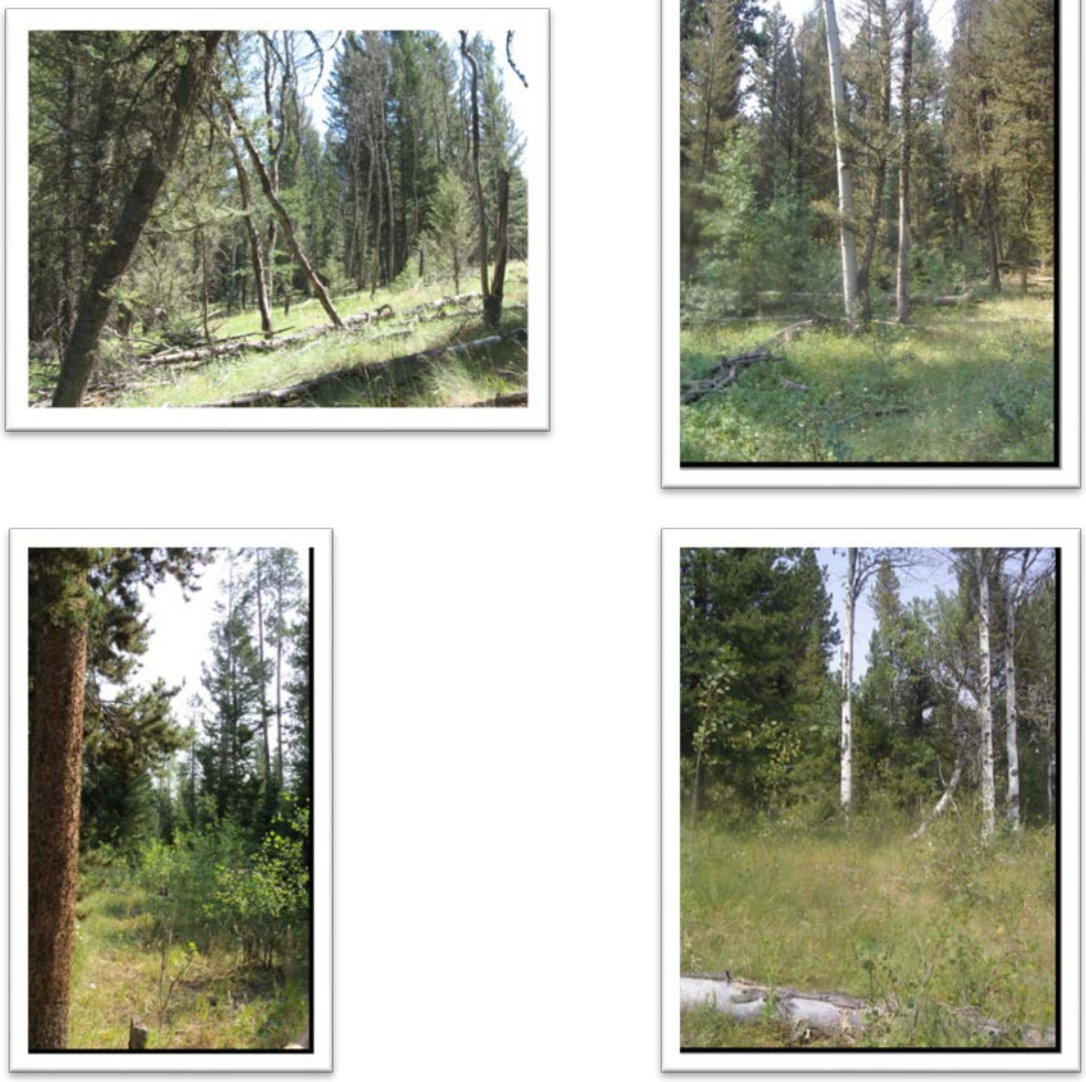

Figure B-7: Desired future condition for Aspen treatments. These four photos show either aspen where conifer competition has been removed or vigorous mixed age aspen stands.

Figure B-8. Lodgepole Pine with dwarf mistletoe

Sanitation Cut/Precommercial Thin/Whole Tree Yard/Lop and Scatter or Masticated or Piled and Burned: These intermediate harvest treatments are intended to improve the health of lodgepole pine stands infected with dwarf mistletoe or Douglas-fir stands infested with western spruce budworm by removing affected overstory and understory trees. The level of trees removed would depend on stand conditions and could result in the removal of all overstory trees *but by definition this intermediate treatment type implies that there is a manageable stand left.* Treatments would favor non-host trees species where present. These units would be harvested with ground based equipment along with precommercial thinning of smaller trees by hand or mechanical means. The commercial sized activity related fuels would be whole tree yarded to landings and then burned. The smaller material from removal of understory trees would be masticated, chipped, piled and/or burned. Natural and activity created fuels would be kept to 15 tons per acre of 3 inch or above. Burning of landing and hand piles would occur when site conditions and local weather permits limited risk of escape, typically in the fall. This treatment implements Forest health, WUI and Evacuation Route Objectives.

Post and Pole Thin/Pile and Burn: Implements WUI and Evacuation Route Objectives and demand for personal use wood products. These intermediate harvest areas consist of very high density small diameter lodgepole pine and thinning would address fuel reduction and forest health concerns. Thinning would be accomplished through personal use permits and/or small commercial operators. Personal use permit areas would be identified on the ground, accomplished by hand, and all specified permit conditions would apply, including limits on material harvested. Commercial operations would be accomplished by hand or with ground based equipment which could include clipper, skidder or rubber tired grapple skidder. Units that are steeper than 35 % would be hand treated. All excess residual fuels would be lop and scattered, trampled, masticated, chipped, hand or machine piled and/or burned. Burning of landing and hand piles would occur when site conditions and local weather permits limited risk of escape, typically in the fall. This treatment implements objectives that address forest health and resiliency and fuel reduction.

REGENERATION TREATMENTS were designed to meet the following objectives: primarily forest health and white bark pine enhancement but also meets fuel reduction objectives.

For the stands identified for Forest health treatments, there are multiple objectives and the silvicultural prescriptions would be designed to integrate other project objectives while improving forest resiliency, stand health and to reduce long term loses. Consideration of forest health and resiliency improvements was focused in areas near other treatments where multiple project objectives could be met and areas that require limited investment for access.

Figure B-9: Existing Condition in Lodgepole Pine with dwarf mistletoe in the mature trees.

Clearcut /Whole Tree Yard/Natural Regeneration: This regeneration harvest treatment would remove nearly all trees from the site to facilitate regeneration of a new age class. These treatment areas consist of one of two conditions: 1.) primarily even-aged lodgepole pine with little species or structural diversity and highly susceptible to mountain pine beetle or 2.) areas severely infected with dwarf mistletoe Regeneration of trees would result from natural seeding; however planting may occur depending on natural regeneration success. These areas would be harvested with ground based equipment, which would also prepare the site for regeneration. Natural and activity created fuels would be kept to 15 tons per acre (3 inch or larger diameter). Residual fuels in excess of this amount would be lop and scattered, trampled, masticated, chipped, piled and/or burned. Burning of landing and hand piles would occur when site conditions and local weather permits limited risk of escape, typically in the fall. This treatment implements forest health and fuels objectives.

Seed Tree with Reserves/Whole Tree Yard/Plant: This regeneration harvest treatment would promote whitebark pine by removing non-whitebark pine species and reserving existing whitebark pine overstory trees as a seed source, which would facilitate regeneration of this species and create a two-aged stand structure. As such, units were designed following relevant literature that suggests mechanical cuttings be used to create openings ranging in size from 1 to 30 acres to mimic patchy mixed severity fire openings. Keane et al. 2012 (pg. 74) reported that some evidence suggests that nutcrackers may favor burn patches less than 37 acres (15 hectares) in size; however, very little research about caching preferences of nutcrackers has been conducted, and these findings may require further substantiation in the literature. Treatments were, thus, designed not to manage for nor influence nutcracker behavior, but, instead, to mimic a fire regime that may be more typical on this landscape in the absence of active fire suppression. Planting of additional whitebark pine seedlings may also occur if regeneration surveys do not show desired levels of natural regeneration is occurring. These areas are currently dominated by lodgepole pine, whitebark pine, Engelmann spruce and/or subalpine fir. Natural and activity created fuels would be kept to 15 tons per acre (3 inch or larger diameter). Residual fuels in excess of this amount would be lop and scattered, trampled, masticated, chipped, piled and/or burned. Burning of landing and hand piles would occur when site conditions and local weather permits limited risk of escape, typically in the fall.

Figure B-10. Both photos show whitebark pine overstory that would be left for seed as well as the intermediate and understory whitebark depending on which prescription applies

Figure B-11. Whitebark Pine in the intermediate and understory age classes.

Figure B-12: Desired condition in whitebark pine stands leaving the cone bearing overstory to contribute a seed source for regeneration.

Overstory Removal/Whole Tree Yard/Plant: This regeneration harvest treatment would release existing whitebark pine regeneration in the understory by removing the non-whitebark pine overstory and would reserve whitebark pine overstory trees as an additional seed source and create a two-aged stand structure. These areas are currently dominated by lodgepole pine, whitebark pine, Engelmann spruce and/or subalpine fir. Planting of additional whitebark pine seedlings may also occur; as some damage to advanced regeneration is anticipated. These areas would be harvested with ground based equipment, which would also prepare the site for regeneration. Activity related fuels would be whole tree yarded to landings and then burned. Landings are expected to be relatively large at approximately ½ to 1 acres each. Natural and activity created fuels would be kept to

15 tons per acre (3 inch or larger diameter) or less. All excess residual fuels would be lop and scattered, trampled, masticated, chipped, piled and/or burned. Burning of landing and hand piles would occur when site conditions and local weather permits limited risk of escape, typically in the fall. This treatment implements Whitebark Pine Enhancement and Fuels or Forest health objectives.

Group Selection/Whole Tree Yard/Natural Regeneration: This regeneration harvest treatment would remove nearly all trees from within groups to facilitate regeneration of a new age class within the groups and an uneven-aged structure within the larger treatment area. Groups would occupy approximately 20%-30% of the treatment area and range from approximately 1 to 3 acres in size. Areas not in groups are not planned for treatment other than possibly some fuels treatments in critical locations. These treatment areas are dominated by lodgepole pine. There is a lot of variability in tree size, density, and insect/disease conditions. Priority placement for groups would be in areas severely infected with dwarf mistletoe and/or areas that are highly susceptible to mountain pine beetle. Regeneration of trees would result from natural seeding; however planting may occur depending on natural regeneration success. These areas would be harvested with ground based equipment, which would also prepare the site for regeneration. Landings are expected to be relatively large at approximately ½ to 1 acres each. Natural and activity created fuels would be kept to 15 tons per acre (3 inch or larger diameter). All excess residual fuels would be lop and scattered, trampled, masticated, chipped, piled and/or burned. Burning of landing and hand piles would occur when site conditions and local weather permits limited risk of escape. This treatment implements WUI, Evacuation Route and Forest Health Objectives.

Figure B-13. This photo shows a 1-2 acre opening created by wildfire. This small opening is similar to what the opening size would be for the group selection prescription. Approximately 20-30 % of a group select units would have small openings like this scattered throughout the unit.

Precommercial Thin (Immature Stands)/Lop and Scatter or Pile and Burn or Masticate: In this treatment the existing immature tree density would be reduced to a target residual density (e.g. 100 to 300 trees per acre or 20ft to 12ft spacing). Precommercial implies trees that are smaller than sawlog specifications, which is less than six inches in diameter at breast height (DBH) in lodgepole pine and less than seven inch DBH for other species. The primary purpose of this treatment is to reduce fuel continuity, and for timber stand improvement such as adjusting species composition, and concentrating growth on the most desirable trees. This treatment will focus on the removal of sapling and pole sized trees generally not greater than 6 inches in diameter at breast height. This treatment is typically accomplished through hand thinning methods (lop and scatter) or through mechanized chipping/mastication. Excess residual fuels would be lopped and scattered, trampled, masticated, chipped, hand or machine piled and/or burned. Burning of piles would occur when site conditions and local weather permits limited risk of escape, typically in the fall. This treatment addresses objective for forest health, fuels objectives (WUI, evacuation, fuel break) and forest resiliency through timber stand improvement.

Figure B-14: Lodgepole pine stand in Hebgen Basin by Madison Arm resort pre-treatment and post treatment. Precommercial size trees were thinned to reduce ladder and crown fuel continuity.

Specialized Treatments

Whitebark Pine Daylight/Pile and Burn or Masticate: Implements white bark pine enhancement objectives. This precommercial (small tree) treatment is applied on an individual tree basis and involves clearing vegetation up to *6.9"* in diameter within a specified distance (~15-30 feet) of a target whitebark pine sapling/pole sized trees. Whitebark pine trees constitute approximately 10 to 20 % of the trees per acre in these areas and other species include lodgepole pine, Engelmann spruce and subalpine fir. *On an area basis, this treatment may occur on up to approximately 60% of the treatment unit and would be dependent on the distribution of whitebark pine.* Clearing and slash treatments (pile and burning or mastication) would be completed by hand or mechanical mean likely bobcat type equipment with a masticating head or a grapple. Excess activity created fuels would be lop and scattered, and/or trampled, masticated, chipped, hand or machine piled and burned. Burning of piles would occur when site conditions and local weather permits limited risk of escape.

Figure B-15. The photo on the left shows the existing condition for most of the stands identified for daylighting. It shows dense competition between young trees. Whitebark pine make up a portion of the understory. The photo on the right shows a daylighted tree that represents a desired condition for this treatment type.

Highway Thin/Whole Tree Yard: This intermediate harvest treatment is designed increase wildlife visibility in areas adjacent to Hwy 191 from Duck Creek to the Madison River a secondary benefit is to

reduce fuels along the evacuation route along the highway. These treatments enhance both, wildlife and human safety. All trees within 50ft of the existing highway clearing limits would be removed and trees from 50 feet to 100 feet would be thinned. Along the corridor an estimated 25-50 feet from the highway is already cleared. All excess residual fuels would be whole tree yarded, and/or lop and scattered, trampled, masticated, chipped, hand or machine piled and burned. Activity created fuels would be kept to 15 tons per acre of 3 inch or above or less. Landing and hand piles would be burned when site conditions and local weather permits limited risk of escape, typically in the fall. This treatment implements wildlife safety and fuels objectives. This treatment will not be implemented along highway 191

Figure B-16: Existing Condition along the Powerline Corridor.

Power Line Clearing/Whole Tree Yard: This intermediate harvest treatment is designed to reduce fuels outside of the permitted right of way but within 100 feet of power lines on National Forest lands within the project area. The special use permittee (Fall River Electric) is responsible to maintain their authorized right of way under the line. An estimated 30-40 feet is already cleared under the line. The proposed treatment begins and extends beyond the current special use authorization. The intent is to ensure that firefighters would not be exposed to the hazards associated with power lines in the event of a wildfire. Outside the current right of way, all trees would be cleared up to one tree height (about 50 feet) of power lines then thinned to 100 feet from power lines. Tree spacing would range from 12-15 feet to allow for feathering or less thinning as the distance from the power line increases. Activity related fuels would be whole tree yarded to landings, lop and scattered, trampled, masticated, chipped, hand or machine piled and/or burned. Activity fuels would be kept to 15 tons per acre of 3 inch or greater material. This treatment implements the fuel reduction objective for power line defensibility (WUI) and firefighter safety.

Hand Treatment: This treatments is limited to hand methods. The hand treatment in Tepee Creek is designed to continue the fuel break along the Tepee Road while minimizing soil disturbance to the cut and fill slope along the road. This would limit potential sediment increases in Little Tepee Creek. Methods to accomplish this would include: cutting followed by piling and burning of small conifers or scattering if fuel loads are low.

Compiled by: Teri Seth 11/2015 updated *12/20/2016*