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Revised Environmental Assessment

East Boulder Fuels Reduction Project

Yellowstone Ranger District, Big Timber Office
Gallatin National Forest
Sweet Grass County, Montana

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Sweet Grass County, Montana

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Introduction

The Yellowstone Ranger District (Big Timber Office) of the Gallatin National Forest has conducted an environmental analysis to evaluate fire risk and the potential effects of implementing a hazardous fuel reduction project on National Forest System lands in portions of the East Boulder River corridor that have been identified as a wildland /urban interface (See Map 2). This Revised Environmental Assessment (EA) was prepared in compliance with the National Environmental Policy Act (NEPA) and provides information to determine whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI). The purpose of the NEPA process is to help public officials make decisions that are based on an understanding of environmental consequences, and to take actions that protect, restore, and enhance the environment (40 CFR 1500.1(c).

The Healthy Forests Restoration Act of 2003 defines wildland/urban interface (WUI) as the area adjacent to an at-risk community that is identified in the community wildfire protection plan. If there is no community wildfire protection plan in place, the WUI is the area 0.5 mile from the boundary of an at-risk community; or within 1.5 miles of the boundary of an at-risk community if the terrain is steep, or there is a nearby road or ridgetop that could be incorporated into a fuel break, or the land is in condition class 3, or the area contains an emergency exit route needed for safe evacuations (Condensed from HFRA § 101).

The East Boulder project area qualifies as an "At-Risk Community" because it contains "other structures with basic infrastructure and services (i.e. utilities and collectively maintained transportation routes) within or adjacent to Federal land" (HFRA, Section 101.(1).(A).(ii)). The East Boulder community is listed as a priority for treatment in the September 2008 Sweet Grass County Community Wildfire Protection Plan (CWPP, Project File 7-4 p. 43) and also occurs on the list of proposed vegetation management/fuel modification projects in the CWPP (Project File 7-4, p. 53). Conditions on adjacent federal land have been determined to have high fire risk, hazard, and occurrence. This risk equates to HFRA, Section 101(1).(A).(ii).(B) "where conditions are conducive for a large-scale wildland fire disturbance event", and (C) for which "a significant threat to human life or property would exist as a result of a large wildland fire disturbance event". Vegetation treatments that reduce fuels around the wildland/urban interface (WUI) are the primary focus of the proposed project

The Sweet Grass County CWPP states that "County history has proven the high potential for large wildfires when enough continuous fuels are available and when certain weather conditions are present. When conditions of extreme fire behavior exist, little can be accomplished aside from evacuating people from harm's way and keeping firefighters in safe positions. During one of these events, the actions that have been taken beforehand will generally prove to be much more effective than any actions taken during the event (Project File 7-4, p. 44)."

The Sweet Grass County CWPP goes on to identify the East Boulder Fuels Reduction Project (Proposed Project 6.6.1.1.3, p. 53) as a US Forest Service project being designed

in conjunction with the Fuels Committee of the Boulder River Watershed Group that would reduce hazardous fuels in the East Boulder River Corridor.

The November 2007 East Boulder Watershed Risk Assessment (Project File 7-2), prepared by a team of resource specialists from the Gallatin National Forest, also identified the potential for severe wildfire, with current fuel conditions in the East Boulder River Corridor, as the greatest threat to numerous values in the East Boulder Watershed. These values include public and firefighter safety, the East Boulder Mine, numerous private inholdings and structures, and water quality in the East Boulder River.

While discussing fuel treatments in higher elevation forests, Jack Cohen (2009) stated: "By doing fuels projects in areas of high social importance (e.g. homes), then we can hopefully allow more natural fire to burn outside of this "contrived" area. Be honest that we are not doing ecological work by thinning high elevation forests, but we are reducing the potential for crown fires." As it pertains to fuel structures along evacuation routes and existing infrastructure, Cohen (2009) continues by stating: "In some cases, we will not be able to modify the fuels enough to save homes, but maybe to reduce fire intensity along travel corridors enough so that people can survive in their vehicles." thus allowing responding emergency personnel more time to evacuate an area (Project File 8-10).

This project is part of the Gallatin Forest's ongoing emphasis on implementing projects that increase firefighter and public safety in the event of a severe wildfire and is part of a broader program to implement the National Fire Plan (USDA Forest Service, 2000). Some of the important partners in the development of this project include private landowners and stakeholders, special interest groups, Boulder River Watershed Group, Sweet Grass County, Sweet Grass County Rural Fire Department, Stillwater Mining Corporation, Northern Rocky Mountain Resource Conservation and Development, and the Department of National Resources and Conservation.

This Environmental Assessment was prepared to address the direct, indirect, and cumulative environmental effects of the proposed fuel reduction treatments in the East Boulder River Corridor WUI. The primary goal for this proposal is to lower the risk to the public and increase firefighter safety in the event of a future wildfire occurring in the drainage.

Summary of Changes in the Revised EA

The Big Timber and the Livingston Ranger Districts were combined to form the Yellowstone Ranger District in 2010 after the release of the original EA. Ranger Avey, the original Responsible Official for the project has moved on to a position at the Regional Office. The lead ranger for the Yellowstone District is Ranger Archuleta, who is the currently the Responsible Official for the project. The Yellowstone District also has a Deputy District Ranger (Ranger Oswald), who is taking the lead on project related reviews.

The original East Boulder Fuels Reduction EA was released to the public on March 16, 2010. A decision regarding the project, a finding of no significant impact (FONSI), and responses to the EA comment letters were released on June 4, 2010. Two appeals to the decision were filed in late July 2010. The project was reviewed by the Regional appeal panel and on August 27, 2010 a decision was made by the Yellowstone District Ranger Archuleta to withdraw the decision. His reasons for withdrawing the decision are as

follows "In light of recent court decisions relative to management indicator species (MIS), the relisting of the gray wolf, and intricacies of meeting Gallatin Forest Plan big game hiding cover standards, I want to re-evaluate the wildlife analysis for the project". After the evaluation was complete, Ranger Archuleta made the decision that additional analysis was necessary and that a Revised Environmental Assessment would be prepared.

Changes made from the original EA include a revised analysis for big game (including winter range, forage, thermal and hiding cover), sensitive/MIS wildlife species, and noxious weeds. A new analysis was conducted for gray wolf, which was relisted as threatened after the original EA was released.

Additional information is also included in the revised EA regarding effects to water quality, aquatics, soils, snags, vegetation (climate change), and roadless/unroaded.

Description of the Project Area

The proposed project area is located in the Absaroka Mountain Range in the southern portion of the Yellowstone Ranger District in Sweet Grass County, Montana. The East Boulder Road #205 branches off of the Main Boulder highway approximately 20 miles south and west of Big Timber and is a highly maintained gravel road that follows the East Boulder River from its confluence with the Main Boulder River to the Stillwater Mining Corporation's East Boulder Mine complex at it terminus. Approximately 6-7 miles of this road are adjacent to private lands up to the forest boundary, and an additional 5-6 miles of the road extend from the forest boundary to the mine with areas of private ownership interspersed (See Vicinity Map 1). The East Boulder corridor is bounded to the south by the East Boulder Plateau and to the north by Long Mountain. The area surrounding the East Boulder Mine consists of a "box canyon" cirque with steep sides and the East Boulder River flowing roughly 3000-4000 feet below the high elevation plateaus, which are located on both the north and south sides of the canyon. The drainage is characterized by a combination of rocky timbered slopes, scree slopes, and occasional meadows. Much of the area is forested with vegetation forming a continuous canopy of both surface and ladder fuels. The project area is heavily utilized for mining operations associated with the East Boulder Mine and to a lesser degree by recreation users.

In accordance with the 1987 Gallatin Forest Plan EIS Inventoried Roadless Analysis (IRA), the proposed project area lies adjacent to the North Absaroka Inventoried Roadless Area, which includes the East Boulder Unit. The approximately 4,000 acre project area consists of the roaded portions of the East Boulder River Corridor, which is also the WUI boundary (See Map 2). The analysis areas for the various resources consist of a mixture of National Forest System (NFS) and interspersed private lands and vary in size and configuration by resource. No treatment activities are being proposed in the North Absaroka IRA.

The WUI as defined on Map 2 combines several parts of HFRA, Section 101.(16).(B) as the "area for which a community wildfire protection plan is not in effect" (HFRA, Section 101, (16).(B)). Because the Sweet Grass County CWPP stopped its WUI designation at the National Forest boundary, the mapped area meets criteria of both HFRA, Section 101, (16).(B).(ii) and (iii). The project treatment areas are "within 1 1⁄2 miles of the boundary of an at-risk community," and includes "land that (I) has a

sustained steep slope that creates the potential for wildfire behavior endangering the at-risk community;" as shown in the Sweet Grass County CWPP Land Cover Fire Risk. The area is also "adjacent to an evacuation route for an at-risk community that requires hazardous fuel reduction to provide safer evacuation from the at-risk community."

Healthy Forests Restoration Act of 2003 (HFRA), Section 101

(16) WILDLAND/URBAN INTERFACE- The term ''wildland-urban interface'' means:

(A) An area within or adjacent to an at-risk community that is identified in recommendations to the Secretary in a community wildfire protection plan; or

(B) In the case of any area for which a community wildfire protection plan is not in effect—

(i) An area extending 1⁄2-mile from the boundary of an at-risk community;

(ii) An area within 1 1⁄2 miles of the boundary of an at-risk community, including any land that—

(I) Has a sustained steep slope that creates the potential for wildfire behavior endangering the at-risk community;

(II) Has a geographic feature that aids in creating an effective fire break, such as a road or ridge top; or

(III) Is in condition class 3, as documented by the Secretary in the project-specific environmental analysis; and

(iii) An area that is adjacent to an evacuation route for an at-risk community that the Secretary determines, in cooperation with the at-risk community, requires hazardous fuel reduction to provide safer evacuation from the at-risk community.

AT-RISK COMMUNITY.—The term ''at-risk community'' means an area:

(A) That is comprised of

(i) An interface community as defined in the notice entitled ''Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire'' issued by the Secretary of Agriculture and the Secretary of the Interior in accordance with title IV of the Department of the Interior and Related Agencies Appropriations Act, 2001 (114 Stat. 1009) (66 Fed. Reg. 753, January 4, 2001)

(ii) A group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) within or adjacent to Federal land;

(B) In which conditions are conducive to a large-scale wildland fire disturbance event; and

(C) For which a significant threat to human life or property exists as a result of a wildland fire disturbance event.

Sweetgrass County Community Wildfire Protection Plan, 2008 (Project File 7-4)

5.3 Fire Risk, Hazard, and Occurrence (pp. 42-43)

"High risk exists in many locations throughout the county. The reason for this risk is based on fire exclusion and successful wildland fire suppression operation. The reasons for this are:

- Heavy dead and down surface fuels;
- Closed canopies;
- Thick ladder fuels to carry surface fires to the canopies;
- Multiple understories
- Steep topography associated with strong down canyon winds.

A large share of the remaining county is rated as high risk, which includes all subdivisions. This designation was determined by combining current fuel complex, concentration of structures (subdivisions) and historical large fire activity.

The purpose of our fire hazard assessment model is to develop a basic fire risk assessment and to prioritize areas within the county for suppression as well as fuels reduction efforts. The assessment consists of three sub-groups: risk, fuel hazard, and

Risk is defined as potential risk of wildfire and is determined by the number of fire ignitions over a time period. Fire ignition points will be totaled and a low, moderate, or high rating will be assigned.

In looking at the GIS generated maps of Sweet Grass County, some areas of potential risk began to take form. When the fuel models are overlaid with potential occurrence, the areas most likely to experience wildland fire can be identified. By adding the areas of human occupation or high value, one can begin to assign priorities for protection. As with the federal agencies, the county's first priority is protection of human life and the second priority is protection of personal property.

The following list represents Sweet Grass County's current priorities in sequential order:

- Whispering Pines Subdivision
- Ken/Dan Acres Subdivision
- Main Boulder
- Stage Coach Estates Subdivision
- Deer Creeks
- Bridger Creeks
- **East and West Forks of the Boulder River**
- Stephens Hill Subdivision
- Indian Rings Subdivision

- Yellowstone Meadows Subdivision
- Eastern side of the Crazy Mountains"

6.6.1 Vegetation Management/Fuel Modification Projects (p. 52-56)

Proposed Project 6.6.1.1.3—"Project Coordinator: US Forest Service with the Fuels Committee—East Boulder Fuels Reduction Project. Approximate area of 700-1000 acres will be treated in the East Boulder Corridor. This project will tie in with the Beaver Meadows Project planned by the BLM in conjunction with the Fuels Committee. The East Boulder Project will begin the scoping process in January 2009 (p. 53)."

The areas being considered for treatment in the East Boulder Fuels Reduction Project are located along the one-way in/out East Boulder Road #205 and the Lewis Gulch Road #6644. All units are located inside the roaded portion of the drainage. No treatment activities are proposed in the adjacent inventoried roadless area (IRA). Fuel management treatments would begin at the Forest boundary, just north of the East Boulder Campground, and extend for approximately six miles east-southeast to the Dry Fork area, which is adjacent to the East Boulder Mine. Treatments along the Lewis Gulch Road would begin at the East Boulder Mine and extend to the southwest to the end of the Lewis Gulch Road. (Refer to Alternative Maps 3 & 4). The East Boulder River corridor is located in Sweet Grass County with proposed treatment units located in T.3.S, R.13.E, Sections 29, 32, & 33 and T.4.S, R.13.E, Sections 2, 3, 4, 5, 9,10, 11 & 15.

The East Boulder River corridor experiences frequent high wind events with wind speeds of up to 35-40 miles per hour, which sometimes persist for several hours. Dry thunderstorms, as well as Pacific Frontal Systems with their associated jet stream, occurring during the summer and fall often produce strong downdrafts in the narrow confines of the corridor. Given cured and dry vegetation these types of winds can result in extreme fire weather behavior.

Vegetative types vary within the corridor with spruce and remnant aspen occurring in the canyon bottoms and lower portions of the side drainages and increased amounts of Douglas-fir and lodgepole pine on the slopes above the canyon bottom. Conifers have encroached upon aspen stands leading to a decline in vigor and the loss of aspen in many areas. A continuous forest canopy covers much of the canyon. Forest floor fuels are moderate to heavy with heavy ladder fuels as well.

The East Boulder Road, the only road servicing the corridor, is a county road that is plowed year round and well maintained by Sweet Grass County. No major federal or state routes are found within the project area. The project area contains a mixture of privately owned and National Forest System lands with approximately 5 year-round private residences, as well as several cabins, out-buildings, and barns. The project area also contains one Forest Service campground, and two Forest Service trailheads.

In addition to the rural residences and recreation facilities, at the end of the East Boulder Road is the East Boulder Mine, a division of the Stillwater Mining Corporation, which is the largest private employer in the State of Montana. Because of recent downsizing due to market and economic conditions, there are currently approximately 300 employees stationed at the East Boulder Mine. Previous numbers of employees at the mine were

significantly higher, which could also be the case in future years depending on market conditions. Paralleling the East Boulder Road is a high capacity transmission line (Owned by Park Electric Company) that provides a critical electrical source for mine operations. These operations range from everyday power usage in office settings, to air compressors and scrubbers that provide a breathable air source several miles below the surface of the ground for the actual mining operations.

The East Boulder Road is heavily traveled year round by mine employees, who are bused in and out of the drainage, and contractor delivery services to the mine. Private residents use the road to access their homes and property. There is also light usage in the summer months and moderate usage in the fall/winter months by recreationists and hunters. The East Boulder Road, a gravel two-lane road provides the only access into the drainage. Emergency evacuation of the public from this corridor, in the event of a severe wildfire, would be difficult due to the proximity of heavy fuel buildups adjacent to the road.

The overall character of the East Boulder project area is dictated primarily from its location within a central southwestern Montana biological environment. The project area is located in the Absaroka Mountain Range where overriding geological features dictate elevation zones, variations in topography, and climate regimes. These general components, along with other determinants such as temperature, effective precipitation, and hydrologic regime tend to dictate the vegetation components of the area. A predominance of Douglas-fir (Pseudotsuga menziesii) and lodgepole pine (Pinus Contorta) occur throughout the area; and to a lesser degree, a mix of Englemann spruce (Picea engelmannii), subalpine fir (Abies lasiocarpa), aspen (Populas tremuloides), big sagebrush (Artemisia tridentate), other shrub-steppe, meadows, and riparian complexes exist. Elevations within the project area range from 5700’ to 7800’ and topographic features are typical of mountainous regions, with rolling hills to steep terrain with saddles and ridges.

The dominant cover types of lodgepole pine and Douglas-fir can generally be found on the drier sites. Often, the moist sites may favor Englemann spruce and in some areas quaking aspen. Park and meadow complexes are dominated by grass and sagebrush communities. Riparian complexes (Seeps, springs, and willow carrs**)** are found throughout the drainage. Forested stand conditions can be described, in the non-managed stands, as mature forests with active insect and disease activity. Most stands in this area had a natural re-establishment following the last stand-replacement disturbance, such as fire, an insect outbreak, or both.

The primary concern related to the current fire risk within the East Boulder project area is the vertical and horizontal arrangement of fuels, including standing and downed woody fuels, as well as the smaller understory tree components. Natural successional stand development, in conjunction with years of successful fire suppression and a consequent lack of low intensity, stand maintenance fires have resulted in greater tree densities, with higher fuel loadings, and a continuous horizontal fuel bed arrangement throughout the drainage. Stand ‘densification’ has also resulted in little or no space between the crowns of trees. A lack of low intensity ground fire in the drainage has allowed smaller, shade-tolerant trees to grow under the large, mature trees creating what are referred to as ‘ladder fuels’. The resulting vertical continuity of fuels could easily carry a wildfire from the ground up into the mature tree crowns. These increasing stand

densities and fuel loadings, along with the continuous fuel bed arrangement (both horizontal and vertical) are key components for a potentially extreme crown fire situation.

The project area is also currently experiencing a building population of mountain pine beetles, small patches of Douglas-fir beetle mortality, as well as infestations of spruce budworm (See Insect & Disease analysis pp. 201-212). As insects and disease move across the landscape and stands of trees become infested/infected, red needles on standing dead trees become highly volatile and act as a catalyst for intense wildfire behavior. These elevated intensities would, however, decrease over time as the finer fuels decompose at their natural rate. As standing dead and down trees become more frequent, the volume of surface fuels increase, resulting in the likelihood that a small, low intensity ground fire could become a large, intense, uncontrollable fire (NEXUS modeling, Project File 8-4).

Fire History of the Area

Although not an official fire history study, in 1904 John Leiberg documented the types of forest vegetative conditions in what was then called the Absaroka Division of the Yellowstone Forest Reserve. Leiberg notes that in the townships associated with the analysis area "Extensive burns have devastated the township, chiefly in the southern and eastern areas." The time in which the fires occurred was not clear, but they appeared "to date back seven to eight years and have destroyed the timber on over 14,000 acres." Seemingly the testimony from Leiberg would be consistent with the ages, species distribution, and vegetative patterns of the current forested areas within the Boulder River drainages. Fire frequency in the Boulder River drainages has increased significantly over the past 20 years. This increased fire occurrence can be attributed to the following factors:

- Maturing fuel complexes
- Insect and disease outbreaks
- Urban interface development
- Climatic changes
- Large expanse of forest types due to fire exclusion
- Changes in land use due to changes in ownership and management practices.

During the 1988 fire season, two large wildfires (Storm Creek and Hellroaring) were recognized as having the potential to enter the Boulder River drainage from the south. At that time, fire management personnel from the Gallatin National Forest recognized the need for further pre-planning to avoid catastrophic losses in the Boulder River drainage. The largest fires in Sweet Grass County history have taken place more recently. One hundred years of successful wildland fire suppression efforts, significant vegetative changes, and climatic changes place the county and its residents in potentially hazardous situations during periods of moderate to severe fire weather. Recent wildfires in Sweet Grass County in various portions of the Boulder drainages include:

1. August 1994, Black Butte Fire in the Deer Creek Drainage
2. 1995, Castle Creek Fire
3. April 1996, Lower Deer Creek Fire

4. August 1996, Cherry Creek Fire
5. July 2000, multiple small fires south of Big Timber
6. October 2002, Boulder Fire near Clydehurst church camp
7. August 2003, multiple small fires in the Boulder drainages
8. July 2005, West Boulder fire
9. August 2006, Derby Fire, 204,000 acres threatening the East Boulder Drainage
10. August 2006, Jungle Fire, 37,000 acres in the West and Main Boulder Drainages
11. August 2007, Hicks Park Fire, 2,500 acres in the Main Boulder Drainage
12. May 2010, East Boulder, 4 acres adjacent to powerline, inside project area.

Recent fire history, however, does not reflect many large wildfire events that actually lay within the East Boulder drainage, however, multiple fire ignitions were recorded (See Map 6). Under the context of National Wildfire Reporting System, large wildfire events are defined as fires greater than one hundred acres in size. Although not quite 100 acres, the Snowslide Fire in 1991 is the closest reported large wildfire to the project area. The Snowslide Fire was lightning caused and resulted in approximately 91 acres burned. The location of the fire was approximately two miles east of the East Boulder Mine in the Dry Fork of the East Boulder River. Fire effects associated with the Snowslide Fire were complete stand replacement due to independent crown fires. The fire burned until confined by natural barriers regardless of suppression efforts by both federal and local government fire suppression entities.

Recent wildfires of notable interest that threatened the East Boulder drainage are the Jungle and Derby Fires of 2006. The Derby Fire burned approximately 204,000 acres, costing nearly twenty-three million dollars to suppress. The Derby Fire forced two separate closures of the East Boulder Mine because of threats to employees' health and safety from ambient smoke, as well as threats to the integrity of mine structures, costing the Stillwater Mining Corporation approximately $750,000 per day that operations were interrupted.

Coincidently the Derby, Jungle, and all of the other large fires of notable interest that were recorded within these areas seemingly have similar characteristics, which are reflected in the undesirable fire effects. The primary commonality of these large fire incidents are a combination of topographical alignment with prevailing wind patterns. Most of the major drainages within the Absaroka-Beartooth Mountains have a south to north positioning. Typically these drainages experience a westerly flow wind pattern throughout the summer months. However, when winds align with the topographical influences from a southerly direction, both topography and wind become the contributing factors for large fire growth. When combined with available fuel, these factors act as a funneling mechanism that allows for explosive fire growth. Such was the case with Jungle Fire in 2006. The Jungle fire started in the headwater area of the West Boulder River, which is approximately fourteen miles south of the shared boundary between National Forest System lands and private lands. For the first several burn periods, the fire was not very active and taking into account the distance to infrastructure and wildland urban interface, the fire was not considered a priority and efforts were focused on fires with more imminent threat. The conditions described above surfaced

several days later, and the Jungle Fire made a fourteen mile run to the north in less than two burn periods, which required significant suppression actions to contain.

There have been no prescribed fires ignitions within the immediate project area, however, in the Dry Fork of the East Boulder River, adjacent to the east edge of the project area (within the analysis area for some resources), both hand thinning and two applications of prescribed fire were implemented as part of the Long Mountain Hazardous Fuels Reduction Project. The mechanical hand thinning was completed in fall of 2004. The first of the prescribed fire applications was implemented in May of 2008, burning approximately five-hundred and fifty acres. More recently, in September of 2009, the Dry Fork prescribed fire units were completed with the burning of approximately 2300 acres. The overall objective of the Long Mountain Hazardous Fuel Reduction was to reduce conifer encroachment on grass and sagebrush meadows as well as within aspen stands; maintain areas of vegetation, fuels, and disturbances characteristic of the natural regime, and provide for public and fire fighter safety.

Purpose and Need for the Project

The primary purpose and need for this project is to improve public and firefighter safety by reducing the probability and effects of human caused fire starts in the corridor and reducing the effects of wildfire entering into the WUI of the East Boulder River Corridor. This would be accomplished by breaking up the vertical and horizontal continuity of fuels by thinning trees, and removing ladder fuels and vegetation along the corridor. Reducing the continuous fuel loadings in the East Boulder corridor would improve public and firefighter safety, as well as the safety of employees at the East Boulder Mine, by lowering the speed and intensity, and altering the pattern of a potential wildfire, thereby gaining additional time to implement an effective emergency evacuation out of the corridor and to conduct other necessary safety measures.

Other project related objectives include:

- Creation of residual stand conditions in the corridor where trees are less susceptible to future insect and disease infestation.
- Encouragement of adjacent private property owners and local groups to develop hazardous fuel reduction plans.

Criteria used in determining treatment areas include:

- The potential to reduce the effects of human-caused fire starts along the East Boulder Road corridor.
- The ability to improve public and fire fighter safety in wildfire situations.
- The ability to break up the vertical and horizontal fuel continuity through the corridor in order to modify potential wildfire behavior
- The ability to reduce future Douglas-fir and lodgepole pine mortality from bark beetle attacks at the stand level within the East Boulder corridor.

Description of the Proposed Action

The proposed action was designed to meet the purpose and need for the project. This proposal was developed considering the areas of high fuel hazard, high risk of human-caused ignition, and high social values. Considering hazard, risk, and value, stands of trees that have high potential for lethal fire to affect lives and property in this wildland/urban interface were included for treatment in this alternative. The proposed action is consistent with management direction in the GNF Forest Plan.

The project area is situated within the roaded portion of the East Boulder River corridor. Proposed treatment units are situated along the East Boulder Road #205, from the Gallatin National Forest boundary east to areas adjacent to the East Boulder Mine (approximately six miles). Proposed treatments are also being considered for areas adjacent to the Lewis Gulch Road, which lies to the south of the East Boulder Mine. All of the proposed treatments are on National Forest System lands. Private property will not be treated as a part of this proposal. All treatment areas lie within the East Boulder WUI, which was identified in the Sweet Grass County Community Wildfire Protection Plan (CWPP) as a priority area for treatment (p. 43).

Vegetation types in the East Boulder Corridor include Douglas-fir, Englemann spruce, lodgepole pine, subalpine fir, and native grasslands. Proposed treatment units are identified on Maps M-3 and M-4. The mapped areas depict approximate treatment unit boundaries and include small natural openings and other small topographic features that may be excluded from treatment. Up to approximately 660 acres in 17 treatment units would be tractor harvested, approximately 70 acres in 4 units would be skyline cable harvested, and an additional 140 acres would be scheduled for hand treatments.

Leave trees would be unevenly spaced with patches of multi-storied trees as well as open spaced individual trees. The continuity of vertical and horizontal fuels among individual trees within a stand would be broken. Prescriptions would vary between adjacent stands to help break up fuel continuity among stands. Pile burning would occur in conjunction with the treatment activities. Detailed descriptions of the individual proposed treatment units to be implemented with the proposed actions can be found on pp. 32-44. Tables 2 & 3 display individual unit information (Unit #, acres, logging system, management area, roads needs, unit treatment type, riparian treatment type, and season of treatment). Specific operating periods for the various associated activities are described on p. 40. Design criteria and mitigation measures that are applicable to all units can be found on pp. 45-57. All of the treatments associated with the proposed action have been designed to maintain and protect values for the East Boulder River. Mechanized equipment would not be allowed within Streamside Management Zones or wet areas in conformance with the State of Montana Best Management Practices (BMP's).

Treatment Prescriptions

Table 1 below outlines various forest types, treatment descriptions, and treatment effects associated with the proposed action. Actual treatment prescriptions for the individual units are based on current conditions, such as fuel continuity, fuel arrangement (vertical and horizontal), and vegetative types and are outlined in Chapter 2 for the various alternatives.

Table 1 -Treatment Types, Descriptions, and Project Effects

Forest Type	Treatment Description	Treatment Effects
(>30%) DF & Mixed Species Dominated Stands in MA11	40-60% canopy retention, Irregular spacing with 13-15 ft. between crowns, Favor DF, then S to leave, Leave 15-20 % of unit acres in untreated clumps of approx. 1/3 acre in size. Very small or linear units may not include clump retention.	Space between leave tree crowns would limit the ability for wildfire to move through the remaining overstory. Crown fires entering the treatment area would drop from the crowns to the ground, creating a surface fire situation. Clumps provide for visual quality and wildlife habitat
(>30%) DF & mixed species Dominated Stands in MA8	35-45% canopy retention, Irregular spacing with 13-15 ft between crowns, Favor DF then S to leave. Most LP and AF would be removed	Space between leave tree crowns would limit the ability for wildfire to move through the remaining overstory. Crown fires entering the treatment area would drop from the crowns to the ground, creating a surface fire situation.
(>70%) LP Dominated Stands in MA 11	40-50% canopy retention, Leave DF & S where available 13-15 ft between crowns. Leave 15-20 % of unit acres in untreated clumps. LP clumps would be 1/10 to 1/8 acre in size. There will be some open areas within these stands.	Space between leave tree crowns would limit the ability for wildfire to move through the remaining overstory. Crown fires entering the treatment area would drop from the crowns to the ground, creating a surface fire situation. Leaving clumps would provide for visual quality and wildlife habitat
(>70%) LP Dominated Stands in MA 8	20%-40% canopy retention, Leave DF & S as clumps or individual trees where available. Most LP would be removed. Where no other species are available LP would be left in small clumps 1/10 to 1/8 acre. There will be open areas in these stands.	Space between leave tree crowns would limit the ability for wildfire to move through the remaining overstory. Crown fires entering the treatment area would drop from the crowns to the ground, creating a surface fire situation.
Hand Treatments	Thinning from below, small diameter trees, ladder fuels will be cut, slashed, hand piled and burned or otherwise removed. Edges will be feathered where necessary to blend with adjacent stands.	Removal of small diameter trees would limit a surface fire's ability to reach conifer crowns. Ladder fuels are the transitional fuels that allow a fire burning on the surface to extend up into the canopy of mature conifers.
Downed Woody Materials	Approximately 15 tons/acres would be left on site in treatment areas, where available, as required by the Gallatin National Forest Plan	Down woody fuel removal would concentrate on small diameter fuels. Down woody material > 3 inches in diameter is not a large contributing factor to rapid fire growth and would be favored to leave.

Other types of treatments that are included in the proposed action in conjunction with thinning activities include:

- Piling of natural and/or treatment-related fuels followed by burning of piles;
- Trampling or crushing woody fuels that are presently suspended above ground - making the woody material in close contact with the ground to accelerate the decomposition process.

Riparian Areas

Harvest will not occur within 15 feet of the East Boulder River, within 50 feet of Twin Creeks, Lewis Creek, and Wright Creek, or within 100 ft of the upper portions of Lewis Creek. Fifty percent of the trees 8" and greater would also be retained in treatment areas adjacent to the East Boulder River beyond the 15 foot no-cut buffer and there would be no harvest on steep slopes leading directly into the East Boulder River (Riparian Reserves). Unit boundaries would be located on the bench and field verified by the fisheries biologist. Riparian reserves will be joined with other retention areas where possible. No-cut buffers around water bodies will be utilized to prevent disturbance to soil, organic matter, and surface vegetation in order to maintain and enhance their function as sediment catches and refuge for wildlife.

Roads

No new permanent road construction is being proposed for the project. Primary access will be provided by the East Boulder Road #205 and the Lewis Gulch Road #6644. Commercial harvest operations are expected to require the construction of some temporary roads. A maximum of 3.5 miles of temporary road may be needed to access the areas proposed for mechanical fuels treatment using conventional ground-based logging systems (tractor and skyline). Another ½ mile of existing road maintenance may be needed to provide access to treatment areas. These areas will be re-examined on the ground prior to project implementation to determine whether opportunities exist to reduce the length of newly constructed temporary road. Some private roads will likely be used. One of the key factors in determining the use of existing roads on private land is whether permission to use the roads can be obtained. Existing roads on either ownership may require maintenance to support safe and efficient use, consistent with project design criteria and mitigations. Options to use existing roads will be examined to assure that the environmental effects of using roads on private and public land do not exceed what has been disclosed in this document. Tables 2 & 3 and Maps 3 & 4 disclose the approximate locations of proposed temporary roads, including those roads to be re-examined.

Actual temporary road locations are determined through agreement by the Forest Service during timber sale contract administration. Temporary roads would be constructed to provide access to the interior of harvest units to facilitate ground-based harvest systems. These roads would be built on relatively flat ground slopes (less than 20%) and would be constructed to the lowest possible standard capable of supporting log haul in order to minimize ground disturbance. Temporary road construction, including clearing and removing of wood products from within the road right-of-way, would likely occur from July 1- October 30. All newly constructed temporary roads would be closed to the public during harvest activities and permanently closed and rehabilitated within one year upon completion of harvest related activities. All new temporary roads will be recontoured and rehabilitated making the temporary roads on National Forest System lands impassable for any motorized travel, as well as necessary other resource protection practices. Existing roads that are improved and utilized for project related activities that are no longer needed, do not include deeded access to private lands, or are not identified to remain open in accordance with the October 2006 Gallatin National Forest Travel Plan Decision would also be rehabilitated within one year of completion of project related activities.

Implementation Timeframe

The East Boulder Road is plowed year round to provide access to the East Boulder Mine. Ground disturbing mechanical treatments in units adjacent to the East Boulder Road and/or East Boulder River would occur in the winter over 4" of frozen ground or 8" of settled snow to help avoid the spread of noxious weeds and protect water quality in the East Boulder River. Treatment units located along the Lewis Gulch Road would be likely be harvested in the fall/winter until snow accumulations prevent harvesting operations. Several of the Lewis Gulch units would utilize cable harvest systems, which can't be safely and effectively completed over heavy snow and there are not known weed populations in these units. Handtreatment units with no ground disturbing activities would not have limited implementation timeframes. Pile burning would occur in the spring, fall, or winter. See Chapter 2 (p. 40) for complete implementation timeframes and restrictions for the various treatment units and alternatives

The entire project is expected to take up to 5 years to complete. Implementation could begin as early as fall/winter 2011/2012.

Scope of the Proposed Action

The Council of Environmental Quality (CEQ) regulations implementing NEPA define the "scope" of an action consisting of "the range of actions, alternatives, and impacts to be considered". To determine the scope, federal agencies shall consider three types of actions; (1) connected actions; which are two or more actions that are dependent on each other for their utility; (2) cumulative actions; which when viewed with other proposed actions may have cumulatively significant effects and therefore be analyzed together; and (3) similar actions; which when viewed with other reasonably foreseeable or proposed actions have similarities that provide a basis for evaluating their environmental consequences together. (40 CFR 1508.25).

The scope of the proposed actions addressed in this EA is limited to stand density reduction and the reduction of downed fuel loadings on National Forest Land including:

- Thinning large diameter green conifers
- Harvesting insect or disease damaged/killed conifers.
- Cutting small diameter conifers and ladder fuels
- Cutting and removing conifers encroaching into aspen stands.
- Piling and removing or burning downed woody materials and fuels resulting from treatment actions.
- Construction and rehabilitation of up to 3.5 miles of temporary road to access treatment units
- Maintenance on up to ½ mile of existing roads to access treatments units

Actions that are not within the scope of the proposed action include:

> Decisions supported by an environmental analysis of the current situation commonly remain valid for six to ten years. Fuel reduction and maintenance projects that may become necessary and could begin beyond this timeframe (twenty or more years) are outside the scope of the decision to be made. The

environmental effects of any future projects would be disclosed and a project-specific decision made before these projects would be implemented.

The Forest Service can only guess what types of fuel reduction activities may occur on private land and the agency has no control over the amount or type of activity occurring on private land. Decisions private landowners may make in the future concerning fuel reduction activities on private land are outside the agency's authority and so outside the scope of the decision to be made.

Relationship to the Gallatin Forest Plan and Other Administrative Direction

Gallatin Forest Plan

The Gallatin Forest Plan (1987) embodies the provisions of the National Forest Management Act, its implementing regulations, and other guiding documents. The Forest Plan sets forth in detail the direction for managing the land and resources of the Gallatin National Forest. The East Boulder Fuel Reduction Project tiers to the Forest Plan FEIS, as encouraged by 40 CFR 1502.20. Chapter 3 includes a summary by resource of the standards and guidelines established in the Forest Plan that are pertinent to this action. The proposed action is also supported by the following Forest Plan direction:

Forest Plan Goals

Provide a fire protection and use program that is responsive to land and resource management goals and objectives. (FP p. II-2)

Forest Plan Standards

Fire Standards: Treatment of natural fuel accumulations to support hazard reduction and management area goals will be continued. (FP p. II-28)

The Forest Plan uses management areas to guide management of the National Forest lands within the Gallatin National Forest. Each management area (MA) provides for a unique combination of activities, practices, and uses. The East Boulder Fuels Reduction project area includes five management areas. The majority of the timber harvest and thinning activities involved with this project would occur in MA8 and MA11, with a few small inclusions of MA3 and MA12 and linear inclusions of MA7. The majority of the temporary road construction would occur in MA8 with some limited temporary road construction also occurring in MA11. All fuel reduction activities associated with the proposed actions comply with Forest Plan guidelines for the applicable MAs (See MA Map 5) and Tables 2 & 3 (Individual Unit Descriptions) for MA designations of individual units.

The Forest Plan (Chapter III) contains a detailed description of each management area as it relates to significant issues. Following is a brief description of the applicable management area direction for each of the MAs affected with the proposed action:

Management Area 8 (MA 8)- These areas consist of lands that are suitable for timber management. Douglas-fir and lodgepole pine should be favored in timber management. Both even aged and un-evenaged harvest methods should be included. Project plans should incorporate considerations for fish and wildlife. Wildfire suppression response will be control.

Management Area 11 (MA 11)- These areas consist of forested big game habitat. They include productive forestlands that are suitable for timber harvest, provided that big game habitat objectives are met. Include even and uneven aged harvest systems. Wildfire suppression response will be control.

Management Area 3 (MA 3) - These areas consist of non-forest, noncommercial forest, and forested areas unsuitable for timber production. Timber salvage, product and firewood removal may occur where access exists. Salvage of dead, dying, or high-hazard trees to prevent insect and disease population buildups that could adversely affect regulated timber stands is permitted. Wildfire suppression response will be control, contain, or confine.

Management Area 7 (MA 7) - These areas consist of lands bordering lakes, streams, and/or springs that support moisture loving vegetation. They will be managed to protect the soil, water, vegetation, fish and wildlife dependent on it. These areas are classified as suitable for timber production if adjacent areas contain suitable timber. Design timber harvest to meet the needs of riparian dependent species. The wildfire suppression response will be the same as for the management areas surrounding riparian areas. *Note: These areas are normally too narrow to be displayed on Forest MA maps.*

Management Area 12 (MA 12) - MA 12 provides goals and objectives to maintain and improve the vegetative condition to provide habitat for a diversity of wildlife species and a variety of dispersed recreation opportunities. Harvest of post, pole, and other wood products can take place adjacent to existing roads. Wildfire suppression response will be control, contain, or confine.

Other Administrative Direction

Project objectives include creating a more defensible area in the Wildland Urban Interface (WUI) by reducing the wildfire severity risk and crown fire hazard in the East Boulder River Corridor. National, regional, and forest level reports have set the stage for more aggressive fuels management including:

- National Fire Plan (2000)
- A Cohesive Strategy (October 2000)
- 10 Year Comprehensive Strategy (August 2001)
- 1995 Federal Wildland Fire Management Policy and 2001 Review
- Gallatin National Forest Fire Management Plan, (annual).

National Fire Plan (2000) states:

"Hazardous Fuels Reduction–Assign highest priority for hazardous fuels reduction to communities at risk, readily accessible municipal watersheds, threatened and endangered species habitat, and/or other important local features, where current conditions favor uncharacteristically intense fires".

Protecting People and Sustaining Resources in Fire-adapted Ecosystems–A Cohesive Strategy, **October 2000**. This report outlines a strategy to reduce wildland fire threats and restore forest ecosystem health in the interior West. The Cohesive Strategy outlined four priorities: 1) wildland urban interface; 2) readily accessible municipal watersheds; 3) threatened and endangered species habitats; and 4) maintenance of existing low-risk Condition Class 1 areas (refer to 2.3.B).

A Collaborative Approach for Reducing Wildland Fire Risk to Communities and the Environment – 10-yr. Comprehensive Strategy, August 2001. This document responds to Congressional direction for a multi-agency strategy by outlining a comprehensive approach to the management of wildland fire. The 10-year comprehensive strategy has four goals: 1) improve prevention and suppression; 2) reduce hazardous fuels; 3) restore fire-adapted ecosystems; and 4) promote community assistance. This document provides the initial foundation of the recent President's Healthy Forest Initiative (August 2002).

1995 Federal Wildland Fire Management Policy and Program

The 1995 Federal Wildland Fire Management Policy and Program contain nine guiding principles that are supported by the Gallatin National Forest Fire Management Plan, which is updated annually.

1) ***Firefighter and public safety is the first priority in every fire management activity.*** The purpose and need of the East Boulder Fuels Reduction project is to provide for firefighter and public safety, modifying fire behavior by changing the vertical and horizontal continuity of fuels throughout the project area. This modification of fuels will provide safer conditions in the event of a large wildfire event.

2) ***The role of wildland fire as an essential ecological process and natural agent have been incorporated into the planning process.*** Treating the Wildland Urban Interface areas will reduce the current level of risk, allowing the possibility of future wildland fires to play an ecological role in the Absaroka-Beartooth Wilderness landscape under certain conditions.

3) ***Fire management plans, programs, and activities support land and resource management plans and their importance.*** The project is consistent with the Federal Wildland Fire Management Policy and the Gallatin National Forest Fire Management Plan.

4) ***Sound risk management is the foundation for all fire management activities***. The East Boulder Fuel Reduction project analyzes the risk to the public and firefighter communities associated with each alternative, by comparing the resulting fuel conditions associated with management activities versus "no action", as related to fire behavior.

5) ***Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.*** With the East Boulder Fuel Reduction project, the overriding value at risk is the safety of the public and firefighters. A financial efficiency summary included in Appendix A supports the conclusion that the predicted high bid for the sale of wood products is likely to cover the majority of the restoration activities associated with the project.

6) ***Fire management plans must be based on the best available science.*** The East Boulder project has incorporated the latest science and modeling techniques for fire behavior prediction and the effectiveness of fuels treatments (NEXUS and FARSITE). All other project-related resource analyses have also incorporated the use of best science.

7) ***Fire management plans and activities incorporate public health and environmental quality considerations.*** The East Boulder Fuels Project addresses the need for increasing public and firefighter safety in the event of a large wildfire event. Smoke management, recreational values, and the impacts of fuels treatments on wildlife, fish, noxious weeds, soils, and visual quality are also addressed in the document.

8) ***Federal, Tribal, State and local interagency coordination and cooperation are essential.*** Coordination and cooperation for the project included local consultation with the Stillwater Mining Company, Boulder Watershed Group, BLM, Sweet Grass County officials including fire and law enforcement, Big Timber city officials, and local environmental groups. Federal cooperation and consultation includes the Fish and Wildlife Service, State, Federal, and Private Forestry groups and interested tribal governments.

9) ***Standardization of policies and procedures among Federal agencies is an ongoing objective***. This is not applicable to this particular project.

Decision to be Made

This Environmental Assessment (EA) is not a decision document. It does not identify the alternative that will be selected by the Responsible Official. This document discloses the environmental consequences of implementing the proposed action and alternatives to that action. The Yellowstone District lead ranger is the Responsible Official for the project. Based on the analysis documented in this EA, and comments received during the 30-day comment period, the Responsible Official will make a decision regarding this project. His decision and the rationale for that decision will be stated in the Decision Notice for the project.

The decision to be made includes:

- What types of hazardous fuels reduction treatments should occur, if any, to improve public and firefighter safety in the East Boulder River corridor?
- What, if anything, should be done to extend the potential time available for evacuation in the event of a wildfire in the project area?
- Should fuel loadings be reduced and fuel arrangements modified to break-up the continuous vertical and horizontal fuels present in the corridor?
- What mitigation and monitoring requirements should be included?

The decision will be documented in a Decision Notice with official notification published in the Bozeman Chronicle, which is the paper of record for the Gallatin National Forest.

Chapter 2- Issues and Alternatives

Introduction

Chapter 2 of this document describes and compares the alternatives that wholly or partially meet the purpose and need for this project as identified on p.16. Alternative 1 (No Action), Alternative 2 (Corridor Units only), and Alternative 3 (Corridor Units & Lewis Gulch Units) are described and considered in detail on pp. 31-44 and displayed on Maps 3 & 4. There are also three other action alternatives that were considered, but were dismissed from detailed analysis. These alternatives are described on pp. 60-62, including the rationale for dismissal.

The purpose and need for action and the desired future condition provide the framework for alternative development along with the discussion of issues identified internally and from public scoping. The alternatives reflect different responses to the issues identified through both the scoping and analysis processes, and the alternatives have different environmental effects. Chapter 3 discloses the effects of the alternatives in terms of the various resource issues. Chapters 2 and 3 provide information to enable the decision maker to make a reasoned choice between alternatives. Chapter 2 also discusses the scoping and public involvement process, environmental issues, alternative development, design criteria and mitigation, a comparison of the alternatives, and alternatives considered but not studied in detail.

Public Involvement and Scoping Process

The first step in an environmental analysis is to determine what needs to be analyzed. To do this the NEPA outlines a process termed "scoping" (refer to 40CFR 1501.7). This is an open process designed to determine the potential issues associated with a proposed action and those that are key to formulating the decision. First, comments are obtained from interested and affected parties, both within and outside the agency, to identify potential issues. Second, the potential issues are reviewed by the interdisciplinary team to determine: (a) the key issues to be analyzed in depth, and (b) issues which are not key or which have been covered by prior environmental review and therefore should be eliminated from detailed study.

Collaboration with Sweet Grass County officials, Big Timber city officials, local fire departments, Stillwater Mining Corporation officials, BLM, local businesses, adjacent private landowners, recreationists, and other interested public has been and will continue to be important in the development of the East Boulder Fuels Treatment Project. The proposal was developed with input from adjacent private homeowners, as well as state, county, and local officials. Public meetings and field trips have been held with the Forest Service providing information and updates regarding the proposed project on National Forest System lands.

A listening session was held at the Big Timber on February 11, 2009. Local business representatives, city officials, county officials, fire department members, and local environmental group representatives that had previously expressed interest in helping to develop the East Boulder Fuel Reduction Project proposal were invited. The District Ranger and various resource specialists facilitated the session. The purpose and need for the project was outlined as was a description of the existing condition of the project area.

The meeting was opened up to each of the public attendees to present any ideas, suggestions, and background information they wanted to provide in order to assist the Forest Service in developing an initial proposal for the project. In attendance were representatives from the Stillwater Mining Corporation (East Boulder Mine), Big Timber Volunteer Fire Department, Boulder Watershed Association, RY Timber, and local environmental groups. The Forest Service also presented the same information later that day to members of the Cottonwood Resource Council (a local environmental group) at their monthly meeting asking for their ideas and input reading the project. The purpose of these sessions was for the Forest Service to listen to what interested parties had to say regarding the project and to incorporate the public's ideas into the development of an initial proposal that would be presented to the general public at a public meeting in March of 2009.

An open house regarding the project was held at the Big Timber Office on March 18, 2009 to discuss the initial hazardous fuel reduction proposal. Notice of this meeting was posted as a Legal Notice in the Bozeman Daily Chronicle on Wednesday, February 25, 2009 and in the Big Timber Pioneer on Thursday February 26, 2009. The meeting, facilitated by the District Ranger and IDT members, was attended by a representative from the Big Timber Pioneer, Sweet Grass County Commissioners, and some of the adjacent private landowners. The initial proposal was presented and discussed with the attendees. Ideas from this meeting were utilized in drafting the project proposal that went out for public scoping.

The scoping letter for the East Boulder Fuels Reduction Project was sent to interested parties on April 10, 2009 (Mailing List, Project File). More than 90 scoping letters were mailed to private individuals, organizations, groups, businesses, media and elected officials that the Forest Service identified would potentially be interested in the project or shown interest in similar projects. The scoping letter provided a map and description of the project area and potential treatment units, the purpose and need for the project, and the types of treatments that were likely to occur. Specific methods of treatment for the units were not identified at that time. Ten groups or individuals responded to the scoping letter. A summary of scoping comments was created and all of these comments, as well as internal comments, were considered in determining potential issues and developing the actual treatment units that are associated with each of the action alternatives.

Public field trips have been and still are available to anyone wanting to review the various activities associated with the alternatives for this project. The intention is to provide the interested public with an on the ground opportunity to comment on various aspects of the proposed project.

The environmental issues addressed in this document were identified through the processes described. Key issues were used to develop alternatives to the proposed action and to focus the scope of the analysis on the issues that are "key" to the decision to be made. Documentation of the review of scoping, comments, and potential issues can be found in the Project File and are available for review upon request.

Once the scoping process was completed, the interdisciplinary team (ID Team) developed alternatives to the proposed action with specific features designed to address the previously identified issues. For the East Boulder Fuels Reduction Project, the No

Action Alternative, the Proposed Action Alternative, and one additional action alternative were developed for detailed consideration.

The East Boulder Fuels Reduction Project was identified on the Gallatin National Forest NEPA Quarterly Project Listings from spring 2008 through spring 2011.

The purpose of this Revised Environmental Assessment (EA) is to disclose the foreseeable effects and consequences of the alternatives being considered in detail and to solicit further public input regarding this project. This Revised EA is being issued after consideration and analysis of comments received regarding the April 2009 scoping letter, from public meetings, regarding the March 2010 original EA, and points addressed in the July 2010 appeal letters. This document will provide information to determine whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI). The Yellowstone District Ranger is the Responsible Official.

Identification of Issues

Through the scoping process, the public and other agencies raised several concerns in response to the proposed action. Issues were identified following review of written and verbal comments from the public, input from Forest Service resource specialists, and comments from state and other federal agencies.

Comments identified during scoping were evaluated against the following criteria to determine whether or not the concern would be a major consideration in the analysis process:

1. Has the concern been addressed in a previous site-specific analysis such as in a previous project analysis or though legislative action?
2. Is the concern relevant to and within the scope of the decision being made and does it pertain directly to the proposed action?
3. Can the concern be resolved through project design or mitigation (avoiding, minimizing, rectifying, reducing, eliminating, or compensating for the proposed impact) in all alternatives?

A complete list of pertinent comments received during scoping and how they were addressed by the interdisciplinary team is contained in the Project File. Design Criteria and mitigation for all resource issues are described on pages 45-58.

Key Issues

For this project**,** two issues were found to be "key" to the decision maker in making a decision and in achievement of the purpose and need. These key issues are introduced in the issues section of this chapter and analyzed in detail on pp. 73-98. Again, these are the issues that the interdisciplinary team and decision-maker concluded were the primary factors to be considered in developing the alternatives and will help to guide the decision for the project.

The purpose of scoping is not only to identify a list of issues and concerns over a proposal, but to determine which issues need to be analyzed in depth and to eliminate from detailed study those which are not key to the decision being made (40 CFR

1501.7). Issues become the focus of interdisciplinary interaction, public involvement, and alternative development. Key issues are those that are not readily mitigated, drive alternatives, are important considerations in the decision to be made, and their resolution is within the scope of the project. The magnitude of a key issue pertains to a resource, as the resource would be affected by a proposed action.

Based on the assessment of effects, public involvement and comments, the agency has determined that the following issues are "key" to the decision to be made:

Issue 1- Fuels

There is the potential for a wildland fire event to threaten public and firefighter safety within the East Boulder River Analysis Area. Years of successful fire suppression and subsequent lack of low intensity stand maintenance fires have resulted in changes to forest structure, tree densities and associated fuel characteristics within the proposed project area.

Indicator: The distribution of fuel loadings by surface area to volume ratio, relative compactness, size class and tons/acre, as well as the vertical and horizontal continuity/arrangement within the fuel bed are indicators of potential flame lengths and fire intensity. The fire related fuels analysis involves the use of the following models:

Farsite: This model was used to determine the rates of spread, fire intensity, and time of arrival of a flaming front at predetermined points of interest within the project area. Farsite is a spatial model that calculates fire spread across a predetermined landscape with historical weather and wind files.

NEXUS – NEXUS is an Excel spreadsheet that links surface and crown fire prediction models. Using inputs from Farsite Landscape Files for the no treatment and proposed treatment alternatives, it is used: a) to estimate surface, transition and crown fire behavior; b) generate site-specific indices of torching and crown fire potential; and c) evaluate alternative treatments for reducing risk of crown fire.

Fire family Plus – All modeling considers typical seasonal weather conditions for a day in August, such as: Temperature 84 degrees; relative humidity 10%; mid-flame wind speed 8 mph. These are conditions represent a typical fire growth day from recent wildland fire events.

Concern: FARSITE and NEXUS fire models were used for evaluating fire behavior and for the fuel modeling of representative forested stands proposed for treatment within the East Boulder River Analysis area. The models assess changes in fireline intensity, flame length, crowning index, and fire type. These models can be used to compare the effects of treatments between alternatives. Using FARSITE and NEXUS, the average rate of spread for an active crown fire and surface fire was found to be 1 to 4 miles per hour with flame lengths ranging from 25 to 110 feet tall for the existing vegetative conditions. It is commonly known that fire suppression activities, including aircraft and heavy equipment, are no longer successful in suppressing fires with flame lengths greater than twelve feet. Therefore, firefighter and public safety would be greatly improved by changing the fire behavior characteristics from an active crown fire to a conditional crown fire or surface fire after the proposed treatments have been completed. The high rate of spread for an active crown fire prior to stand treatments would make the task of public evacuation on the gravel road difficult while trying to dispatch firefighting

resources to the fire. The extreme behavior of a crown fire makes for an unsafe situation for ground firefighting forces to implement control tactics that would be effective. Using NEXUS, in conjunction with the Farsite Model, results indicate that the majority of the forested stands within the East Boulder River Analysis Area maintain conditions for active crown fire potential. A complete affected environment discussion and effects analysis regarding this issue is found in Chapter 3 on pp. 73-84.

Issue 2 –Noxious Weeds

Project related activities could increase the spread and density of noxious weed populations in the proposed project area and adjacent private and public lands where suitable habitat exists.

Indicator: Impacts to existing native herbaceous vegetation were evaluated by assessing the existing infested acres and location of noxious weeds relative to proposed fuels reduction units, (mapped weed polygons by species were overlaid on the unit boundaries and analyzed in map and tabular form).

Concern: The concern is that proposed activities and vegetation changes in the East Boulder corridor could increase noxious weeds and habitat for noxious weeds and reduce competitive success of native vegetation. There could be direct effects to native vegetation, and indirect effects to dependent animal species and soils. Weeds are spread through soil disturbance caused by mechanized equipment, burning practices and reduction in the forest canopy cover. Proposed changes in the East Boulder Corridor could increase habitat for noxious weeds and reduce competitive success of native vegetation. A complete affected environment discussion and effects analysis regarding this issue is found in Chapter 3 on pp. 85-98.

Other Issues

The National Environmental Protection Act (NEPA) provides for the identification and elimination from detailed study the issues which are not significant factors to the decision being made or which have been covered by prior environmental review. This narrows the discussion of these issues to a brief presentation of why they will not have a significant effect on the human environment and provides a reference to their coverage elsewhere (40 CFR 1501.7(3)). While these issues are important, they were either unaffected or mildly affected by the proposed action, or the effects could be adequately mitigated. These issues were discussed, summarized, and dismissed in Chapter 3 for the following reasons:

1. They were not relevant or specific to this proposal for fuel reduction in the East Boulder analysis area.
2. They were beyond the scope of this project level analysis and decision to be made.
3. Experience or analysis from other similar projects on the forest has consistently demonstrated that effects related to this issue are not significant.
4. The proposed action was modified to include mitigation, which is effective in alleviating any major impacts.

There are twenty one other issues that were identified that would either not be affected by this project or their impacts could be mitigated or resolved through project design.

Following is a list of these issues. A summary of the effects analysis and dismissal of these issues can be found in Chapter 3 (pp. 99-220), while the full analysis for each of these issues is located in the Project File.

a. Water Quality
b. Aquatics
c. Air Quality
d. Soils
e. Roadless/Unroaded
f. Visuals
g. Recreation
h. Special Uses
i. Lynx Habitat
j. Grizzly Bear
k. Gray Wolf
l. Sensitive Wildlife, Fish, Amphibian Species
m. Management Indicator Species
n. Big Game
o. Migratory Birds
p. Snags/Downed Woody Debris
q. Vegetative Structure/Diversity/Old Growth
r. Insect & Disease (MPB & DFB)
s. Sensitive Plants
t. Economics/Mine
u. Heritage Resources

Alternative Development Process

The November 2007 East Boulder Watershed Risk Assessment (USDA 2007) was a multi-resource effort to identify the highest risks to resources in the East Boulder drainage. The resources that were identified at highest risk include wildfire concerns in the WUI, the spread of existing and occurrence of new noxious weed populations, current and future insect and disease epidemics, encroachment of grass/ shrub communities, and threats to water quality if a large, severe wildfire were to occur in the drainage.

Findings from the risk assessment were utilized in the development of the East Boulder Fuels Reduction Project. With input from scoping and numerous discussions among the interdisciplinary team, the "key issues", as well as other pertinent issues, were agreed upon by the team. Once these issues were identified, the team began the process of developing alternatives that would address the issues identified, while also fulfilling the purpose and need of the project.

The fuels specialist, with the help of the silviculturist, and other fire specialists, began running various fuel modeling programs in an effort to determine how much fuel would need to be removed and where in order to bring the likelihood of an uncontrollable crown fire to an acceptable level. Since the models are based on mathematical relationships, they tend to present a stark choice; either fuel will be treated to better provide for human safety or the current level of risk will be accepted indefinitely into the future. Several options were studied.

The area was also looked at for current and potential insect and disease epidemics. The annual insect and disease flights for the Gallatin National Forest were used to determine trends in the area as a basis to begin the ground-truthing process. It was discovered that mountain pine beetle infestations in lodgepole pine are increasing in the area and that there are also active spot infestations of Douglas-fir beetle in the project area.

Potential impacts to existing native herbaceous vegetation were evaluated by assessing the existing infested acres and location of noxious weeds relative to proposed fuels reduction units, (mapped weed polygons by species were overlaid on the unit boundaries and analyzed in map and tabular form).

After numerous discussions among various specialists, the interdisciplinary team determined that both Alternatives 2 and Alternatives 3 would fully address the issues, meet the purpose and need of the project, and comply with Forest Plan standards and guidelines. These alternatives comply with the legal and administrative constraints that combine to define how well any alternative can meet the purpose and need for the project.

Alternatives Considered in Detail

Each action alternative, to the extent possible, must fully or partially meet the purpose and need for which the project is proposed. Alternative 1, the No Action Alternative, provides a baseline for comparing the effects of implementing the various action alternatives. It also shows the predicted effects of continuing the current management in the project area.

Alternative 1–No Action

The National Environmental Policy Act (NEPA) requires the consideration of a No Action Alternative (40 CFR 1502.14d) where none of the proposed actions outlined in Chapter 1 would occur. It provides a baseline of comparison to aid in determining the significance of issues and effects of the proposed action. Under this alternative, no vegetation treatments would occur. Vertical and horizontal fuel continuity of fuel arrangement would remain a concern in the East Boulder WUI, threatening public and firefighter safety (pp. 77 -78).

With Alternative 1, no actions would be undertaken over the next few years that respond to the purpose and need identified on p.16. The opportunity to reduce fuel accumulations would be deferred. No treatments such as hand piling or machine piling would be done to reduce existing ground fuels. No burning of piles would be completed. No vegetative treatments would be undertaken to treat stands, which are susceptible to lethal fire and to insect and disease outbreaks. Trees would not be harvested to meet the objectives for fuels management.

Those activities described as Reasonably Foreseeable Actions on p. 68 would, however, likely proceed.

Alternative 1 responds the least to the purpose and need for the project, which is to improve public and firefighter safety in the event of a large wildfire. The current buildup of insect and disease epidemics in the project area adjacent to private land and dwellings would continue and likely increase. There would continue to be natural vegetative changes including insect and disease mortality, encroachment, undergrowth,

and increased fuel loadings over time. Alternative 1 would have no direct or indirect impacts; neither would there be any benefits that would increase safety for firefighters, residents, and/or forest visitors.

Alternative 2– Corridor Units

Alternative 2 was designed to meet the purpose and need for the project. All elements of the purpose and need have been addressed. This alternative was developed considering the areas of high fuel hazard, high risk of human-caused ignition, and high social values. The proposed action emphasizes treating those stands where thinning of conifers and removal of ladder fuels would improve public and firefighter safety and improve the health of those stands having existing insect and disease outbreaks. The majority of the units associated with Alternative 2 lie in Management Area (MA) 8 and MA 11, both of which include productive forest lands that are available for timber harvest. Some units have linear inclusions of MA 7 (riparian), and there are very small inclusions of MA 3 and MA 12, all of which allow for the harvest of wood products where adjacent to existing roads. Management area direction for these MAs is outlined in the Gallatin Forest Plan (pp. III-6 through III-39).

Map 3 displays the units of treatment associated with Alternative 2 (Corridor Units Only). Alternative 2 includes vegetation treatments on a maximum of 650 acres in twenty-five separate units. Stand density reduction utilizing tractor harvesting equipment would occur on a maximum of approximately 490 acres on slopes up to 35%, harvesting both large and small diameter trees. A maximum of approximately 20 acres of stand density reduction on slopes >35% would involve skyline cable harvest, and approximately 140 acres would consist of hand-treatments (removal of ladder fuels, limbing of large diameter trees, and thinning of small diameter trees). Hand-treatments would occur in sensitive areas, areas where trees are too small for commercial harvest operations, and/or in areas that are not conducive to either tractor or skyline harvest methods. Due to the high cost and current market conditions, helicopter harvest was not included in any alternative for the project.

Leave tree spacing would be irregular and somewhat variable between units. Mechanically treated units in MA11 would retain 15%-20% of the acres in untreated clumps to protect big game winter range habitat address visual concerns of partial retention. Very small or narrow units would not include clump retention. Secondary streams would be buffered (uncut strips along streams) to provide wildlife corridors. These irregular stand structures would break the continuity of vertical and horizontal fuels in the project area. Prescriptions would vary between adjacent units to disrupt the continuity of fuel conditions among stands and would include:

Douglas-fir (DF) and mixed species dominated stands (>30% mixed)

MA11-Treatments would include a 40-60% canopy retention favoring DF then S to leave, irregular spacing with 13-15 feet between crowns. In addition, 15 to 20% of the unit acreage would be left in untreated irregular shaped clumps approx. 1/3 acre in size. (Very small or linear units may not have clumps retained).

MA8-Treatments would include a 35-45% canopy retention favoring DF then S to leave, irregular spacing 13-15 ft between crowns. Clumps would not be retained in MA8 units. Most LP and AF would be removed.

LP dominated stands (>70% LP)

MA11-Treatments would include 40-50% canopy retention. Leave DF and S where available with 13-15 feet irregular spacing between crowns. Leave 15–20% of the unit acreage in untreated irregular shaped clumps 1/10 to 1/8 acre in size. There would be some open areas within these stands.

MA8-Treatments would include 20-40% canopy retention. DF and S would be left, where available with 13-15 feet irregular spacing between crowns. Where no other species are available, LP would be left in small clumps 1/8 to 1/10 acre in size. There would be openings in these units.

1) **Clumps**- Clumps would be located at least 200 feet from the power line, wherever possible. Clumps will have irregular shapes and sizes. DF and mixed species clumps would be approximately 1/3 acre in size, LP clumps would be 1/10 to 1/8 acre in size. Retention clumps would be excluded from any treatment.
2) **Skyline cable units**- Would have corridors approximately every 150 feet.
3) **Hand treatments**–Thinning from below, ladder fuels and small diameter trees will be hand piled, piles will be burned, edges will be feathered to blend with adjacent stands. The objective is to break up continuous fuels and remove ladder fuels. Regeneration stands (20-30 year old) will only be thinned if they are immediately adjacent to the high voltage Park Electric power line.
4) **Small diameter trees and activity fuels**- Would be slashed, piled and burned, or otherwise removed unless they lie within the untreated retention clumps.
5) **Downed Woody Debris**-Approximately 15 tons/acre of downed woody debris per Gallatin Forest Plan direction would be left on site, where available. Large diameter pieces would be favored to leave.
6) **Snags**-Adhere to Forest Plan standards of leaving 30 snags per 10 acres greater than 18' and 10" DBH, where available. Wherever possible, snags will be retained within the untreated leave clumps for safety purposes. An additional 30 live snag replacement trees per 10 acres will be left in harvest units in either retention clumps or thinned areas. For Douglas fir and subalpine fir on rocky or shallow soils designate 60 trees per 10 acres as replacement trees.
7) **Rivers and streams**- The East Boulder River would be buffered by a 15' no cut zone, with only up to 50% of the trees 8" diameter and greater slated for removal in the areas 15'-50' from the river. There would be no harvest on >35% slopes leading into the East Boulder River to protect water quality and aquatic habitat. No heavy equipment would be allowed in the streamside management zones. Tributary streams (Twin Creek, Lewis Creek, and Wright Creek) would have a 50' no cut buffer on either side of the streams to provide travel corridors for big game, upper portions of Lewis Creek will be buffered for 100 feet.
8) **Seeps, springs, wallows**- These areas will be buffered and included as part of the unit's 15-20% retention clumps.

Treatment descriptions for the individual units included in Alternative 2 are found in Table 2 below: Table 2 below displays individual unit information including Unit #, approximate acres (Rounded to the nearest 5 acres), logging system, management area, roads needed, riparian treatment, and season of treatment. Design criteria and mitigation measures for the proposed treatments can be found on pp. 45-58.

Table 2-Alternative 2(Corridor Units) Treatment Descriptions

Unit #	Approx Acres	Logging System	MA	Roads Needed	Unit Treatment Type	Riparian Treatment Type[1]	Season of Treatment
1	25	Tractor	11	390 ft temp. road construction 511 feet existing rd. maintenance	Retain 15-20% in irregular shaped clumps (approx.1/3 acre in size), Irregular spacing of leave trees 13-15 ft. between crowns, Favor DF	NA	Winter
2	10	Hand Treatment	11	NA	Remove dead and dying trees, Remove ladder fuels except near campsites (cut & pile)	50 ft. no treatment buffer along East Boulder River (EBR)	Summer-Winter East Boulder Campground.
3	120	Tractor	11, 8	3794 ft temp road construction FS, 1185 ft. temp. road PVT (PVT Access)	N ½, MA11 Retain 15-20% untreated clumps (approx.1/3 acre), Irregular spacing leave trees 13-15 feet. between crowns, S1/2 (MA8) irregular spacing 13-15 ft between crowns, Favor DF	Small ponds in unit will be buffered as part of untreated clumps	Winter

[1] NA in riparian treatment type means that there are no known riparian areas within the unit so mitigation is not needed for protection of such

Unit #	Approx Acres	Logging System	MA	Roads Needed	Unit Treatment Type	Riparian Treatment Type[1]	Season of Treatment
3A	5	Hand Treatment	11	NA	Thin/remove small dbh (<8") trees approx. 13-15 ft. between crowns	NA	Summer-Winter
4	25	Hand Treatment	12	NA	Thin small dbh (<8") (cut, buck, & pile)	Minimum 15 ft. no cut along EBR; No treatment on steep slopes adjacent to EBR boundary to be located at top of the terrace	Summer-Winter
5	35	Tractor	11	1111 ft. temp road construction (may need stream crossing exemption for Wright Creek))	Retain 15-20% in untreated irregular clumps (approx 1/3 acre in size), Leave tree irregular spacing (13-15 ft) between crowns, Favor DF	Minimum 15 ft. no cut along EBR, No treatment steep slopes adjacent to EBR boundary located at top of the terrace, Maintain 50 ft buffer both sides of Wright Creek	Winter
5A	45	Tractor	11	704 ft. temp road construction	Retain 15-20% untreated clumps (approx 1/3 acre size), Leave tree irregular spacing (13-15 ft) between crowns, Favor DF& S, In LP areas leave only 1/8	50 ft. no cut buffer either side of Wright Creek except adjacent to power line	Winter

Unit #	Approx Acres	Logging System	MA	Roads Needed	Unit Treatment Type	Riparian Treatment Type[1]	Season of Treatment
					to 1/10 acre size clumps		
6	10	Hand Treatment	12	NA	Thin/remove small trees <8" in diameter (cut, buck, & pile)	Leave tree clump located along Lewis Creek	Summer-Winter
7	30	Tractor	11, 8	730 ft. temp road construction 924 ft. existing road maintenance	Retain 15-20% in untreated irregular clumps (approx 1/3 acre in size), Leave tree irregular spacing (13-15 ft) between crowns, Favor DF	50 ft. no cut buffer either side of Twin Creek except adjacent to power line	Winter
7A	5	Tractor	11	NA	Irregular spacing 13-15 ft. between crowns Favor DF	NA	Winter
7B	5	Hand Treatment	11	NA	Thin/remove small trees <8" dbh, Approx 13-15 ft. between crowns	50 ft. no cut buffer either side of Twin Creek	Summer-Winter
8	10	Hand Treatment	11	NA	Thin/remove small trees <8" dbh Approx 13-15 ft. between crowns Leave all DF except adjacent to power line	NA	Summer-Winter

Unit #	Approx Acres	Logging System	MA	Roads Needed	Unit Treatment Type	Riparian Treatment Type[1]	Season of Treatment
8A	20	Hand Treatment	11	NA	Thin/remove small trees <8" dbh, Approx 13-15 ft. between crowns Leave all DF except adjacent to power line	NA	Summer-Winter
9	20	Tractor	11	423 ft. temp. road construction	Irregular spacing leaving 13-15 ft. between crowns Favor DF & S Remove LP, Remove all trees within 35' of power line	NW corner has a SMZ retention clump	Winter
9A	10	Tractor	8,12	97 ft. temp road construction 376 ft. existing road maintenance	Irregular spacing (13-15 ft) between crowns, Favor DF	50 ft. buffer of Lewis Creek	Winter
10	30	Tractor	8, 11	502 ft. temp. road construction	Retain 15-20% in untreated irregular clumps (approx 1/3 acre in size), Leave tree irregular spacing (13-15 ft) between crowns, Favor DF	NA	Winter
11	40	Tractor	8,12	608 ft. temp. road construction	Irregular spacing leaving 13-15 ft. between crowns Favor S and DF	Minimum 15 ft. no cut along EBR; No treatment on steep slopes adjacent to EBR,	Winter (Identify well heads belonging to mine)

Unit #	Approx Acres	Logging System	MA	Roads Needed	Unit Treatment Type	Riparian Treatment Type[1]	Season of Treatment
						boundary to be located at top of the terrace	
11A	45	Hand Treatment	8,12	NA	Thin/remove small trees <8" dbh, Approx 13-15 ft. between crowns	Minimum 15 ft no cut along EBR, No treatment 50 ft either side of Dry Fork; No treatment on steep slopes draining into EBR boundaries located on top of terraces	Summer-Winter
12	10	Tractor	8	NA	Irregular spacing leaving 13-15 ft. between crowns Favor DF	50 ft. no cut buffer Lewis Creek	Winter
12A	5	Hand Treatment	11	NA	Thin/remove small trees <8" dbh, Approx 13-15 ft. between crowns Leave all DF except adjacent to power line	NA	Summer-Winter
13	70	Tractor	8,3	1226 ft. temp. road construction (may need exemption for Lewis Creek crossing)	N ½ leave S & DF, Irregular spacing 13-15 ft. between crowns, S ½ leave 1/8 to 1/10 acre LP clumps	50 ft. no cut buffer either side of Lewis Creek	Summer-Winter

Unit #	Approx Acres	Logging System	MA	Roads Needed	Unit Treatment Type	Riparian Treatment Type[1]	Season of Treatment
14	15	Skyline	8	1529 ft. temp. road construction	13-15 ft irregular spacing between crowns, Favor DF	NA	Summer-Winter (Will need to lay down mine fence)
16	5	Skyline	8	NA	13-15 ft spacing between crowns, Favor DF Remove LP	50 ft. No cut buffer either side of Lewis Creek	Summer-Winter
17	25	Tractor	8	NA	LP dominates, leave 1/8 to 1/10 acre clumps, Leave untreated area on south end due to wetness	Minimum 15' no cut along EBR, No cut on steep slopes adjacent to EBR, boundary to be located at top of terrace	Winter Buffer snotel site
18	25	Tractor	8	Need PVT Access Unit lies across East Boulder River	Remove LP, Leave 15-20% in untreated clumps 1/8 to 1/10 acre in size, Favor S	Minimum 15' no cut EBR, 50 ft no cut Dry Fork; No treatment on steep slopes adjacent to EBR or Dry Fork, boundaries located at top of terrace	Winter

Roads-No new permanent road construction is being proposed with the project. Primary access will be provided by the East Boulder Road #205 and the Lewis Gulch Road #6644. Commercial harvest operations are expected to require the construction of some temporary roads. A maximum of 2.1 miles of temporary road may be needed to access the areas proposed for mechanical fuels treatment using conventional ground-based logging systems (tractor and skyline). Another .57 of a mile of existing road maintenance may be needed to provide access to treatment areas. These areas will be re-examined on the ground prior to project implementation to determine whether opportunities exist to reduce the length of newly constructed temporary road. One of the

key factors in determining the use of existing roads on private land is whether permission to use the roads can be obtained. Existing roads on either ownership may require maintenance to support safe and efficient use, consistent with project design criteria and mitigations. Options to use existing roads will be examined to assure that the environmental effects of using roads on private and public land do not exceed what has been disclosed in this document. Tables 2 & 3 and Maps 3 & 4 disclose the approximate locations of proposed temporary roads and road maintenance.

Actual temporary road locations are determined through agreement by the Forest Service during timber sale contract administration. Temporary roads would be constructed to provide access to the interior of harvest units to facilitate ground-based harvest systems. These roads would be built on relatively flat ground slopes (less than 20%) and would be constructed to the lowest possible standard capable of supporting log haul in order to minimize ground disturbance. Temporary road construction, including clearing and removing of wood products from within the road right-of-way, would likely occur in late summer or early fall when the soils are dry. Mitigation timeframes for various wildlife species described on pp. 51-54 would be followed.

All newly constructed temporary roads would be closed to the public during harvest activities and permanently closed, recontoured, and rehabilitated within one year upon completion of harvest related activities. Rehabilitation will include making the temporary roads on National Forest System lands impassable for any motorized travel, as well as necessary other resource protection practices. Existing roads that are improved and utilized for project related activities that are no longer needed, do not provide deeded access to private lands, or are not identified to remain open in accordance with the October 2006 Gallatin National Forest Travel Plan Decision would also be rehabilitated within one year of completion of project related activities.

Implementation Timeframe

The East Boulder Road is plowed year round to provide access to the East Boulder Mine. Mechanical treatments in the corridor units adjacent to the East Boulder Road and/or East Boulder River would occur in the winter over frozen or snow-covered ground to minimize ground disturbance in order to avoid the spread of noxious weeds and protect water quality in the East Boulder River. Mechanical harvest activities such as skidding, and mechanical slash piling must be conducted over at least 4 inches of frozen ground and/or 8 inches of settled snow, which would normally occur between December 1 and March 31. Mechanized equipment would not be allowed within Streamside Management Zones or wet areas in conformance with the State of Montana Best Management Practices (BMP's) located in Appendix A. Mitigation timeframes described on pages 48-55 would be adhered to.

Treatment units located along the Lewis Gulch Road would likely be harvested in the fall/winter until snow accumulations prevent harvesting operations. Several of the units would utilize cable harvest systems, which can't be safely and effectively completed over heavy snow and there are not known weed populations in these units. Mechanical operations would likely occur between August 16 and March 31 as long as appropriate weather related conditions exist. All ground disturbing activities would occur when soils are dry, frozen, or snow covered as defined above, and all project-related mitigation timeframes would be adhered to.

Hand treatment units without ground disturbing activities would not have limited implementation timeframes. Pile burning would occur in the spring, fall, or winter. See Table 2 for individual unit implementation timeframes and restrictions.

Treatment of activity-related and natural down fuels would maintain 10-15 tons of coarse, downed woody material per acre (>3" in diameter), where available, per the Gallatin Forest Plan.

Alternative 3 – Corridor & Lewis Gulch Units

Alternative 3 (proposed action) includes all units and activities associated with Alternative 2 and includes 5 additional treatment units located along Lewis Gulch Road (See Map 4). Alternative 3 includes vegetation treatments on a maximum of approximately 870 acres in thirty separate units. Stand density reduction utilizing tractor harvesting equipment would occur on a maximum of approximately 660 acres on slopes up to 35%, harvesting both large and small diameter trees. A maximum of approximately 70 acres of stand density reduction on slopes >35% would involve skyline cable harvest, and approximately 140 acres would consist of hand-treatments (removal of ladder fuels, limbing of large diameter trees, and thinning of small diameter trees). Hand-treatments would occur in sensitive areas, areas where trees are too small for commercial harvest operations, and/or in areas that are not conducive to either tractor or skyline harvest methods. Due to the high cost and current market conditions, helicopter harvest was not included. All of the information included in the description of Alternative 2 and Table 2 is also applicable to Alternative 3. The additional Lewis Gulch units are mixture of tractor and skyline cable harvest areas. Treatment of units located along the Lewis Gulch Road would be conducted in the fall/winter from mid-August until until snow accumulations prevent harvesting operations. Several of the units would utilize cable harvest systems, which can't be safely and effectively completed over heavy snow and there are not known weed populations in these units. Mechanical operations would be allowed as long as appropriate weather related conditions exist and project-related mitigation is adhered to. Any ground disturbing activities would occur when soils are dry, frozen, or snow covered as defined above. Table 3 below provides the approximate acres (Rounded to the nearest 5 acres), temporary road needs, management area, and treatment type descriptions for the additional units associated with Alternative 3. All units associated with Alternative 2 (Table 2) are also included in Alternative 3 (Table 3).

Table 3-Alternative 3-Additional Lewis Gulch Unit Descriptions

Unit #	Approx Acres	Logging System	MA	Roads Needed	Unit Treatment Type	Riparian Treatment Type[2]	Season of Treatment
19	40	Tractor	8,3	822 ft. temp. road construction	Remove LP, Favor DF, approx 13-15 ft between crowns, some areas will have LP clumps retained (1/8 to 1/10 acre in size)	NA	Summer-Winter
21	70	Tractor	8	2535 ft. temp. road construction	Remove most LP, Favor DF & S, approx 13-15 ft between crowns, Some LP clumps retained (1/8 to 1/10 acre in size)	NA	Summer-Winter
22	20	Skyline	8	1450 ft. temp. road construction	Remove LP& AF Favor DF & S Approx 13-15 ft between crowns, some LP clumps retained (1/8 to 1/10 acre in size)	100 ft. no cut buffer of Lewis Creek	Summer-Winter
22A	60	Tractor	8	1443 ft. temp rd. construction	Remove LP, AF Favor DF & S Irregular spacing 13-15 ft between crowns	100 ft. no cut buffer from Lewis Creek	Summer-Winter
23	30	Skyline	8	1309 ft. temp. road construction	Remove LP, AF Favor DF Irregular spacing 13-15 ft between crowns	NA	Summer-Winter

[2] NA in riparian treatment type means that there are no known riparian areas within the unit so mitigation is not needed for protection of such

Roads-No new permanent road construction is being proposed with Alternative 3. Primary access will be provided by the East Boulder Road #205 and the Lewis Gulch Road #6644. Commercial harvest operations are expected to require the construction of some temporary roads. The temporary roads needed for Alternative 2 (described above) plus an additional 1.4 miles of temporary roads for a total of up to 3.5 miles of temporary roads may be needed to access the areas proposed for mechanical fuels treatment using conventional ground-based logging systems (tractor and skyline) for Alternative 3. These areas will be re-examined on the ground prior to project implementation to determine whether opportunities exist to reduce the length of newly constructed temporary road. No additional existing road maintenance above that identified for Alternative 2 would be needed to provide access to treatment areas. Lewis Gulch Road would likely require blading pre and post treatment.

All other road treatment information pertinent to Alternative 2 would apply to Alternative 3, including recontouring, rehabilitation, and closure of new temporary roads constructed for the project.

Detailed Stand Treatments - Common to All Units (Alternatives 2 & 3)

Described below are the stand treatments that are common to all tractor and skyline cable units associated with the two action alternatives (Alternatives 2 & 3)

A. **Fuels** – Merchantable trees would likely be whole tree yarded and skidded to designated landings. Sub-merchantable material and slash from logging operations would be piled or otherwise removed from the unit. Approximately 10-15 tons/acre of down woody material would be left on the ground for nutrient recycling, favoring larger diameter pieces. Coarse woody material not needed to meet residual fuel needs would be skidded to a landing, piled and burned, piled and burned on the harvest site, or otherwise removed from the area.
B. **Burning** – Activity fuels would be treated and burned or otherwise removed following harvest. Burning methods would include burning hand or mechanical piles, and landing piles (treatment of concentrated fuels). These actions would reduce ladder and activity fuels within the treated units.
C. **Canopy Cover** – Existing canopy cover is somewhat variable within the proposed treatment units ranging from 70-90%. The number of existing trees per acre varies greatly for each stand. On average, the units located in MA 11 (along the East Boulder Road from Unit 1 through Unit 12A) would retain a 40% to 60% canopy cover post-treatment in DF & mixed species units and 40-50% canopy cover in LP dominated units to address winter range and visual quality of partial retention. In addition to the individual leave trees they would retain untreated clumps ranging from1/10 to 1/3 acre in size (depending on conifer species) to meet a variety of resource objectives. The remaining trees would vary in size from seedlings to mature trees (six inches tall to 80 feet tall). Treatments are designed to reduce ladder fuels (small to mid-story trees and shrubs), thin the overstory to increase the space between crowns, reduce accumulations of down woody material, and create healthier stand conditions. The untreated portions of units would be left in a natural appearing condition.

Units located in MA8 (units adjacent to the East Boulder mine site and along the Lewis Gulch Road) would retain a post-treatment canopy cover of approximately 35-45% in DF and mixed species units and 20-40% canopy retention in LP dominated units. These

stands are not within identified winter range areas. Canopy cover remaining post-treatment would have irregular spacing of conifers or small clumps in order to create a more natural appearing condition.

Comparison of Alternatives

Table 4 provides a comparison of the three alternatives considered in detailed study and how they address each of the key issues.

Table 4-Comparison of Alternatives by Key Issue

Key Issue	Alternative 1 (No Action)	Alternative 2 (Corridor Units)	Alternative 3 (Proposed Action– Alternative 2 & Lewis Gulch Units)
Fuels	Under the existing condition expected fire behavior within the proposed units would likely be a passive crown fire with a crowning index of 4.8 miles per hour to produce an active crown fire. Rates of spread would vary from 42.5 to 126.8 chains per hour. With flame lengths ranging from 69.2 to 122 feet.	These treatments would greatly reduce the expected fire behavior. Would take 25+ mile per hour winds to initiate or sustain a crown fire. Within the treated units the projected crowning index is zero, thus changing the fire type from an active crown to a surface fire. Rates of spread for the units would range from 1.8 to 3 chains per hour, while flame lengths would range from 1.2 to 2 feet.	Treatments would have same effect as Alternative 2. Treatments in Lewis Gulch offer additional characteristic fire behavior reduction and act as a deflecting mechanism of fire approaching the project area from the south. This deflecting mechanism increased the overall time of arrival of a flaming front to existing infrastructure by two hours.
Noxious Weeds	There would be no fuels treatments, no new temporary roads, no new ground disturbance, treatment costs for noxious weeds would likely remain at current levels, infestations of noxious weeds would remain somewhat static unless a large wildfire where to occur in the project area,	Fuel treatments would occur on up to 490 acres of tractor ground with a total of up to 660 acres treated; 13 units would be treated over snow or frozen ground; 24 high risk and 6 low risk units would be treated; 1 non-winter tractor Unit 13 (70 acres) with dedicated skid trails required equating to approximately 5 acres of soil disturbance over length of skid trails, up to 2.1 miles of low standard temporary road would be constructed with associated ground disturbance of approximately 3.6 acres;	Fuel treatments would occur on up to 660 acres of tractor ground with a total of up to 870 acres treated; 13 units would be treated over snow or frozen ground; 24 high risk and 11 low risk units would be treated; 4 non-winter tractor Units 13, 19, 21, & 22A (240 acres) with dedicated skid trails required equating to approximately 18 acres of soil disturbance over length of skid trails, up to 3.5 miles of low standard temporary road would be constructed with associated ground disturbance of

Key Issue	Alternative 1 (No Action)	Alternative 2 (Corridor Units)	Alternative 3 (Proposed Action– Alternative 2 & Lewis Gulch Units)
		Approximately 31 landing piles would be needed equating to approx. 15.5 disturbed acres	approximately 5.9 acres, Approximately 43 landing piles would be needed equating to approx. 21.5 disturbed acres

Design Criteria and Mitigation Specific to the Action Alternatives (2&3)

This section describes project design features, mitigation measures, and monitoring activities that are specific to the action alternatives.

Water Quality

1) SMZ treatments: 15' no cut zone adjacent to East Boulder River, additional SMZ retention guidelines of harvest up to 50% of trees >8" dbh, no harvest on >35% slopes in Units 5, 11, 17 & 18 adjacent the East Boulder River.
2) No treatment buffer of 50'on either side of Twin Creeks, Lewis Creek, and Wright Creek except in Unit 22 & 22A where Lewis Creek will be buffered by 100' for both water quality and winter range objectives.
3) Apply standard BT timber sale protection clauses to the commercial harvest activities to protect against soil erosion and sedimentation. Include standard BMP's for all activities including Montana SMZ compliance rules.
4) All required water quality permits would be acquired by the Gallatin National Forest prior to any ground disturbance activities for the East Boulder fuels project. If logging road stormwater discharge NPDES permits are required for East Boulder fuels project the Gallatin National Forest will work with the Montana DEQ to obtain the permits prior to project implementation.
5) 5) The Gallatin Forest Plan, Forest Wide Standards 10.2 (page II-23) requires that Best Management Practices (BMP's) will be used in all Forest watersheds. The Montana Forestry BMP's are included in Appendix A of this EA and are required to be followed in all timber harvest and road construction activities.

Effectiveness: No Gallatin NF timber sale-related BMP violations have been documented in implementation monitoring reviews since 1990 (GNF 1997 Annual Monitoring Report). Improved harvest methods, SMZ rules of 1993, and more complete BMP direction incorporated in NEPA documents and timber sale contracts have worked to virtually eliminate BMP problems (e.g., skidding across streams, insufficient sediment filtering, inadequate skid trail rehabilitation) of the past.

Aquatics

The underlying goal of protection measures for riparian and aquatic habitats is to follow a functional definition of riparian zone consistent with GNF Plan and FSM direction,

and consider riparian vegetation in relation to stability, integrity, and meeting needs of riparian zone dependent species including fish and fish habitat. The following stream protection measures are included in the proposed action:

1) No riparian treatment up to 100 feet either side of streams except for designated areas where riparian harvest is necessary to meet fuels treatment objective along a critical reach.
2) Where riparian treatment is necessary to meet fuels objectives, a 50 feet no treatment buffer is preferred. In limited areas where riparian treatment is critical to meet fuels objectives, treatment is allowed within 50 feet, but not closer than 15 feet of the high water mark. This is more restrictive than State SMZ rules. This "no harvest" mitigation protects thermal regulation, overhead cover, and protects banks. It also maintains age class diversity of trees along stream corridors. Where riparian treatment is necessary within a 50 feet SMZ, additional mitigation measures described below apply.
3) Follow all SMZ rules and Gallatin FP regarding operation of wheeled or tracked equipment in riparian zones.
4) Favor leaving large diameter trees along riparian corridors. Purpose is to protect those trees most likely to provide anchored and stable LWD when it is recruited to the channel. Fisheries biologist will be involved with marking cut trees along all riparian corridors.
5) For tree retention guidelines follow SMZ rules which require retention of at least 50% of trees $\geq$ 8 in dbh. The SMZ retention guidelines apply to all stream segments beginning 15 feet from the stream high water mark and extend out 50 feet. As such, 50% of trees $\geq$ dbh between 15' and 50' of the stream high water marks will be retained. Trees within the 15' no cut zone do not count towards the 50% retention.
6) Favor leaving trees that are leaning towards the stream channels and favor taking trees leaning away from the stream channel. Purpose is to protect those trees most likely to provide anchored and stable LWD when it is recruited to the channel.
7) To the extent possible, but still meeting fuels objective, leave species and size classes representative of original stand.
8) Fisheries biologist will assist in tree marking along all riparian corridors.
9) No riparian treatments on steep slopes >35% that drain directly into a stream with no floodplain filter.
10) No harvest in active floodplains (inundated on 1.5 – 2 year recurrence interval). Fisheries biologist will assist in identifying these areas.
11) Follow all BMP's and other mitigation measures outlined in the water quality section of the EA.

Effectiveness: Similar aquatic mitigation measures were applied to treatment units along the main Boulder River and tributaries for the Main Boulder Fuels Reduction Project. During summer 2009, the Big Timber Ranger District hosted a field trip with fisheries professionals representing Yellowstone National Park, Montana Department of Fish, Wildlife and Parks, and US Forest Service. The intent of the field review was to

solicit comments and input relative to the applied aquatic mitigations along the main Boulder River and its tributaries. Collectively, the group considered the mitigation effective at protecting aquatic resources. For that project, the 15 foot no cut zone was applied to all streams. Though the group considered the 15 foot distance adequate to protect aquatic resources when applied in conjunction with other mitigation (e.g., selective harvest to protect LWD recruitment), there was a general consensus that 15 feet was the minimum distance necessary for adequate protection.

Air Quality

The primary focus of the East Boulder pile burning would be to prevent wildfire initiating from the burn projects. Specific mitigation includes:

1) Pile burning would be done in the spring, fall, or winter when wildfire potential is low.
2) Pile burning would be constrained to no more than 200 piles per day and at least 0.2 to 0.3 miles from the East Boulder mine, where possible, to keep smoke emissions within the National Air Quality Standard (NAAQS) for particulate matter. For Units 17 & 18 that are adjacent to the mine, piles will kept as small and as far from the mine as reasonably possible and piles should only be burnt during times of robust wind dispersion away from the mine and there is little risk of nighttime inversions
3) Pile burning should attempt to keep smoke away from the East Boulder mine as smoke in the mine ventilation system can be problematic for mine operations as it can trigger an evacuation.
4) All East Boulder pile burns will be coordinated with the Montana/Idaho State Airshed Group (http://www.smoke.org). The operations of the Montana/Idaho State Airshed Group are critical to minimize cumulative smoke/$PM_{2.5}$ air quality impacts. The State Airshed Group, Monitoring Unit in Missoula, evaluates forecast meteorology and existing air quality statewide by individual air shed and specifies restrictions when smoke accumulation is probable due to inadequate dispersion. Pile burning would be done in coordination with the Montana/Idaho Airshed group on days of good-excellent stability.

Effectiveness: Particulate monitoring air quality particulates has not been done for fuels projects on the Gallatin NF. Particulate monitoring has, however, been conducted at the East Boulder Mine. Monitoring has also been conducted extensively on the Bitterroot NF to check calibration with the SIS model and compliance with NAAQS. The Montana/Idaho State Airshed group cooperates with the Montana DEQ and member agencies with an extensive network of TEOM's and Data Rams, which are used in scheduling prescribed burns and pile burns along with developing and managing burning restrictions. The program has been very effective in minimizing adverse smoke impacts from open burning for the last 15 years in Montana and Idaho. Prescribed burn projects on the Gallatin National Forest have been visually monitored for smoke dispersion effects for several years.

Soils

Use of these soil mitigation practices will protect soil productivity by meeting the Regional Soil Quality standards (USDA Forest Service. 1999). For further details, see soils section (Chapter 3) and soil specialist's report (Project File).

Skid Trail Placement and Slope Limitations

1) Require a systematic skid trail pattern during logging. Mechanical ground-based skidding and harvesting equipment may be used off of skid trails only to the degree necessary to harvest the available timber and only when soil moisture conditions are favorable (see below for details).
2) Use ground-based harvest systems only on slopes having sustained grades less than 35 percent.
3) Maintain an average of at least 75 feet between skid trails in partial cut areas. Skid trails may be closer than this spacing where converging so long as overall spacing averages 75 feet.
4) Lay out skid trails in a manner that minimizes or eliminates any extended sections of trail running down slope at grades steeper than 15%.
5) Avoid placing skid trails or temporary roads over convex knobs or along narrow, rocky ridges (areas least able to recover from disturbance) to the extent possible.

Limited Use of Skidding and Harvesting Equipment Off Skid Trails – Non-winter

6) Ground based skidding equipment may travel off of the established skid trails but only to the extent reasonably necessary to harvest timber based on the sale administrator's judgment and only when the top 6 inches of soil will not form a ribbon between the thumb and forefinger and will not form a ball when squeezed in the palm of the hand that will withstand a moderate amount of handling. (Criteria integrates the combined influence of soil texture and soil moisture – see USDA Technical Guide for Estimating Soil Moisture)
7) Feller/buncher/mechanical harvesters may be used off established skid trails to the extent reasonably necessary to harvest timber and only when the top six inches of soil will not form a ball when squeezed in the palm of a hand or will only form a weak ball and at most will form a weak ribbon between the thumb and forefinger. (Criteria integrates soil texture and soil moisture effects – see USDA Estimating Soil Moisture Tech. Guide). Repeat passes over the same ground should be minimized.
8) In some limited instances, soils may be too dry to allow ground-based, mechanical skidding or harvesting equipment to operate off of established skid trails in sensitive areas, such as on sandy or shallow soils on south facing aspects, along ridges, and other convex slopes. These are often the lowest productivity sites within a stand in any event.

Winter Harvesting Restrictions

9) Tractor harvesting over snow or frozen ground in the winter should be limited to periods when there is a minimum of 8 inches of settled snow covering the ground or, in the absence of sufficient snow, when the top four inches of mineral soil is frozen. Otherwise, standard non-winter, off skid trail limitations will apply.

Harvesting should not proceed if ponding occurs at the mineral soil surface due to partial thawing of a surface frost layer. Previously noted limitations to off skid trail use based on soil texture and moisture conditions and the need for a systematic skid trail system do not apply to winter harvesting providing the settled snow depth or frozen ground criteria are met.

Effectiveness: Past monitoring of harvested areas indicate that protective measures noted above will minimize soil disturbance and maintain soil productivity relative to the use of mechanical harvesting and skidding equipment in forest stands. The predictions of detrimental soil disturbance for non-winter, tractor harvest treatments are less than those reported by Shovic in past monitoring reports for the Gallatin National Forest (Shovic and Widner 1990; Shovic and Birkland 1992; Shovic 2006). Current proposals are for partially cut fuel treatments with a 20-60% canopy coverage retention. Previous monitoring reports were for clearcuts. No ground scarification or broadcast burning is proposed for the East Boulder Fuels Project in contrast to the earlier areas monitored. Significant off-trail use of ground-disturbing equipment had also been allowed in the previously monitored areas, which is not allowable for the East Boulder Project.

Lower soil disturbance levels occur when lower volumes of material per unit area are being removed from forest stands (Miller et.al. 2004). Since fewer trees are removed in fuels treatments, the level of soil disturbance is both less widespread and less severe than with clearcutting. The Region 1 Technical Guide to Soils NEPA Analysis Regarding Detrimental Soil Disturbance (DSD) in Forested Areas includes fuel treatments as "ground based activities with effects appearing to be much lower than 15%".

That being said, the majority of tractor harvest units proposed for the East Boulder Fuels Project will be treated during the winter months. Tractor harvesting has been demonstrated to cause substantially less soil disturbance (Page-Dumroese, et.al. 2006) as well as substantially less archeological site disturbance (Philipek 1985) if it is conducted during winter months when the ground surface has adequate snow cover. On the Gallatin National Forest, the 2009 implementation review of treatment units in the Main Boulder Fuels Project showed very little detrimental soil disturbance in winter harvested units except for one unit where jack pot burning was included in the prescription (Keck 2009 -personal observations). In this case, some DSD due to burning, occurred immediately below the burn piles.

Combined influences of from all of the above will ensure that detrimental soil disturbance from the proposed fuels treatments will remain well below the 15% maximum DSD standard for Region One Forests. These guidelines were developed utilizing both Regional and research input and then modified to account for local conditions. Their purpose is to protect soil productivity for the next generation of forest vegetation. They reflect a "best estimate" of soil disturbance/soil productivity effects, based on scientific research and field experience. Use of these mitigation practices will also protect soil productivity by meeting the Regional Soil Quality standards (USDA Forest Service. 1999). See the soils effects section in Chapter 3 for details regarding each treatment unit.

Noxious Weeds

Noxious weed prevention and control procedures are described in Forest Service Region 1 Supplement to Forest Service Manual 2080. This Supplement outlines responsibilities

and methods to manage noxious weeds at Forest and District levels. It includes numerous best management practices that would be followed during activities associated with the East Boulder Fuel Reduction Project. The Manual includes an integrated approach of education, prevention, suppression, and monitoring. All manual direction would be followed. Follow Zero Code 2080- Noxious Weed Management Guidelines:

1) Remove the seed source that could be picked up by passing vehicles and limit seed transport into new areas.
2) Spray weed infested areas for noxious weeds prior to seed production each year during harvest and follow-up operations. Weed spraying and funding will be coordinated with Sweet Grass County, the Stillwater Mining Corporation, and with Park Electric for the power line corridor.
3) Power wash to remove all mud, dirt and plant parts and inspect all off-road vehicles before entering the project area. Cleaning must occur off National Forest Lands. This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the project area.
4) Any gravel or other surfacing/fill materials brought or moved on-site for project related activities must be from a weed seed free source. Any straw used for road stabilization and erosion control must be weed seed free.
5) Temporary roads, re-opened roads, and trails used during harvest should be closed to the public until harvest and reclamation operations are completed.
6) Minimize the creation of sites suitable for weed establishment. Designate all skid trails. Minimize road building and road cut and fill lengths.
7) Re-vegetate bare and disturbed soil, except on surfaced roads, in a manner that optimizes plant establishment. Use native plant seed where appropriate. Use weed–free seed as tested by a certified seed laboratory.
8) Harvest and skidding operations would be limited by groups of units with reclamation, road restoration, and other ground disturbing activities, etc. completed as soon as possible after harvest to minimize establishment of non-native or noxious plants. Monitor and evaluate the success of re-vegetation in relation to project plan.
9) Monitor harvest units and associated activity areas and treat new weed infestations for several years following harvest and reclamation. Treatment should begin the year following disturbance to be effective. Weed treatments would be mandatory and adequate funding would be allocated by either project related funds or as part of the annual district weed program.
10) Mechanical treatments on units along the East Boulder Road with ground disturbing activities must be conducted over 8” of settled snow or 4” of frozen ground (Units 1-12 and 17, 18)
11) Include in retention areas (untreated clumps) portions of units heavily infested with knapweed, sulfur cinquefoil, oxeye daisy, or other noxious weeds These would include knapweed infested portions of Units 1 & 7, and heavy oxeye daisy infested portions of Units 3, 5, 7 & 7A.

12) Avoid the use of meadow areas through layout as much as is practical, for temporary roads, slash or landing piles, decking, parking, camping by loggers, and mechanized equipment use.

Effectiveness: Mitigation measures such as these have proven effective on the Forest and throughout the Region as precautionary measures to reduce or minimize the spread of noxious weed species from one area to another (1992 Monitoring Report, pages 254 to 260, and 1997 Monitoring Report, pages 58 to 60).

Wildlife; Threatened, Endangered, Sensitive, Migratory Birds, and MIS Species (Includes Snags)

The Forest Plan contains direction for managing big game winter range to meet forage and cover needs of deer and other species, and to maintain hiding cover associated with key habitat components over time. Further, the Plan contains standards specific to MA 11 for management of big game winter range. Forest Plan amendments provide big game cover definitions (Amendment 14) establish minimum snag retention requirements (Amendment 15), incorporate direction pertaining to management for lynx (Amendment 46) and grizzly bear access within recovery zones. In addition, the project is located within designated Critical Habitat for lynx, and will require consultation with the US Fish and Wildlife Service.

1) As per Forest Plan Standard (6. A. 5. Pg. II-18), maintain at least 2/3 of the hiding cover associated with key habitat components over time. Buffer both mapped key components, as well as point locations such as wallows, when they are encountered during initial field review and/or during layout and marking. At least 2/3 of the existing hiding cover around these sites will be left untreated. The width of the buffers will be prescribed by the biologist based on an assessment of the site characteristics.
2) Retain 15-20% of the forested habitat component in each MA11 treatment unit as untreated clumps, strips or patches, at least 1/10 acre in size for spruce/fir dominated types, and at least 1/3 acre in size for pine dominated types, in order to retain some degree of hiding and thermal cover, and provide habitat continuity for big game. Retention patches will be left so that no created openings are more than 600 feet of cover
3) Retention patches will favor key habitat features (e.g. wallows, licks, natural openings) where present, to assist with the requirement to maintain at least 2/3 of the hiding cover associated with these features.
4) The Forest Plan standard for snags and down woody debris is critical management direction to ensure habitat components key to species dependent on snags and down woody material for habitat or prey species' habitat. The Forest Plan provides specific direction for snag retention within areas prescribed for timber harvest (USDA 1987, Amendment #15, Wildlife Snag Amendment, 02/26/1993). Additional guidance in determining which trees to leave for snags includes:
    a) Where possible to meet fuels objectives and safety concerns (OSHA 29CFR 1910.266), leave the largest snags standing in each treatment unit (at least 10" dbh and 18' tall).

b) Incorporate snag retention in leave (non-treated) clumps to meet snag retention objectives.
c) Large, broken-topped (live or dead) and trees with existing cavities should be a high priority for retention.
d) Strive to locate snag retention in areas away from easy access for firewood cutting. No firewood cutting signs will be posted within the Sale Area.
e) Leave hardwood snags where available; e.g. aspen, cottonwood, birch.
f) Where available, leave a variety of snags and/or replacement trees (e.g. species, size, form, rate of decay).
g) Snags will be marked to leave either individually or in clumps.

5) The Forest Plan provides specific definitions and direction for road density within grizzly bear recovery areas. However, the project area is located outside of the Greater Yellowstone Recovery Area. Within this area we are responsible for mitigating incidental take of the species and minimizing impacts to secure habitat and impacts during spring bear emergence. The area is primarily used by transient grizzly bears during spring emergence. There are no standards that limit activities in these areas. All road construction would be temporary and would be obliterated and re-contoured after project completion. The project would be active in winter in most of the roadside units and during late summer and fall in those units further from the main road; therefore no incidental take is expected or anticipated. Grizzly bears are not likely to be present in these habitats during harvest & treatment operations. In order to meet the intent of both the plan and our cooperative agreements outside of the recovery area, specific guidelines would be designed that will limit the use of existing roads, construction of new roads, or reopening existing roads to access or remove forest products and reduce fuels**.** New temporary roads will be closed and recontoured after completion of harvest related activities.

6) As per the Forest Travel Management Plan, (Guideline D-7, pg. I-II) project roads should be temporary in nature, and effectively gated to restrict public use. Once the activity is complete, these roads should be permanently and effectively closed and re-vegetated.

7) Forest Plan Amendment No. 46 incorporates conservation measures from the Northern Rockies Lynx Management Direction ROD. In addition, the Final Rule designating critical habitat for lynx (Federal Register, Feb. 2009) establishes Primary Constituent Elements (PCE) for lynx critical habitat that must be addressed in effects analyses for projects within designated critical habitat.

a) Vegetation management projects must maintain habitat connectivity within a Lynx Analysis Unit (LAU)
b) Limit fuel reduction treatments in WUI that affect snowshoe hare habitat so that such treatments shall occur on no more than 6% (cumulatively) of lynx habitat mapped on the Gallatin National Forest

c) Evaluate effects to PCEs in lynx critical habitat, including: snowshoe hare habitat, winter snow conditions, denning habitat and matrix habitat.

8) Based on historic detections, an intensified survey effort to identify nest stands will be conducted within the analysis area prior to fuel reduction activities involving tree removal. If nests are located, maintain a minimum 40 acre no activity buffer around nest trees to maintain existing conditions in the nest stand. In addition, no treatment related activity will be allowed in the area representing the post fledgling area (PFA) (240 acres in size) from April 15-August 15 to protect the goshawk pair and young from disturbance during the breeding season until fledglings are capable of sustained flight. After August 15, treatment related activities may commence within the PFA, but outside the nest area, unless site-specific monitoring supports earlier entry. Additional guidance in determining which trees to leave for snags includes:

   a) No harvest of trees with goshawk nests or nests of other large raptors, whether they are occupied or inactive. Trees and snags with obvious large nest structures or cavities should be left intact, with immediately surrounding vegetation retained to provide security cover.
   b) If found within treatment areas, leave a minimum 50-foot buffer around trees with large raptor nests.
   c) Mechanical treatment prescriptions should be designed to leave irregular patterns with clumps of trees and a variety of age and size classes.

9) Maintain a 50-foot untreated buffer on each side of Wright Creek, Lewis Creek and Twin Creek except in Unit 22 & 22A where Lewis Creek will be buffered by 100'to maintain cover in important wintering areas for mule deer and moose.

10) No treatment on steep (>35%) slopes that drain directly into a stream with no floodplain filter. This will help to maintain cover in riparian winter habitat for moose and mule deer.

Effectiveness: The Forest Plan was amended in 1993 in order to define big-game definitions for cover, hiding cover, thermal cover and security cover (Amendment 14). Pertinent literature was reviewed and contacts were made with Montana Fish Wildlife and Parks biologist to discuss potential impacts to big-game cover and possible mitigation solutions. The mitigation measures illustrated above were designed to minimize impacts to big-game species in relation to the retention and availability of appropriate types of cover. The project is affecting a narrow corridor of big-game habitat that currently receives abundant use by deer, but more limited use by elk and moose because of the proximity to the county road bisecting the analysis area. This road receives moderate traffic seasonally between May and October from forest users and heavy traffic yearlong by East Boulder Mine employees and delivery services. This activity along with regular seasonal migration to higher elevations limits the presence of elk and moose in the area proposed for treatment. The resulting big–game cover and habitat should provide more foraging opportunity, while retention of clumps of cover in the silvicultural design will provide sufficient cover requirements. In addition, because

of the linear nature of the proposed treatments there will be abundant cover of all types remaining within less than one-quarter mile of all proposed treatments.

The Forest Plan was also amended in 1993 to address issues related to the management of snags and down woody debris (Amendment No. 15). For Amendment 15, pertinent literature was reviewed, and contacts were made to individuals with expertise in wildlife and timber management. Information gathered was used to develop prescribed retention standards for snags and down woody debris listed in wildlife design feature measures numbers 2 and 8 above. These measures have been deemed adequate to provide the *minimum* amounts of standing and down dead, woody materials required to sustain suitable habitat for wildlife species that depend on these habitat components

The Forest Plan was again amended in 1996 in order to address concerns about motorized access in Grizzly Bear recovery zones (Amendment 19). This amendment sets a standard of "no net increase" in motorized road density within any Bear management Units (BMU) in the recovery zone. All pertinent literature was reviewed and consultations were conducted with the U.S. Fish and Wildlife Service in order to identify and mitigate any potential impacts to bears from the proposed treatments. In addition, Habitat Effectiveness Indices (HEI) was calculated for the analysis area in order to determine the potential impact of additional temporary roads from the proposed treatments. The analysis area provides abundant grizzly bear habitat, however the project area itself receives very limited use by grizzly bears. The HEI calculations indicated that habitat effectiveness in the recovery area would remain well above (85% - 95%) the standard of 70 percent. Furthermore, the road density will remain very low in comparison to other BMU's and should not have any temporary or lasting impact to grizzly bears or their habitat. Although the analysis revealed that little to no impact to grizzly bears or their habitat is expected, the mitigation measures listed above were proposed to further limit any potential impacts to bears.

The Forest Plan was amended (Amendment No. 46) in 2007 to incorporate conservation measures from the Northern Rockies Lynx Management Direction (NRLMD) ROD. The Lynx Amendment underwent formal consultation with the US Fish and Wildlife Service (FWS). The FWS determined in a Biological Opinion that management direction contained in the NRLMD is compatible with recovery needs for lynx. Direction provided by the NRLMD is primarily habitat based, and addresses the habitat components described as PCEs for designated critical habitat. Therefore, following the NRLMD would also provide effective management of critical habitat for lynx.

Sensitive Plants

1) Sensitive plant surveys were conducted in July and August 2009 for the proposed treatment areas and are documented in the Project File. No locations of sensitive plants were found within proposed treatment areas
2) In the event that sensitive plant species are found in any treatment area, measures will be taken to protect them. If these measures are not adequate to provide protection, the Forest Service may cancel or modify units within this fuel reduction project.

Effectiveness: Sensitive plants species have been monitored since 1988. Monitoring has included basic inventories to determine a species' distribution across the forest. Surveys

occur on all activities that involve ground disturbance or burning. Qualified individuals conduct the surveys.

Visuals

Proposed fuels management activities in the East Boulder have the potential to negatively affect the scenic integrity of the corridor in areas managed for a Visual Quality Objective (VQO) of Partial Retention. This primarily includes areas along the East Boulder, Dry Fork and the intersection with the Lewis Gulch Road. The area in the upper Lewis and Wright Gulches are managed for the VQO of Maximum Modification and are less visually sensitive.

For discussions and mitigations regarding the Forest Plan Standard for the Visual Quality of Partial Retention, the applicable viewsheds (referred to as "Seen Areas" or "SAs") are from these key observation areas:

The East Boulder Road

East Boulder Campground and

Green Mountain Trailhead and Dry Fork Trailhead.

SAs from private land are not a consideration but would most likely be mitigated from other key observation points.

To meet the Forest Plan Standard for Visual Quality of Partial Retention, landscape modifications due to fuels treatment should not be visually dominant within the Seen Areas one year after the treatments and associated project activities are completed. Seen Areas, for the purpose of these mitigations, imply those areas that are currently visible as well as those areas that become visible after treatment. By incorporating the following mitigations in this project, the proposed work would meet the Forest Plan standards for Visual Quality for areas managed for Partial Retention:.

1) Edges of units would be irregularly shaped or feathered to be predominantly natural appearing where possible.
2) Where units abut the East Boulder Road and Lewis Gulch junction, unit prescriptions and treatment would, where possible, continue on either side of the road to avoid abrupt visual transitions. Due to interspersed private ownership and previously treated areas, there are several areas that this is not possible.
3) Within one year following completion of treatment activities, corresponding unit boundary signs, markers, flagging, etc. should not be readily discernible from key observation points.
4) Where practical, slash piles, decks and landings would be located out of sight of key observation areas. Where they cannot be located out of sight, they should not visually dominate the area. Residual work, such as slash treatment and site cleanup would preferably be completed within one year following stand treatments.
5) A variety of individual trees, tree groupings and vegetation clumps of a range of sizes and shapes would be left to provide natural appearing vegetation patterns, spacing, age class, and stand diversity. In addition to those trees that would remain according to the fuel treatment thinning prescriptions, an additional

approximately 15-20% of many unit's overall acreage would be left in untreated clumps in many units (MA 11) to create these patterns.

a.) Favor leaving individual trees with larger crown ratios and crown diameters that would appear to be more naturally open-grown after treatment. Leaving spindly, small crowned individually standing trees would be avoided.

b.) Spacing between clumps and individual trees would be irregular and varied in size and shape.

c.) All clumps would be selected to have edges and interior configurations to be as natural appearing as possible.

6) Within key observation areas, dependent upon the angle of the slope, the viewing situation and the amount of residual vegetation and rocks, stumps would be cut to maximum of eight (8) inches in height, where ground surface conditions allow this to be done safely.

7) Treatment within and immediately adjacent to the East Boulder Campground should be sensitive to maintain what visual screening exists.

8) In areas of Maximum Modification (Lewis Gulch & units not visible from key observation points) treatment units can dominate the natural landscape but should look natural for a distance.

Effectiveness: Results of monitoring, when performed by qualified individuals from past timber sales on the Gallatin as well as other fuel reduction projects in the region demonstrate that the mitigations described above have been effective.

Recreation, Public Safety and Special Uses

Proposed fuels management activities in the East Boulder have little potential to negatively affect recreation opportunities. Incorporate the following mitigations in this project to protect recreation values and improvements:

1) All structures and improvements would be protected from damage due to project activities (Includes monitoring wells in Unit 11, and snotel site in Unit 17).
2) Fuel treatment, logging and log hauling would occur in a safe manner so as not to endanger Forest users.
3) Warning signs notifying Forest users of potential hazards would be used when fuel treatment activities are adjacent to East Boulder Campground, trailheads and Forest Service trails. Signs would be posted in both directions on roads and trails. If necessary, special orders would be drafted to temporarily close some areas or recreation sites to protect the public.
4) Holders of special use permits (such as powerline permittees and outfitters) would be notified prior to treatment in the vicinity of their authorization. Park Electric should be consulted regarding treatments in the vicinity of the 69 kV powerline.

5) No equipment use, staging or storage, nor the decking or piling of slash would occur within the campground, at trailheads or on Forest Service trails unless specifically approved.

Effectiveness: Results from past timber sales on the Gallatin as well as on other fuel reduction project in the Region have shown that these general design criteria and mitigations, combined with site specific marking have been effective in the protection of recreation facilities. Forest protection officers routinely monitor campgrounds, trails, signs, as well as other types of activities and/or restrictions on the Gallatin National Forest. Although there are always exceptions, restrictions have been effective on the Yellowstone Ranger District. The traveling public has come to recognize several components of traffic control plans by virtue of their past and continual use in timber sale contracts. Additionally, these provisions are monitored and enforced by the sale administrator and Forest Service Law Enforcement assigned to the area.

Roadless (the North Absaroka Roadless Area) and Private Land

Incorporate the following mitigations to prevent encroachment into the Inventoried North Absaroka Roadless Area No. 1-371 and private land.

1) Cutting unit boundaries adjacent to the IRA will be clearly painted and mapped to avoid IRA. No roads or skid trails would be constructed within the IRA. No treatment units or areas are located in the IRA.
2) Adjacent land owners should be notified and consulted regarding treatment adjacent to their property.
3) This project does not propose any treatments on private property. However, to avoid any unintentional treatment on private land, property boundaries adjacent to proposed units would be surveyed.

Heritage Resources

The following mitigation should be incorporated to protect the heritage resource:

1) An archaeologist and the sale administrator will properly flag off the known sites before work would begin in the site vicinity such that the sites would be avoided by any disturbing activities. Landing areas and skid trails would also be located outside of the heritage site(s) locations. The fuel reduction actions can easily be completed and still avoid the site as long as the operators and sale administrator know where the site is located.
2) If any additional heritage sites should be encountered during the project then disturbing actions should be halted immediately and an archaeologist contacted.
3) If for some unknown reason, a heritage site could not be avoided, then winter harvest methods described on p. 48 would be applied.

Effectiveness: Following these mitigation measures would allow for modification of the project should sites be found.

Road Maintenance/Rehabilitation

1) Temporary roads constructed or re-opened for project activity should be designed with minimum handbook standards necessary to accomplish the task, temporary

in nature, and effectively signed or gated to restrict public motorized use. Once the activity is complete, all of these roads should be effectively closed and re-vegetated. All new temporary, as well as re-opened roads not needed for future access would be recontoured, drained, and seeded. (GNF Travel Management Plan FEIS, Detailed Description of the Alternatives, Chapter 1-31.)

2) Forest roads utilized by this project that are vulnerable to spring break up damage should be restricted during this time.

Effectiveness: By adhering to the above mitigation measures, no adverse environmental impacts are anticipated related to roads. The above mitigation have been utilized successfully with numerous similar projects on the Forest

Project Monitoring

The Gallatin Forest Plan Monitoring Report for the years 2005-2007 are included in the Project File. The report includes the results of the monitoring procedures that Gallatin National Forest specialists have used to measure the effectiveness of various mitigation measures and design criteria associated with recent projects. The May 2008 vegetation council review of the completed units of the Main Boulder Fuels Reduction Project is also included in the Project File. This project, although quite a bit larger in scale has the same purpose and need and includes very similar treatments to those being prescribed in the East Boulder Project.

The East Boulder Fuels Reduction Project incorporates various mitigation and design criteria that have been monitored for effectiveness for the past several years. Forest Service personnel are responsible for the general implementation of the project including project design, contract preparation, contract administration, and assurance that mitigation measures are being carried through in treatment prescriptions, contract provisions, and are implemented on the ground. Contract administration will be conducted on a regular basis to assure acceptable contractor performance. The responsible official and/or as appropriate, resource specialists will review changes in contract requirements or provisions. Contract violations will be addressed promptly and will be resolved prior to further fuel reduction actions being implemented. All contract activities and correspondence will be documented and filed in the fuels reduction contract records. Post-harvest monitoring will be conducted and evaluated to determine whether required mitigation was effective at achieving desired results and will be utilized to determine any follow- up treatments that may be necessary.

Fuels

The project area will be monitored following the Gallatin National Forest fire/fuels monitoring protocol. This includes taking fuel plots and photo points in years 1, 3, and 5 following treatment.

Recreation, Safety and Special Uses

Regular field visits by contracting officer's representatives/sale administrators and by other district personnel will be done to verify proper installation and maintenance of warning signs in accordance with a traffic control plan and/or public involvement plan.

The District Ranger will contact owners of adjacent properties to attempt to coordinate the fuel reduction projects on the National Forest lands with those on adjacent private land.

Noxious Weeds

Monitor units and associated activity areas for new weed infestations both pre and post-activity for seven years. Treat infested areas within the project area until controlled.

Monitor and evaluate the success of revegetation of temporary roads, landings, and burn pile areas in relation to project plan.

Wildlife

The District wildlife biologist will monitor retention of conifer clumps, snags, and down woody debris retention during implementation of prescribed treatments (at a minimum) to determine whether the wildlife mitigation and snag retention prescriptions were effective in maintaining sufficient habitat to meet Forest Plan Standards.

For reporting mandated by the Northern Rockies Lynx Amendment, monitoring would be required to quantify the presence of lynx foraging habitat in all treatment units *prior to implementation* of fuel reduction actions. Monitoring post-treatment would help improve the accuracy of estimates for lynx habitat actually impacted by treatment. These estimates would be used to track Forest-wide impact on lynx habitat over time.

Water Quality/BMP's/Fisheries

At least one BMP review will be conducted for some of the larger treatment units as well as for temporary road construction and rehabilitation. The BMP review team will use the Montana BMP audit forms augmented by the additional BMP's and EA required mitigation for the East Boulder Fuels Reduction Project. The objective of the BMP review is to document BMP and SMZ rule compliance and to validate the erosion and water quality effects predicted by examination soil erosion, runoff and water quality response, and re-vegetation of understory burns. A BMP review report, including observations and recommendations, will be prepared by the Gallatin NF Hydrologist and submitted to the Yellowstone District Ranger.

Soils

None of the proposed mechanical treatment units had previous ground based harvest. Pre-project monitoring was completed in the summer and fall of 2009 using traverses as allowed in the Region 1 Technical Guide for Soils NEPA Analysis (USFS 2009) for treatment areas where past and existing activities do not include ground based activities. Additional soil profiles will be sampled in spring 2011 prior to harvest activities. Post-harvest monitoring will be undertaken in representative tractor harvested units as needed based on the judgment of the Soil Scientist for the Gallatin National Forest. Monitoring will be conducted using the Northern Region Soil Quality Monitoring Protocol (version current at the time). The timing of monitoring will be two years and five years after from the end of the contract period. The Soil Scientist for the Gallatin National Forest will be actively involved with implementation of the contract relative to soil related issues during harvest and will review all tractor harvest units and selected cable and hand thinning units in the field immediately after harvest.

In addition, soils will be monitored during the BMP reviews that would be conducted for some of the larger harvest units. The BMP review team would use the Montana BMP audit forms augmented by the additional BMP's for the East Boulder Fuels Reduction Project. The objective of the soils portion of the BMP review is to document compliance with the soils BMP and to validate soil effects related to maintaining soil productivity. A review report will be prepared by the Gallatin NF Soil Scientist and submitted to the Big Timber Ranger District upon completion of the review.

Air Quality/Smoke

Pile burning associated with this project will provide an opportunity to validate the particulate ($PM_{2.5}$) effects predicted by actually measuring $PM_{2.5}$ levels in sensitive areas. $PM_{2.5}$ will be monitored with a Data RAM, taking measurements at 15-minute intervals. Observations will be averaged for 1, 8, and 24 hour periods to compare to the SIS model predictions and the National Ambient Air Quality Standards. Pre-burn particulate background will be measured for approximately 6 hours before the burn and continued for a 24-hour period to include the burn, smoldering, any down valley drift, and post burn emissions.

Insect and Disease Infestations

Aerial detection surveys will continue to be conducted yearly by the Regional Forest Health and Protection and made available to the Forest in January of the following year. Ground observations will also occur at least every five years to determine progression of mountain pine beetle and Douglas-fir beetle attacks.

Roads

Monitoring of the temporary road construction and rehabilitation would be administered as part of the project contract, including closures of these roads to public use during project implementation.

Alternatives Eliminated From Detailed Study

In addition to Alternatives 1-3, three other alternatives were considered by the interdisciplinary team. However, during the preliminary analysis, the interdisciplinary team concluded that these alternatives did not warrant detailed analysis as they did not fully meet the purpose and need, were not feasible, or failed to comply with Federal or State laws, or Standards and Guidelines set forth in the Forest Plan or other administrative plans. Following are descriptions of these alternatives and the reasoning for dismissal from detailed analysis.

Alternative 4 –Additional Harvest in Steep Areas Adjacent to the East Boulder Road

There was concern that treatments should also occur on the steep slopes adjacent to the south side of the East Boulder Road in Sections 3 & 4 in order to maximize the effectiveness of meeting the purpose and need for the project. These areas mainly consist of dense, small diameter lodgepole pine stands in MA 8 & MA11. There are no existing roads that access these areas. In the current economy, we have been advised by the Regional office that helicopter harvest is not economically feasible and not to plan new projects that include this type of harvest. The cost and effects to resources of constructing the amount of temporary road that would be needed to utilize skyline cable harvest in these areas, coupled with the low value of the products that would be removed

make this option unreasonable as well. It was determined that the best option for treatment would be to tractor harvest and/or hand treat those areas immediately adjacent to the East Boulder Road and the major Park Electric powerline that services the East Boulder Mine, which is included in both Alternatives 2 & 3. Therefore, Alternative 4 was dismissed from further analysis.

Alternative 5 – Defensible Space Alternative (300 foot buffer)

Alternative 5 would create defensible space in areas adjacent to structures or developments. Concerns for the intensity and scale of changes to the current condition resulting from treatments in the East Boulder WUI would not be fully satisfied with Alternative 5. Vegetation would be modified within roughly 300 feet of existing structures. If implemented throughout the WUI, treatments would occur on less than ten percent of the area proposed with either Alternatives 2 or 3. Alternative 5 is too limited in scale to satisfy the purpose and need of the project, which is to increase public and firefighter safety and extend the potential time available for evacuation in the event of a wildfire.

The Sweet Grass County Community Wildfire Plan concluded that, following numerous years of successful fire suppression efforts and the resulting increases in vegetation and fuels, the East Boulder corridor is at high risk during periods of severe fire weather. Fire behavior specialists concluded that an ignition during severe fire weather would seriously threaten life and property. Treating only areas adjacent to structures and developments would neither break fuel continuity nor reduce fuel volumes sufficiently to buy time to evacuate or increase personal safety within the WUI.

The objective of the project is not to protect private structures. However, treatments that reduce the likelihood of an uncontrollable wildfire will, in turn, aid in protecting structures. Alternative 2 & 3 encompass the benefits of Alternative 5 and much more. For this reason, Alternative 5 was dismissed from further study.

Alternative 6- Include Treatments in the Adjacent Roadless Area

The interdisciplinary team looked at opportunities to include treatments in the roadless areas in Sections 32, 33, 3 & 2 that lie adjacent to the north side of the East Boulder Road. Similar to the conclusions made for Alternative 4, we have been advised by the Regional office not to include helicopter harvest units in projects that the FS is currently planning for economic feasibility reasons. If helicopter treatment methods were not utilized, any mechanized harvest in these areas would require crossing the East Boulder River. The East Boulder Mine has several water quality monitoring sites located along this portion of the river, further complicating the issue. Much of the area immediately adjacent to the East Boulder Road is privately owned and would not be available for FS treatment and there are currently several fairly open south facing meadows interspersed on these slopes. For these reasons, Alternative 6 was dismissed from further consideration.

Chapter 3-Affected Environment and Environmental Consequences

Introduction

Chapter 3 discusses the environmental effects that would occur with implementation of the alternatives described in Chapter 2 and forms the scientific and analytical basis for comparing the environmental effects of each alternative. The direct, indirect, and cumulative effects of each alternative are presented by issue. Also included are discussions of past, present, and reasonably foreseeable future activities that were considered in the cumulative effects analysis for the various issues.

The impacts discussed in this chapter are for those issues considered to be factors in formulating the decision. For each "key" issue, this chapter addresses: a) the affected environment, b) direct and indirect effects, and c) cumulative effects are described in full. Chapter 3 includes a summary of effects for those issues that were not considered to be "key" factors in making a decision or did not drive an alternative or could be effectively mitigated and dismissed. The specialist reports (Project File) contain the complete discussion/analysis regarding these issues and can be obtained upon request. Additional information regarding resource issues can also be found in the Project File. A discussion of the various alternatives; compliance with the Gallatin Forest Plan and applicable laws, regulations, policies, and other direction is provided for all issues and alternatives in Chapter 3.

Some of the effects discussed in this chapter are complex and not easily quantified. In regard to this, it should be kept in mind that many of the values presented are based on professional analysis or are modeled predictions of the effects. The actual effects may not occur exactly to the degree presented. More important than the exact effects, is the comparison of effects between the alternatives, the current condition Alternative 1 (no action), Alternative 2 (corridor units), and Alternative 3 (corridor units & Lewis Gulch units), as predicted by models and analytic projections (See Maps 3 & 4).

Past Present and Reasonably Foreseeable Activities That May Contribute to Cumulative Effects

Consistent with the Council for Environmental Quality (CEQ) guidance, past, present, and reasonably foreseeable activities are considered in the cumulative effects analysis for each resource area relative to the specific potential future effects of the proposal. For each of the "key" issues discussed in this chapter, cumulative effects that pertain to the issue are presented. Because the project's direct and indirect effects vary in time and space, each resource issue has a defined specific cumulative effects analysis area (spatial boundary) and timeframe (temporal boundary) that is pertinent to the specific resource and issue being considered. The resource discussions evaluate the degree to which past, present, and future actions influenced or will influence the affected environment. Cumulative effects for each of the "other" issues are summarized in Chapter 3 and fully addressed in the specialist reports and cumulative effects worksheets (Project File).

The activities described below occur on lands in and around the project area and may contribute to cumulative effects. These are activities that have occurred in the past, present, or may occur in the foreseeable future. Future activities, including planned projects, may or may not occur. Not all activities pertain to every resource issue, so they will not all be addressed in the effects analysis for every issue.

General Description of the Area

The East Boulder project area is located in the Absaroka Mountain Range in the southern portion of the Big Timber unit of the Yellowstone Ranger District in Sweet Grass County, Montana and lies adjacent to the North Absaroka Inventoried Roadless Area. The East Boulder Road branches off of the Main Boulder highway approximately 20 miles south and west of Big Timber and is a highly maintained gravel road that follows the East Boulder River from its confluence with the Main Boulder River to the East Boulder Mine complex. The first 6-7 miles of this road are adjacent to private lands and an additional 5-6 miles of the road extend from the Gallatin National Forest boundary to the East Boulder Mine (project area) with areas of private ownership interspersed. The approximately 4,000 acre project area consists of the East Boulder River Corridor within the Gallatin National Forest boundary. The project area is considered to be the WUI boundary (high risk area) as defined by the Sweet Grass CWFPP (See Map 2).

Elevations within the Analysis Area (AA) range from 4800' to 7100' and topographic features are typical of mountainous regions, with rolling hills to steep terrain with saddles and ridges. No major federal or state routes lie within the project area. The main access to the project area the county maintained, East Boulder Road. Within the project area, there are approximately five year round residences with several out-buildings and barns. In addition to the rural residences, at the end of the East Boulder Road is the East Boulder Mine, a division of the Stillwater Mining Corporation, which currently has approximately 300 employees. Paralleling the East Boulder Road is a high capacity transmission powerline (Owned by Park Electric), which provides a critical electrical source for mine operations. These operations range from everyday power usage in office settings to air compressors and scrubbers that provide breathable air several miles below the surface to the actual mining operations.

The areas included for treatment are located along the one-way in/out East Boulder Road #205 and the Lewis Gulch Road #6644. All units are located inside the roaded portion of the East Boulder drainage. No treatment activities are proposed in the adjacent inventoried roadless area (IRA). Fuel management treatments would begin at the Forest boundary, just north of the East Boulder Campground, and extend for approximately six miles east-southeast to the Dry Fork area, which is adjacent to the East Boulder Mine. Treatments along the Lewis Gulch Road would begin at the East Boulder Mine and extend to the southwest to the end of the Lewis Gulch Road. (Refer to Map 4). The project area is heavily utilized for mining operations and to a lesser degree by recreation users. The analysis areas for the issues addressed in this EA vary by resource and consist of a mixture of National Forest System (NFS) and interspersed private lands. The spatial and temporal boundary for each issue is described as part of the analysis for that specific issue.

Historical Activity and Uses

Past activities (50-100 years) within the project analysis area include fire suppression, timber harvest and associated road building, recreational activities, and mining operations. Fire suppression has altered plant communities' biomass production, species composition, and diversity. Conifers have encroached into previously non-forested areas. Noxious weeds were introduced and infestation levels have increased in some areas. Past logging and road building have also contributed to altered habitats in portions of the analysis area. Wildlife management of big game populations by permit has evolved to present day hunting permits, seasons, and protections. Mining operations by the Stillwater Mining Corporation's East Boulder Mine are permitted and are ongoing since the mid 1990s.

Major fires occurred in the project area in the late eighteen hundreds. More recent fires in the project vicinity include the 200,000 acre Derby Fire and 28,000 acre Jungle Fire in August of 2006, and the 100 acre Snowslide Fire in 1990 (See Map 9). The majority of the past timber harvesting in the project area occurred in the 1980s through the 1990s. Table 5 below and Map 8 provide a summary of these activities.

Table 5-Past Timber Harvest Activities in the Project Area

Sale Name	Date Harvested	Acres	Type of Harvest
Lucky Logger	1983	16	Even-aged
Rocky Remains	1984	15	Even-aged
East Boulder Post & Pole	1986	6	Even-aged
East Boulder Timber Sale	1987-1989	322	Even-aged
East Boulder Salvage	1991	15	Even-aged
East Boulder Wildlife	1992	13	Even-aged
Lewis Gulch Ips	1996	77	Even-aged
East Boulder Wildlife	1998	18	Even-aged
Lewis Products	1998	7	Even-aged

Other tree cutting activities that have occurred on national forest land in the project area include personal use firewood gathering. Some of these firewood areas are included with the past timber harvest areas. In 1996 there was a 30 acre personal use firewood area created. Other personal use fire gathering has occurred and is still occurring randomly in small amounts through the drainage. It is likely that additional firewood cutting will occur in the future as the current mountain pine beetle infestation becomes more widespread in the drainage.

Other permanent land clearing associated with road relocation and permitted mining operations have occurred over the past twenty five years. This clearing is outlined in Table 6 below and is shown on Map 8.

The East Boulder Road was relocated in 1983 to its current location. Permanent land clearing was associated with the road relocation. Park Electric Company constructed a major overhead power line to service the East Boulder Mine. Power line right-of-way

clearing occurred in 1996. The power line right-of-way was widened in 2005 for safety purposes.

Permanent land clearing associated with operations of the Stillwater Mining Corporation's East Boulder Mine occurred in 1997, 1999, 2007 and minor additional amounts of clearing will continue to occur as a part of permitted mining operations.

Permanent land clearing for the mine includes the mine site, buildings, storage areas, parking areas, the tailing pond, etc. A small amount of land clearing associated with the Derby Fire in 2006 also occurred. These activities are outlined in Table 6 below.

Table 6-Land Clearing for Road Relocation & Mining Operations

Name	Dates Harvested	Acres	Harvest Type
East Boulder Road Relocation	1983	85	Permanent Land Clearing
Power line Right of way Clearing	1996	49	Permanent Land Clearing
Mine Products Settlement	1999	148	Land Clearing
East Boulder Mine	2007	5	Land Clearing
Mine Deck 1	1997	1	Land Clearing
PGM Post & Pole Settlement	1990	17	Land Clearing
East Boulder Products	1999	12	Land Clearing
Widening of Power line Clearing	2005	50	Permanent Land Clearing
Emergency Wildfire Clearing	2006	7	Land Clearing

A wind event occurred in the project vicinity in November of 2008 in Fuller Gulch causing a large area of blow down timber. The blow down is located in the inventoried roadless area adjacent to the project area and has not been salvage harvested. See Table 7 below.

Table 7-Wind Event in the Project Vicinity

Name	Occurrence	Acres	Status
Fuller Gulch Blowdown	2008	80	Not Harvested

Current Activity and Uses

Private land exists within the Forest Service administrative boundary in several locations within the analysis area. These private lands are mostly old homesteads and do not contain any large sub-divisions. There has been some recent fuel reduction activity on the private parcels that are interspersed along the corridor. The Fuels Committee of the Boulder River Watershed Group and the Forest Service have been providing homeowner

information regarding defensible space, encouraging rural homeowners to reduce vegetation on private parcels and within subdivisions.

The Long Mountain Fuel Reduction Project includes four large prescribed burns that are either prepared for burning and/or have been completed to the north east of the project area. In 2008, 550 acres were burned in the Dry Fork prescribed burn. In September of 2009 an additional 2300 acres were burned in the Dry Fork. The Elk Creek Prescribed Burns (two burns totaling approximately 300 acres) have been prepped and are ready to treat (2010) when there is an appropriate burning window and fuel condition are within the prescription for burning. All of the Elk Creek units are located in a different, but adjacent drainage to the project area.

The East Boulder corridor is not a heavily used recreation area. The East Boulder Campground lies within Unit 2 of the project and is scheduled for hand treatment to remove some dead and dying trees and ladder fuels. The campground is very small (3 sites) and does not receive heavy use. The Green Mtn. trail lies across the road from the campground and receives only light usage. Some amount of fishing occurs in the East Boulder River in the vicinity of the project, but usage is fairly light. The heaviest amount of recreational use of the area occurs as motorized use on the Dry Fork Road. Hunting is popular in this area including the use of four wheel drive vehicles, ATVs, and snowmobiles. There is one hunting outfitter base camp that is permitted for the Dry Fork area.

The October 2006 Gallatin Forest Travel Plan decision included some changes to recreational use of the area. Passenger cars, 4 wheel drive vehicles, ATV, and motorcycles are restricted to existing FS system roads and/or FS authorized or permitted roads. Snowmobiles are not restricted except on East Boulder Road. For more detail on allowable use see the Gallatin National Forest Travel Management Plan FEIS (10/2006), Detailed Description of Decision, pp. II-2-59-II-62.

Noxious Weed Control is an ongoing activity in the project area. Park Electric is responsible for annual treatment of the weed infestations adjacent to the power line (right-of-way clearing areas) that services the East Boulder Mine. Stillwater Mining Company is responsible for annual weed treatment at the East Boulder mine site (clearing and structure areas). The Forest Service and Sweet Grass County treat noxious weed infestations along the East Boulder Road. This type of weed treatment work is expected to continue during and for several years after project related activities are completed.

No major improvements are planned for forest and county roads in the project area at this time. Roads will likely to be maintained at about the current level. The East Boulder Road is graded on a regular basis and is plowed all winter to provide access for workers and deliveries to the East Boulder Mine. The East Boulder Mine currently employs approximately 300 employees who travel the East Boulder Road daily in buses. There are numerous delivery vehicles that also travel the corridor year long. A speed limit of 35 miles per hour is strictly enforced on the county portion of the East Boulder Road (to the East Boulder Campground) as part of the East Boulder Mine plan of operation.

The footprint of the mine and tailing pond is regulated by the plan of operations that was approved in the East Boulder Mine EIS (1996). There will be minor changes to cleared areas with the various phases of mining operations.

Reasonably Foreseeable Activities and Uses

Weed treatments will continue and likely increase over the next several years due to harvest related mitigation. Recreation in the form of camping, hiking, fall hunting, trail riding, and backcountry driving will likely continue in the area.

Additional prescribed burning in the Elk Creek drainage that is adjacent to the NE portion of the project area is planned over the next 2-5 years, but it would be located in a different drainage, so any cumulative effects related to these potential prescribed burns would be expected to be minor.

It is unknown how much additional thinning/fuel reduction may occur in the future on the adjacent private lands. There is no reason to believe that any of the landowners intend to split up or create subdivisions on any of the private parcels within the project area.

There is a proposed project by BLM and the Fuels Committee of the Boulder River Watershed Group that would create a fuel break and provide for structure protection on the west facing slopes near the upper reaches of Green Mountain in Section 24. This fuel break would be located approximately 2 miles NW of Unit 1. The proposal would use the existing road system to develop a fuel free zone or thinning for a distance of one chain on both sides of the road. The proposal also includes treatment and prescribed burning of an area to the east of the ranch on BLM land to develop a safe area between BLM land and the Beaver Meadows Ranch.

Mining operations will continue. The footprint of the mine and tailing pond is regulated by the plan of operations that was approved in the East Boulder Mine EIS (1996). There will be minor changes to cleared areas with the various phases of mining operations into the future.

Gallatin National Forest Plan-Management Area Direction

This document tiers to the Final Environmental Impact Statement and Land and Resource Management Plan (Forest Plan) for the Gallatin National Forest (Record of Decision signed 9/23/87). The Forest Plan provides direction for all resource management programs, practices, uses, and protection measures for the Gallatin National Forest. The Forest Plan subdivided the forest into 26 management areas (MA's). These areas are described in detail in Chapter 3 of the Forest Plan (FP, pp. III-2 through III-73).

The West Bridger/Carey Gulch Allotments are located in eight management areas including MA6 (dispersed recreation), MA7 (riparian), MA8 (timber management), MA10 (range/timber), MA11 (timber/livestock), MA12 (wildlife/dispersed recreation), MA16 (livestock), and MA17 (livestock/wildlife). The Forest Plan uses management areas to guide management of specific National Forest lands within the Gallatin National Forest. Each management area (MA) provides for a unique combination of activities, practices, and uses.

Management Area 6 (MA6)-Dispersed Recreation: These areas are generally large blocks of undeveloped land with a trail system or roads passing through that provide for dispersed recreation activites (FP. p. III-17). Management in MA6 allows for livestock grazing to the range resource, including the development of range improvements and forage improvement projects. Both action alternatives are consistent with direction for MA6.

Management Area 7 (MA7)-Riparian: These are riparian management areas (FP, p. III-19). Direction for MA7 includes livestock grazing as long as concentrations of livestock are kept at a level compatible with riparian dependent resource needs through development of pasture systems and associated improvements. Both action alternatives have been designed and include mitigation and monitoring that will protect the soil, water, and vegetation that riparian dependent species rely on.

Management Area 8 (MA8)-Timber Management: These areas consist of lands, which are suitable for timber management (FP, pp. III-24 through III-26). Management goals for MA 8 allow for livestock grazing as long as it is compatible with timber goals for the area. Conifer regeneration should be protected from the effects of grazing. In these allotments the majority of the past harvest units are not located in the suitable range for livestock and recent surveys of the area have not noted significant grazing damages in any of the plantations.

Management Area 10 (MA10)-Range/Timber:- These areas contain open grasslands, which provide forage for livestock interspersed with suitable timberlands (FP, pp. III-30 through III-32). Management goals are to improve range management to optimize livestock grazing while coordinating with timber management to ensure tree regeneration after harvest. Both action alternatives are compatible with this direction.

Management Area 11 (MA11)-Forested Big Game Habitat: - These areas consist of forested big game habitat (FP, pp. III-33 through III-36). Management goals for MA 11 include livestock grazing as long as big game forage needs are met. Project design and mitigation has been incorporated that

Management Area 12 (MA12)-Wildlife/Dispersed Recreation - These areas provide important habitat for summer of winter wildlife use in a variety of terrain and vegetative types and also offer dispersed recreational opportunities. (FP, pp. III-37 through III-39). Management goals for MA 12 include:

Maintain and improve the vegetative condition to provide habitat for a diversity of wildlife species.

Provide for a variety of dispersed recreational opportunities

Provide forage for livestock consistent with goal 1.

In MA 12 the standards for range include:

On big game winter range, meet big game forage need before making forage allocations for livestock.

Base allocation of big game summer range forage on the range allotment analysis.

Range improvements may be scheduled when identified in the allotment management plan.

Management Area 16 (MA16-Range/Open Grasslands:- These areas have open grasslands interspersed with nonproductive timber lands on slopes generally less than 40 percent. They contain the most productive and heavily used portions of range allotments (FP, pp. III-50 through III-51). The goal of MA 16 is:

Maintain or improve vegetative conditions and forage production for livestock use.

In MA 16 the standards for range include:

Implement intensive management systems to utilize the range resource

Schedule forage improvement projects, such as sagebrush burning and poisonous plant control

Schedule structural improvements when identified in approved allotment management plan

Management Area 17 (MA17)-Range/Big Game:- These areas consist of grasslands or nonproductive forestlands on slopes less than 40 percent that are suitable for livestock grazing and contain important big game habitat. They contain some of the most productive and heavily used portions of range allotments (FP, pp. III-52 through III-53). The goal of MA 17 is:

Maintain or improve vegetative conditions and forage production for livestock and wildlife usage.

In MA 17 the standards for range include:

On big game winter range, big game forage needs are to be met before making forage allocations to livestock.

Base allocation of big game summer range forage on range allotment analysis

Schedule structural improvement when identified in an approved allotment management plan.

Schedule forage improvement projects, such as sagebrush burning and poisonous plant control

Applicable Federal Laws

Federal Laws

Based on the issues identified in Chapter 2, the principle Federal Laws applicable to this proposal include the National Forest Management Act of 1976, National Environmental Policy Act of 1969, Executive Order (03 February 1999), which directs Federal Agencies to prevent and control invasive species, Federal Noxious Weed Act of 1974 (PL 93-6329), Endangered Species Act of 1973, Migratory Bird Treaty Act (16 USC 703-711), Executive Order 12898, Presidential Executive Order 12962 (June 1995), Multiple Use Sustained Yield Act of 1960, National Historic Preservation Act (as amended 1992), the Clean Air Act, and the Clean Water Act. Compliance with these laws and other State Laws and guidance are discussed in this chapter. Laws that are not specifically related to a particular issue are outlined below. Compliance with laws directly related to resource issues are outlined following the effects analysis for that resource.

National Forest Management Act of 1976 / Gallatin Forest Plan

Timber production on Federal land is a use allowed by several acts of congress. It is a part of the mission of the Forest Service to manage the timber resource on a multiple-use/sustained yield basis. The National Forest Management Act (NFMA) restricts timber production to lands classified as suitable for timber management (36 CFR 219.14). NFMA also set certain management requirements for Forest Plans to meet, pertaining to conservation of such resources as soil and water and plant and animal diversity (36 CFR 219.27) (Novak 2000a). The Gallatin Forest Plan standards are established to meet these requirements.

In accordance with NFMA, the proposed timber harvesting would occur only on suitable timberland. Other NFMA requirements would also be met. Both action alternatives would be consistent with NFMA and management direction provided by the goals, objectives, and standards of the Forest Plan.

National Environmental Policy Act (NEPA) of 1969

This Environmental Assessment (EA) was prepared in compliance with the National Environmental Policy Act (NEPA) and provides information to determine whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI). The purpose of the NEPA process is to help public officials make decisions that are based on an understanding of environmental consequences, and to take actions that protect, restore, and enhance the environment (40 CFR 1500.1(c).

Direct, Indirect, and Cumulative Effects

The Council on Environmental Quality (CEQ) regulations implementing NEPA require that federal agencies consider three types of actions: (1) connected actions, which are two or more actions that are dependent on each other for their utility; (2) cumulative actions, which when viewed with other proposed actions may have cumulatively significant effects, and should therefore be analyzed together; and (3) similar actions, "which when viewed with other reasonably foreseeable or proposed actions, have similarities that provide a basis for evaluating their environmental consequences together." (40 CFR 1508.25(a))."

The agency is not required nor is there a benefit to a rendering of all effects from all actions that have impacted a particular resource regardless of whether the proposal under consideration contributed an additive effect. Recent guidance from the Council of Environmental Quality (CEQ), Guidance on the Consideration of Past Actions in Cumulative Effects Analysis, (6/24/2005 states "Generally , agencies can conduct adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions. "The environmental analysis required under NEPA is forward-looking, in that it focuses on the potential impacts of the proposed action that an agency is considering. Thus, review of past actions is required to the extent that this review informs agency decision making regarding the proposed action. This can occur in two ways. First, the effects of past actions may warrant consideration in the analysis of the cumulative effects of a proposal for agency action. CEQ interprets NEPA and CEQ's NEPA regulations on cumulative effects as requiring analysis and a concise description of the identifiable present effects of past actions to the extent they are relevant and useful in analyzing whether the

reasonably foreseeable effects of the agency proposal for action and its alternatives may have a continuing, additive, and significant relationship to those effects."

Cumulative effects assessment requires consideration of past, present, and reasonably foreseeable events. Vegetation altering processes can have long-lasting effects on various natural resources. Past impacts are reflected in the current baseline vegetation used for analysis of the proposed action alternatives. The analysis of potential future actions and events was limited to those activities currently planned, proposed, or contemplated in the analysis area. There is no way to reasonably predict what may occur beyond these known potential events. Further, any future federal actions in the project area that are not being considered at this time, will undergo a separate analysis, based in part on an understanding of the consequences to the various resources incurred by the proposed project. A summary of past, current, and reasonably foreseeable activities is included below. A detailed description of these activities can be found on pp. 63-68 of this document.

Past and current activities in the East Boulder corridor include past harvesting in the 1980s and 1990s of approximately 570 acres, clearing for the relocation of the East Boulder Road in 1983, Park Electric power line clearing for the major power line serving the corridor in 1996 and widening of the clearing in 2005, clearing for the East Boulder Mine in 1999 and minor amounts of ongoing land clearing as specified in the East Boulder Mine operational plan. The area currently has personal use firewood gathering as an ongoing activity. There has been and will likely continue to have fuel reduction activities on the private parcels that are interspersed in the drainage.

Noxious weed treatments are conducted annually along the power line, at the mine site, and along portions of the East Boulder Road. This work will likely continue indefinitely.

The East Boulder Road is graded and plowed on a regular basis to provide access for workers and delivery services to the East Boulder Mine.

The corridor is not a heavily used recreation area, but contains one small campground (3 sites), and two Forest Service trails. Hunting and the use of four wheel drive vehicles, ATVs, and snowmobiles are popular seasonal activities in the Dry Fork area.

It is unlikely that there will be other vegetation treatment projects in the analysis area on National Forest system lands in the foreseeable future. Fuel reduction on private property will likely continue for several years. Other reasonably foreseeable actions include implementation of the recent decision for the Gallatin National Forest Travel Management Plan.

Affected Environment, Direct, Indirect, & Cumulative Effects for Key Issues

Issue 1 - Fuels

There is the potential for a wildland fire event to threaten public and firefighter safety within the East Boulder River Analysis Area. Years of successful fire suppression and subsequent lack of low intensity stand maintenance fires have resulted in changes to forest structure, tree densities and associated fuel characteristics within the proposed project area.

Affected Environment

The overall character of the East Boulder project area is dictated primarily from its location within a central Southwestern Montana biological environment. The East Boulder drainage is located in the Absaroka Mountain Range; these overriding geological features dictate elevation zones, variations in topography and climate regimes. These general components along with other determinants such as temperature, effective precipitation and hydrologic regime tend to dictate the vegetative components of the area.

The dominant cover type of Lodgepole pine and Douglas fir can generally be found on the relatively drier sites. Often, the moist sites may favor Englemann spruce and subalpine fir. The park and meadow complexes are dominated by grass and sagebrush communities. Riparian complexes (Seeps, Springs, Fens and Willow Carrs) are interspersed throughout. Forested stand conditions can be described, in the non-managed stands, as mature forests with active insect and disease activity. Most stands in this cover type had a natural establishment following the last stand-replacement disturbance, such as fire, insect outbreak or both.

Nearly all of the East Boulder Project Area is forested by densely populated, closed tree canopy stands of lodgepole pine, Douglas-fir and subalpine fir/spruce. Forest habitat types for the Project Area are categorized into six fire habitat type groups based on Fischer and Clayton (1983). The dominant fire habitat types consist of: FG 0 (scree, rock, meadow, grass ridges); FG 4 (warm, dry Douglas fir habitats); FG 6 (moist, Douglas-fir habitats), FG 7 (cool habitats dominated with lodgepole pine), FG 8 (dry, lower subalpine habitats), and FG 9 (moist, lower subalpine habitats). Table 8 provides a description of the mean fire return interval and historical fire type associated with each fire habitat type group.

Table 8-Fire Habitat Type Groups in the East Boulder Project Area

Fire Habitat Type Group	Fire Regime (Mean fire interval *)	Fire Type
0	no estimate available	These habitats do not burn easily or very often. Can serve as anchor points and firebreaks in most cases.
4	5 to 20 yrs (occasionally > 20 years)	Variable depending on site condition and time between disturbance cycles; frequent disturbances, ground fire; less frequent disturbances ground fire to a mixed severity (fire acted as a thinning agent); fuel loadings range from 13 to 25 tons/acre.
6	42 yrs	Variable depending on site condition, stand history and successional stage; ground and mixed severity fire (fire is a thinning agent); fuel loadings average 15 tons/acre and greater.
7	50 yrs < 7600', 150 –200 yrs > 7600', 300-500 yrs	For periodic thinning ground fires. For stand-replacing fire events; fuel loadings average 15-25 tons/ac. and higher.
8	75-120 yrs same as FG 7	For periodic thinning ground fires. (Information lacking for habitats east of the Continental Divide, per Arno 1980) For stand-replacing fire events.
9	90-130 yrs 300-400 yrs	For periodic thinning ground fires. Mixed severity and stand-replacing: depends on stand condition and species composition; fuel loadings average greater than 20 tons/ac.

*(Mean Fire Return Interval, based on Fischer & Clayton, 1983)

Methodology for Fuels Analysis

Landscape files for the project area were generated out of Wildland Fire Decision Support System (WFDSS) utilizing Landfire's Rapid Refresh material. Scott and Burgan's standard fire behavior models were selected as the fuel model identifier, which were later run using Farsite and NEXUS. Since Landfire data sets are remotely projected, the individual units were site visited and field verified to be accurate.

A landscape file was generated from Wildland Fire Decision Support System (WFDSS) utilizing Landfire's Rapid Refresh information set for the analysis area to represent the existing vegetative condition. The Landscape file was then imported into Farsite as Scott and Burgan's Standard Fire Behavior Models with randomly generate fire ignitions. These random ignitions were allowed to burn for 48 hours to generate potential fire behavior characteristics within the analysis area. The landscape files were then modified to represent post treatment conditions within the units and run again using random ignitions.

Fuel Model 161 (Project File)

For the landscape file 113877.lcp the fuels models in the treatment units were changed to fuel model 161 TU1, Low Load Dry Climate Timber-Grass-Shrub from model 165 TU5, Very High Load, Dry Climate Timber-Shrub to reflect the post treatment conditions and subsequent fire behavior changes. In addition to the model changes, the canopy cover was also changed to forty percent for all stands that had a greater than forty percent existing canopy.

Fuel Model 184 (Project File)

For the landscape file EBoulder_284.lcp the fuel models in the treatment units were changed to fuel model 184 TL4, Small Downed Logs from 165 TU5, Very High Load, Dry Climate Timber-Shrub to reflect post-treatment conditions. The canopy cover was also changed to forty percent for all stands that had greater than forty percent pre-treatment canopy cover.

Weather and Wind Files

Weather and wind files came from the Derby Mountain weather station using 2006 weather data. Weather and wind data were extracted through KC-Fast and interpreted in Fire Family Plus, then exported into readable files for use in Farsite. The period of weather data was from June 1 through August 24. The burn period file was set to the hours of 1300 through 2100 for the days of the simulation.

Simulation Settings

The simulation was run for 48 hours from July 27 through July 28. The parameters for the simulation are as follows:

- Time Step - 2 hours
- Visible Step - 2 hours
- Perimeter Resolution - 60 meters
- Distance Resolution - 60 meters

The fire behavior options used in the simulation were:

- Crown Fire was enabled in all runs using the Scott and Reinhart method.
- Ember from torching trees were used
- Spot fire growth was set to five percent ignition frequency and zero delay time was used in the "spot simulations”.
- Fine dead Fuel moistures were conditions starting June 1.

It is important to note that the models used to represent the effects of the different treatment alternatives rely on several assumptions and limitations. Nexus assumes a constant state of weather and topography. It also assumes that fuels are both vertically and horizontally arranged continuously over the project area. In addition fire predictions were only predicted at the flaming front. As it pertains to weather, weather forecasts were extrapolated out of KCFAST and have no known quality control factors. It is assumed that historical weather patterns would persist and changes to climate, associated to global warming factors, were not considered as part of this analysis. It was also assumed that grasslands within the project area would not likely be adversely affected by fire events, so only areas where forest structures exist were examined.

Analysis Area Boundary

Spatial boundary: The overall affected geographic area, where the results are expected to be the most valid, are those areas directly adjacent to the existing infrastructure along the East Boulder Corridor. The infrastructure in question is the high voltage power transmission line, the East Boulder Mine, private residences, and the East Boulder Road, which provides ingress and egress to the area.

Temporal boundary: The results of the proposed treatments are expected to remain valid for a period of approximately twenty to thirty years, when through the process of natural stand succession, seedling conifers will re-establish and grow gradually increasing vertical and horizontal fuel densities. At that point, further examination of fuel conditions will be required, but that is outside the scope of this analysis.

Direct/Indirect Effects

Alternative 1

Alternative 1 (No Action) would have no effect on changing the fire related effects of an uncontrollable crown fire from what currently exists within the East Boulder River corridor. Additionally, there would be no change to the distribution of fuel loadings by surface area to volume ratio, relative compactness, size class, and tons/acre, as well as the vertical and horizontal continuity/arrangement within the existing fuel bed, which are indicators of potential flame lengths, fire intensity, rates of spread, and crown fire activity. Without hazardous fuel reduction, forested areas would continue to follow their natural rates of succession, becoming denser and ultimately climaxing to a stand replacing fire event. There would be little if any space between the crowns of individual trees. A wind-driven fire would be expected to transition quickly from the ground into the forest canopy, resulting in almost total stand replacement. Fire behavior of this kind - an independent crown fire - is the most resistant to suppression control efforts of any of the associated fire types.

Without treatment, it would be expected that the fuels within the analysis area will continue to follow their normal succession. This course will most likely lead to a climax disturbance that will eventually result in stand replacement. The suppression strategy would continue to be direct suppression with the option to 'control and confine' due to the location of the East Boulder Mine, as well as the use of the East Boulder corridor for recreation and private land ownership patterns (FP, 1987). As such, risks to public and firefighter safety would not be changed from the current situation.

All of the modeling for this project was modeled under current and/or past recorded weather events. Historical weather data was extrapolated out of KCFAST data archive (FAMWEB 2009). It was assumed that historical weather patterns would persist and changes in climatic conditions were not considered as part of this analysis. However, if warming temperature trends continue to occur, it becomes more obvious that the effects of unwanted fire ignitions would continue to be more frequent and intense. The Farsite Fire Model, when run for "Crown Fire", in the pretreatment condition shows that approximately seventy percent of the area is available to burn as a crown fire. When the model was run for the "Time of Arrival" it indicated that the majority of the infrastructure, including the evacuation route within the corridor, would be compromised in five to eight hours following the ignition. It is important to note that this time frame is an approximate variable, due to the randomness of individual fire starts within the analysis area and the proximity to infrastructure.

The suppression strategy with any alternative would continue to be direct suppression with the option to 'control and confine' due to the location of the East Boulder Mine as well as use of the East Boulder corridor for recreation and private land ownership patterns (FP, 1987). Since many of the stands in the drainage are heavily stocked with older trees, and experiencing mountain pine beetle infestations, the incidence of tree mortality is expected to increase over time with no action (Alternative 1). This would lead to an increase in the rate of accumulation of standing and down dead fuels available to support a fire, with a resulting increase in the probability that, once ignited, a wildfire would have sufficient material to burn that it would quickly escape attempts to contain it. Using NEXUS, the average rate of spread for an active crown fire and surface fire under the existing conditions was found to be 1 to 4 miles per hour. With the additional fuels expected to accumulate without treatment, the rate of spread would be expected to increase proportionately to the additional fuels.

Direct and Indirect Effects

Alternative 2 - Corridor Units

The units associated with Alternative 2, when modeled for post-treatment effects would meet the purpose and need of the project. Modeling of the post-treatment condition demonstrates a reduction in rate of spread, flame lengths, and fire intensities that would increase the time of arrival to critical infrastructure. The NEXUS fire model was used to produce Tables 9 & 10, which represent the change in expected fire behavior following implementation of the proposed unit treatments.

Table 9-Alternative 2 Pre (TU5) and Post-treatment (TU1) Fuel Modeling

Outputs	Existing Condition	Post Condition (Leave Clumps)	Post Condition (Non-Leave Clumps)	Percent Change (Leave Clumps)	Percent Change (Non-Leave Clumps)
Fire Type	Active Crown	Conditional Crown	Surface Fire		
Rate of Spread (Chains/Hour)	126.8	126.8	3.07	0.00	-97.58
Flame Length (Feet)	122	88.6	2	-27.38	-97.74
Fire Line Intensity (BTU/Ft^2)	15057	9324	26	-38.08	-99.72
Crowning Index (Miles/Hour)	4.8	10.5	0	-45.71	No Crown Potential

It would be expected that surface rate of spread for the post-treatment activities would not decrease. The lack of spread rate reduction is mostly attributed to the opening up of a stand structure prior to a fire burning, which would allow for smaller material, such as forbs and grasses, to grow on the forest floor in the remaining stand structures. It is important to note that to achieve the overall purpose and need, it is not the rate of spread that is important, but rather intensity of the fire as it reaches evacuation corridors and existing infrastructure. That being said, Table 10 displays that both the fireline intensity and flame lengths demonstrate a reduction from the existing condition to post-treatment conditions. The model indicates an almost ninety-nine percent reduction in fireline intensity while the flame length demonstrates a ninety-seven percent reduction. The crowning index, the wind speed required to initiate and sustain a crown fire, shows greater than forty-five percent increase over the existing condition. This is perhaps the most crucial of all variables, because by implementing the proposed treatments, the units would require mid-flame wind speeds in excess of twenty-five miles per hour to initiate and sustain a crown fire, whereas prior to treatment lesser wind conditions would allow for a crown fire to initiate.

Table 10- Alternative 2-Pre (TU5) and Post-Treatment (TL4) Fuel Modeling

Outputs:	Existing Condition	Post Condition (Leave Clumps)	Post Condition (Non-Leave Clumps)	Percent Change (Leave Clumps)	Percent Change (Non-Leave Clumps)
Fire Type	Active Crown	Conditional Crown	Surface Fire		
Rate of Spread (Chains/Hour)	42.52	126.8	1.82	-33.53	-98.56
Flame Length (Feet)	69.2	85.8	1.2	-19.35	-98.60
Fire Line Intensity (BTU/Ft^2)	8254	8889	9	-7.14	-99.90
Crowning Index (Miles/Hour)	4.8	10.5	0	-45.71	No Crown Potential

As with the fore-mentioned fuel models both pre and post condition had similar results when predicted by the model. Fireline intensity showed a ninety-nine percent decrease for the existing to post treatment condition. Similarly the flame length showed a ninety-eight reduction than what would be expected under the existing condition. And the Crowning Index had a forty-five percent increase, meaning it would require almost twice as much wind to initiate and sustain a crown fire in the treated areas. In addition to the change of the other outputs, the overall fire type changed from a passive crown fire, single and group tree torching, to a conditional fire type, meaning, under the right conditions crown fire could exist if initiated outside of the treated unit, but could not initiate from inside the unit itself.

Direct/Indirect Effects

Alternative 3 - Corridor & Lewis Gulch Units

Alternative 3, when modeled for post treatment effects, meets the proposed purpose and need of the proposed project. The modeling of the post-treatment condition demonstrated a reduction in rate of spread, flame lengths, and fire intensities that would increase the time of arrival to critical infrastructure. The NEXUS fire model was used to produce Tables 11 & 12, which represent the change in expected fire behavior following the implementation of the proposed units.

Table 11- Alternative 3-Pre (TU5) and Post-Treatment (TU1) Fuel Modeling

Outputs:	Existing Condition	Post Condition (Leave Clumps)	Post Condition (Non-Leave Clumps)	Percent Change (Leave Clumps)	Percent Change (Non-Leave Clumps)
Fire Type	Active Crown	Conditional Crown	Surface Fire		
Rate of Spread (Chains/Hour)	126.8	126.8	3.07	0.00	-97.58
Flame Length (Feet)	122	88.6	2	-27.38	-97.74
Fire Line Intensity (BTU/Ft^2)	15057	9324	26	-38.08	-99.72
Crowning Index (Miles/Hour)	4.8	10.5	0	-45.71	No Crown Potential

It would be expected that surface rate of spread for the post-treatment activities would not decrease. The lack of spread rate reduction is mostly attributed to the opening up of a stand structure prior to a fire burning, which would allow for smaller material, such as forbs and grasses, to grow on the forest floor in the remaining stand structures. It is important to note that to achieve the overall purpose and need, it is not the rate of spread that is important, but rather intensity of the fire as it reaches evacuation corridors and existing infrastructure. Both the fireline intensity and flame lengths seemingly demonstrate a reduction from the existing condition to post-treatment conditions. The model indicates an almost one hundred reduction in fireline intensity while the flame length demonstrates a ninety-seven percent reduction. The crowning index, the wind speed required to initiate and sustain a crown fire, shows greater that forty-five percent increase over the existing condition. This is perhaps the most crucial of all variables, because by implementing the proposed action within the unit areas, the units would require mid flame wind speeds in excess of twenty-five miles an hour to initiate and sustain a crown fire, whereas prior to treatment lesser wind conditions would allow for crown fire to initiate.

Table 12- Pre (TU5) and Post Treatment (TL4) Fuel Modeling

Outputs	Existing Condition	Post Condition (Leave Clumps)	Post Condition (Non-Leave Clumps)	Percent Change (Leave Clumps)	Percent Change (Non-Leave Clumps)
Fire Type	Active Crown	Conditional Crown	Surface Fire		
Rate of Spread (Chains/Hour)	42.52	126.8	1.82	-33.53	-98.56
Flame Length (Feet)	69.2	85.8	1.2	-19.35	-98.60
Fire Line Intensity (BTU/Ft^2)	8254	8889	9	-7.14	-99.90
Crowning Index (Miles/Hour)	4.8	10.5	0	-45.71	No Crown Potential

As with the fore-mentioned fuel models both pre and post-condition had similar results when predicted by the model. Fireline intensity showed a ninety-nine percent decrease for the existing to post-treatment condition. Similarly the flame length showed a ninety-eight percent reduction than what would be expected under the existing condition. And the Crowning Index had a forty-five percent increase, meaning it would require almost twice as much wind to initiate and sustain a crown fire in the treated areas. In addition to the change of the other outputs, the overall fire type changed from a passive crown fire, single and group tree torching, to a conditional fire type, meaning, under the right conditions crown fire could exist if initiated outside of the treated unit, but could not initiate from inside the unit itself.

As for the units in the upper portion of Lewis Creek, approximately one to one and a half miles south of the main road corridor, effects of the proposed treatment in these areas would have the same results as listed above. T hese units, although not directly adjacent to the main corridor would effectively change fire characteristics on a unit by unit level, not unlike the rest of the lower units. However, due to proximity to other untreated fuels, steepness of the terrain, and exposure to higher winds, these units would only locally meet the overall purpose and need. Once a fire burns around the treated areas increased intensities with increased flame lengths would return effectively negating the treatment areas. When Farsite was run, with randomly placed ignitions, these treatment areas went from a crown fire state to no crown fire. It is important to note that with Farsite modeling, either a stand will crown or it won't, there is no variation under that output within the model. When looking at the time of arrival from an ignition source to infrastructure located along the main corridor, the units in upper Lewis Creek did not have an effect on fires starting mid-slope, to the north, below the proposed treatment areas or from the west or east. However, if a fire was ignited to the south, either inside or outside of the analysis area, the above mentioned units allowed for an increase of one to two hours before the flaming front would threaten the infrastructure. Another

important note, the fires starting to the south were strategically placed to test the validity of the proposed treatment in those units. It is also important to note that areas immediately to the north of the proposed units in Lewis Gulch showed no change and continued to be crown fires. These areas are closer to the main road corridor and would be more appropriate for treatment than further up Lewis Creek. However, due to the steepness of the slope and no existing roads, the area is not economically feasible to treat.

Cumulative Effects

Alternatives 1, 2, & 3

The primary concern related to the current fire risk within the East Boulder Analysis Area is the vertical and horizontal arrangement of available fuel, both standing and dead woody fuels as well as the smaller understory tree component. Natural successional stand development, as well as years of successful fire suppression and a consequent lack of low intensity, stand maintenance fires have resulted in fuel loadings and arrangements that are more conducive to extreme fire behavior. A lack of low intensity ground fire in the drainage has also allowed smaller, shade-tolerant trees to grow under the large, mature trees creating what are referred to as 'ladder fuels'. The resulting vertical continuity of fuels could carry a fire from the ground up to the mature tree crowns.

A lack of small, stand-replacing fire and frequent, low intensity surface fires in the drainage (which were historically more typical for the lower elevations in this area) has lead to greater tree densities and a continuous even aged horizontal fuel. Stand 'densification' has resulted in little or no space between the crowns of trees. As a result, a fire can run quickly through the crowns unlike a surface or ground fire. The lack of stand replacing fires has lead to a condition of continuous horizontal fuel bed arrangement throughout the drainage. The increasing stand densities and fuel loads, along with the fuel bed arrangement (both horizontal and vertical) are key components for a crown fire situation.

The analysis area is currently experiencing mountain pine beetle and to a lesser extent, Douglas-fir beetle mortality (See Insect & Disease analysis pp. 210-212). As insects and disease move across the landscape and stands become infected, red needles on standing dead trees are highly volatile and would act as a catalyst for intense fire behavior, which would ultimately affect both public and fire fighter safety. However, these elevated intensities would decreases over time as the finer fuels decompose at their natural rate. As standing dead and down trees become more frequent, the volume of surface fuel would increase, resulting in the likelihood that a small, low intensity ground fire could become a large, intense, uncontrollable fire (NEXUS modeling, Project File 8-4).

Currently, all National Forest System Lands within the Analysis Area are covered under a Fire Management Plan (FMP). FMP's allow for a range of fire management options or Appropriate Management Response (AMR) to fire. AMR to fire may include full direct suppression of any fire start through allowing fire to occur for resource benefits. The Gallatin's fire management plan delineates various geographic areas across the landscape called Fire Management Units (FMU), and applies specific fire management responses to them whether fire suppression or fire for resource benefits. The analysis area falls within FMU 1 (North Suppression) and FMU 2 (North). This FMU is described in the Fire Management Plan as interface/intermix WUI area; road areas (suitable for engine

access, 1-hr walk-in time, and suitable timber base areas per GNF 1987 Forest Plan); and unroaded areas (RNA's, wilderness study areas). The use of fire to achieve resource benefits is not an appropriate fire management response option at this time. Rationale for direct suppression across this FMU consists of timber values, watershed concerns, wildland urban interface and a host of other resource concerns including public safety.

Within the immediate fuels analysis area, there have been no prescribed fires ignitions or other recent mechanical fuel reduction activities. There are, however, areas in the Lewis Creek proper which were harvested in the mid-eighties to early nineties (Refer to past harvest in Chapter 3) and do offer a significant change in fire behavior from inside to the outside of the harvested areas, which currently consist of sapling sized stands. These areas would cumulatively augment treatments associated with Alternatives 2 & 3.

Outside, but adjacent to the analysis area in the Dry Fork of the East Boulder River, both hand thinning and two applications of prescribed fire were implemented as part of the Long Mountain Hazardous Fuels Reduction Project. The mechanical hand-thinning was completed in fall of 2004. The first of the prescribed fire applications was implemented in May of 2008, burning approximately five-hundred and fifty acres. More recently, in September of 2009, the Dry Fork prescribed fire units were completed with the burning of approximately 2300 acres. The overall objective of the Long Mountain Hazardous Fuel Reduction was to reduce conifer encroachment on grass and sagebrush meadows as well as within aspen stands; maintain areas of condition class 1; and provide for public and fire fighter safety. The units treated within the Dry Fork area offer a reduction of potential fire behavior. If a fire were to start within the treated area or move into the treated area, fire behavior would be reduced to a level that would allow emergency responders to engage in suppression activities. However, once the fire moves out of the Dry Fork treatment area, without additional treatments (Alternative 1), it would most likely transition from a surface to a crown fire subsequently threatening both public and fire fighter safety as well as the evacuation route down the East Boulder River corridor. Treatments associated with Alternatives 2 and 3 would effectively extend the reduction of potential fire behavior along the corridor to the Forest boundary on the west edge of the treatment areas.

In addition to the Dry Fork treatment units, as part of the Long Mountain Hazardous Fuels Reduction Project, several units within Elk Creek drainage have been or are being prepared for future prescribed fire applications. These units would offer no cumulative effects in association with the treatments being proposed as part of the East Boulder Project (Alternatives 2 or 3), because they are located in an entirely different watershed.

Conclusion

It would be expected that without treatment (Alternative 1), the fuels within the Analysis Area will continue to follow their normal succession. This course would most likely lead to a climax disturbance that would eventually result in stand replacement conditions. The suppression strategy would continue to be direct suppression with the option to 'control and confine' due to the location of the East Boulder Branch of the Stillwater Mining Corporation as well as popularity of the East Boulder corridor for recreation and private land ownership patterns (FP, 1987). However, in discussing fuel treatments in higher elevation forests, Jack Cohen (2009) stated: "By doing fuels projects in areas of high social importance (e.g. homes), then we can hopefully allow more natural fire to burn outside of this "contrived" area. Be honest that we are not

doing ecological work by thinning high elevation forests, but we are reducing the potential for crown fires…."

Because many of the stands in the drainage are heavily stocked with older trees, and experiencing mountain pine beetle infestations, the incidence of tree mortality is expected to increase over time. This would lead to an increase in the rate of accumulation of standing and down dead fuels available to support a fire, with a resulting increase in the probability that, once ignited, a wildfire would have sufficient material to burn and it would quickly increase in intensity and escape attempts to contain it. As it pertains to fuel structures along evacuation routes and existing infrastructure, Cohen (2009) continues by stating: "In some cases, we will not be able to modify the fuels enough to save homes, but maybe to reduce fire intensity along travel corridors enough so that people can survive in their vehicles…" thus allowing responding emergency personnel more time to evacuate an area.

Both the Nexus and Farsite models seemingly indicated there is a need to treat hazardous fuels within the East Boulder analysis area to promote public and fire fighter safety as well as reducing the impacts to existing infrastructure in the event an unwanted wildfire occurs. In addition to the models used to display treatment effects several literature publications were consulted and seemingly support a reduction in fuels for public and firefighter safety. Reductions of timber harvesting activities, as well as fire exclusion activities on National Forest Lands have "exacerbated the risk and severity of fire hazard (Laband et. al 2005). Laband states three problems that crowns fires have that surface fires do not, which are: "1) Crown fires are more ecologically harmful, because they kill mature trees of even fire-resistance species, and may sterilize the soil. 2) Because crown fires burn at high temperatures and rates, they are more difficult than ground fires to fight and control. 3) Therefore, crown fires exact an increasingly severe toll on humans, both in terms of loss of life and loss of property." The first of the three statements is not applicable, as the ecological function of fire within this system is outside the scope of this analysis.

The overall intent of the project is to minimize potential fire behavior along existing infrustructure and evacuation routes to promote public and fire fighter safety. It is within the later of the three which are the most important. Both fire suppression experience in addition to the literature indicated suppression tactics on crown fires are not successful. Moreover, crown fires have offered a severe toll on the human condition over the past several years, resulting in more associated deaths and increased loss of personal property. The magnitude of loss in the United Stated is high. The coming of the new century, 2000, was the worst fire year recorded in over fifty years (Laband 2005). Two years later in 2002, 88,458 wildfires burned 2.9 million hectares in the United States. Three States, Arizona, Colorado, and Oregon, suffered their worst fires in history that year (Laband 2005). In 2003, the worst wildfires in California history were responsible for 22 human deaths (Laband 2005). Seemingly every year new records are being set in acres burned, numbers of homes destroyed, and human lives lost.

Compliance with Laws, Regulations, and Forest Plan Direction

National Forest Management Act of 1976

Compliance with Gallatin Forest Land Management Plan - A review of the Gallatin Forest Plan direction applicable to this project indicates that the proposed treatments are consistent with the Forest Plan

Forest-wide Standards

- Forestlands and other vegetative communities such as grassland, aspen willow, sagebrush and whitebark pine will be managed by prescribed fire and other methods to produce and maintain the desired vegetative condition. (Vegetation Diversity Item 1, FP p. II-19)
- Methods of site preparation will normally be machine scarification and piling or broadcast burning. Other methods may be prescribed which meet the objectives of the silvicultural system. These include underburning, trampling, hand tool scarification, machine yarding, herbicides, and others.
- Activity created dead and down woody debris will be reduced to a level commensurate with risk analysis.
- Treatment of natural fuel accumulations to support hazard reduction and management area goals will be continued.

Issue 2 -Noxious Weeds

Project related activities could increase the spread and density of noxious weeds throughout the proposed project area and adjacent private and public lands where suitable habitat exists. Weeds are spread through soil disturbance caused by mechanized equipment, burning practices, and reduction in the forest canopy cover. Proposed changes in the East Boulder Corridor could increase habitat for noxious weeds and reduce competitive success of native vegetation.

Affected Environment

Noxious weeds can have a long-term biological impact on the eco-system by displacing native plant species and reducing species diversity, reducing the quality and quantity of wildlife forage and habitat, decreasing soil stability and water quality, and by altering plant succession dynamics. It is possible that stand changes involving overstory removal, ground disturbance, and burning could result in invasion of weed species that do not currently inhabit the East Boulder.

Control of noxious weeds is required by the State of Montana County Noxious Weed Management Act, by the Federal Noxious Weed Act of 1974, and by Executive Order 13112, Invasive Species (February 3, 1999). Also, the Gallatin Forest Plan (p. II-28) requires the Forest to "confine present infestations and prevent establishing new areas of noxious weeds. Funding for weed control on disturbed sites will be provided by the resource which causes the disturbance."

The East Boulder River drainage currently has existing populations of noxious weeds. spotted knapweed, houndstongue, and oxeye daisy are concentrated in and around the lower portions of the proposed project area, while Canada thistle can be found

throughout the proposed project area. See Table 13 below for existing noxious weed infestations by treatment unit.

Table 13- Current Weed Population by Unit (FACTS Database, 2009)

Unit Number	Species	Acres Infested Inside of Unit	Acres Infested Inside of Unit
1	Spotted knapweed	2.1	0.4
	Oxeye daisy	0	6.6
	Houndstongue	0	2.1
	Canada thistle	0	27.6
2	Oxeye daisy	1.4	5.8
3	Oxeye daisy	11.0	7.9
	Canada thistle	49.0	11.1
3a	Oxeye daisy	1.5	0
5	Oxeye daisy	2.8	0.3
	Houndstongue	5.6	0.6
7	Oxeye daisy	0.2	0.9
7a	Oxeye daisy	1.3	0.8
7b	Oxeye daisy	2.4	3.2
8	Spotted knapweed	8.9	0.4
	Oxeye daisy	0.7	0
Total		**86.9**	**67.7**

The following are brief descriptions of the primary noxious weeds and their habitats that are found in the East Boulder are:

Spotted Knapweed

Originally from Eurasia, spotted knapweed has become well established throughout the western United States. Spotted knapweed is a biennial or short lived perennial, producing 5,000 - 40,000 seeds/square meter per year. Seeds remain viable in the soil for many years. One study showed that 90% of buried seed was able to sprout after being buried and dormant for eight years (Davis, 1993). Plant densities correlate to the degree of soils disturbance: the greater the disturbance, the higher the density. However, spotted knapweed is also capable of invading undisturbed areas.

A knapweed invasion is associated with reductions in biodiversity, reduction in wildlife and livestock forage and increased soil erosion. Elk use, as estimated by pellet groups/acre was reduced by 98% on spotted knapweed dominated range compared to bunch-grass dominated sites (Hakim, 1979), (Sheley & Petroff, 1999).

Spotted knapweed dominance on bunchgrass rangeland is also detrimental to water and soil resources. Lacey et al, (1989) determined that surface water runoff and stream sediment yield were 56% to 192% higher, respectively for spotted knapweed-dominated sites compared to bunchgrass-dominated sites. Bare ground was higher and water infiltration rates were less on spotted knapweed sites than on bunchgrass sites (Lacey et al 1989), (Sheley & Petroff, 1999).

Habitat at Risk: Spotted knapweed prefers areas with open forest-grassland on well developed to dry soils. Knapweed has been observed at elevations ranging from 1,900 to 10,000 feet and in precipitation zones ranging from 8 - 79 inches (Sheley & Petroff, 1999). Within the area analyzed for noxious weeds "cumulative effects" there are currently 11.8 known acres of spotted knapweed. Spotted knapweed is well adapted to the East Boulder River environment and capable of growing anywhere within the analysis area given sunlight and a seed source.

Sulphur Cinquefoil

Sulphur cinquefoil, a native of Eurasia, is now found across the southern United States to Oregon, Washington, Montana and British Columbia. It has recently been recognized as an invader in Sweet Grass County where it is now well established and spreading rapidly.

Sulphur cinquefoil, is a strong competitor that reduces grass production on many rangeland sites. Because of its high tannin content, it is unpalatable to most wildlife and livestock. In areas where sulphur cinquefoil grows with spotted knapweed, cattle will graze the spotted knapweed over the sulphur cinquefoil, (Rice et al, 1991).

Habitat at Risk: This species is adapted to a wide range of environmental conditions. It occurs in open grasslands, shrubby areas, open forests and logged area, roadsides, and waste areas. It cannot survive under full canopy cover, (Werner and Soule, 1976). There are currently no mapped acres of sulphur cinquefoil in the East Boulder drainage although infestations occur nearby on private land.

Canada Thistle

Considered native to southeastern Europe and the eastern Mediterranean area, Canada thistle is now well established throughout North America. Canada thistle is an aggressive perennial weed that spreads by both seeds and roots. If left unmanaged, Canada thistle has the potential to form dense infestations. An individual seedling can spread rapidly, forming a large patch through vegetative reproduction of the root system, (Sheley and Petroff, page 165).

Canada thistle will displace native forbs and grasses, decrease forage production, and limits recreation use due to the sharp spines of the leaves. Canada thistle can reproduce vegetatively and by seed. Seeds can be carried for half a mile or more by wind. Seedlings require full sun for normal development.

Habitat at Risk: Canada thistle has a wide habitat range and has been in the United States long enough to have spread throughout much of its suitable habitat. It is found in open areas with moderate or medium moisture levels. Canada thistle grows in areas with precipitation of 16 to 30 inches and in clay to sandy soils. This species is so prevalent that active management is limited to isolated roadside or trailhead treatments. Canada thistle has not been specifically mapped on the Big Timber unit of the Yellowstone Ranger District but is estimated to cover over 500 acres primarily along roadsides, timber harvest units, log landings, skid trails and haul roads, burn pile areas, high use recreation sites, and areas heavily impacted by livestock, especially sheep bed grounds where the plant has persisted for decades in some cases. Within the East Boulder Fuels Project analysis area there are 87.7 mapped acres of Canada thistle.

Houndstongue

Houndstongue is native to Eurasia and has spread throughout the United States and Canada. It is found in Washington, Oregon, Wyoming, and Montana. Houndstongue competes strongly with native vegetation. The seeds have the ability to attach to people, livestock and vehicles, enabling the plant to spread great distances. The plant is also poisonous to cattle and especially horses. No information is available about toxicity to wildlife, however, the plant is considered non-palatable under range conditions and livestock and wildlife will avoid it, (Upadhyaya and Cranston 1991). Houndstongue plants are able to resist mowing and severe drought.

Habitat at Risk: Houndstongue prefers hot, dry summers and cold winters with soils ranging from well drained, relatively coarse, alkaline soils to clay subsoil in open coniferous forest. It is shade tolerant and thrives in wetter grasslands. It is frequently found on roadsides, meadows and in disturbed areas. The plant is widespread on the Yellowstone District along roadsides, timber harvest units, timber landings, skid trails, burn pile areas and trails. It is carried by livestock and wildlife into many suitable habitats and can be found in scattered and remote locations. Houndstongue within the project area totals 8.3 mapped acres. These infestations are located in the East Boulder River drainage on disturbed sites along the East Boulder Road, the East Boulder Power line corridor, and in skid roads, trails, and landings from past timber activities. These populations are usually relatively small, however, the plant is widely scattered and can easily colonize disturbed areas.

Oxeye Daisy

Introduced from Europe, oxeye daisy is a perennial herb that spreads by both seeds and roots. It is an aggressive competitor and often forms dense patches. One plant is capable of producing 26,000 seeds and the seeds can remain viable in the soil for more than 30 years. Oxeye daisy is considered drought tolerant and a pioneer species in several habitats exposed to soil drying.

"The ecological, environmental, economic, or sociological impacts of oxeye daisy have not been well documented. It frequently invades fields where it competes aggressively, especially in grazed pasture, and forms dense population. In turn, this reduces plant species diversity. Bare soil is more prominent in areas with high densities of oxeye daisy, implying that the potential for soil erosion would increase in these areas. Oxeye daisy has a relatively small taproot compared to the extensive fibrous root systems of associated grasses. Thus, a heavy infestation of oxeye daisy may reduces the amount of

organic matter contributed below ground annually, and in turn may slow the rate of nutrient cycling," (Sheley and Petroff, 1999. p. 284).

Habitat at risk: These include meadows, native grasslands, waste grounds and roadsides. Oxeye daisy grows in relatively nutrient rich soils (Sheley and Petroff. 1999. p. 283) Oxeye daisy has been mapped using GPS and currently occupies about 124 acres on the Yellowstone Ranger District. There are approximately 51 acres infested with oxeye daisy in the East Boulder drainage. This species can easily and rapidly spread throughout suitable habitat.

Direct and Indirect Effects

The potential effects of both action alternatives on the spread of noxious weeds are of two types, direct and indirect:

- ***Direct effects*** are those that result in spreading weed seeds or root fragments directly into the treatment units. For example, moving equipment from an infested unit to a new unit without cleaning would directly result in the spread of weeds. An effective mitigation is to wash off-road equipment prior to moving to each unit and between units. Another effective mitigation is to treat weeds in the proposed units as well as adjacent to the units prior to activity commencement. These mitigations have been used in timber sale, mining contracts and road decommissioning projects throughout the region and are proven methods to reduce weed spread with the exception of weeds such as Canada thistle, which has a wind disseminated seed. If noxious weed treatments are conducted prior to any activities and off-road equipment is power washed and inspected between units, then there will generally be little or no direct effect.
- ***Indirect effects*** result from activities that create favorable habitat for invasion by noxious weed or reduce the competitive ability of native plant species. Removing the forest canopy and creating soil disturbance next to an established population of weeds would likely indirectly result in the spread of weeds. This type of invasion can be made less likely by strategically locating untouched leave islands adjacent to weed populations. As can be seen from Table 14, weed populations exist in or adjacent to many proposed units especially in the lower portions of the East Boulder.

Table 14 displays a summary of the current weed infestations and the risk of weed invasion for each unit. The presence or absence of weeds is based on current GPS (Geographic Positioning System) weed mapping. The determination of Habitat Suitability is based on literature review, TSMRS database information, field review, knowledge of the East Boulder River Corridor, and experience with weed treatment. Predictability in weed spread generally follows the parameters used by the R1 Weed Risk Assessment, (see Table 14):

1) Are there existing weeds within the project area?
2) Are there weeds adjacent to the proposed project area?
3) Is the habitat suitable for weed expansion?
4) What time of year are the proposed treatment (winter vs. summer/fall)?

The determination of Risk of Invasion is based on a combination of the three variables: "Very High" equals a "yes" for all three variables; "High" is when weeds are present and

the habitat is suitable; the rating is "Low" when the habitat is suitable but no weeds are present in the vicinity (within 500 feet); "None" is when the habitat is not suitable.

Units that have a "Very High" risk of weed invasion are the following: Unit 1 (knapweed), 2, 3, 3A, 5, 7, 7A, 7B, and 8. Units that have a "High" risk of weed invasion include: Unit 1, 4, 9, 9A, 10, 11, 11A, 12, 12A, 13, and 14. Units that have a "Low" risk of weed invasion include: Unit 5A, 6, 8A, 16, 17, 18, 19, 21, 22, 22A, and 23.

Table 14- Summary of Weed Risk for each Unit and Species

Unit #	Species	Weeds Present Within Unit	Weeds Present Adjacent to Unit	Habitat Suitable for Weed Expansion	Risk of Weed Invasion
1	Knapweed	Yes	Yes	Yes	Very high
	Oxeye daisy	No	Yes	Yes	High
	Houndstongue	No	Yes	Yes	High
	Canada thistle	No	Yes	Yes	High
2	Oxeye daisy	Yes	Yes	Yes	Very high
3	Canada thistle	Yes	Yes	Yes	Very high
	Oxeye daisy	Yes	Yes	Yes	Very high
3A	Oxeye daisy	Yes	Yes	Yes	Very high
4	None	No	Yes	Yes	High
5	Oxeye daisy	Yes	Yes	Yes	Very high
	Houndstongue	Yes	Yes	Yes	Very high
5A	None	No	No	Yes	Low
6	None	No	No	Yes	Low
7	Oxeye daisy	Yes	Yes	Yes	Very high
7B	Oxeye daisy	Yes	Yes	Yes	Very high
8	Knapweed	Yes	Yes	Yes	Very high
8A	None	No	No	Yes	Low
9	None	No	Yes	Yes	High
9A	None	No	Yes	Yes	High
10	None	No	Yes	Yes	High
11	None	No	Yes	Yes	High
11A	None	No	Yes	Yes	High
12	None	No	Yes	Yes	High
12A	None	No	Yes	Yes	High
13	None	No	Yes	Yes	High
14	None	No	Yes	Yes	High
16	None	No	No	Yes	Low
17	None	No	No	Yes	Low
18	None	No	No	Yes	Low

Unit #	Species	Weeds Present Within Unit	Weeds Present Adjacent to Unit	Habitat Suitable for Weed Expansion	Risk of Weed Invasion
19 Alt 3	None	No	No	Yes	Low
21 Alt 3	None	No	No	Yes	Low
22 Alt 3	None	No	No	Yes	Low
22A Alt 3	None	No	No	Yes	Low
23 Alt 3	None	No	No	Yes	Low

Methodology for Analysis

Impacts to existing native herbaceous vegetation were evaluated by assessing the existing infested acres and location of noxious weeds relative to proposed fuels reduction units. To do this, GPS mapped weed polygons by species were overlaid on the proposed unit boundaries and analyzed in map and tabular form. The risk analysis protocol used is the Region 1 risk analysis recommended and used in the Gallatin National Forest Noxious and Invasive Weed Treatment EIS, June 2005. Weed analysis is a predictive technique with the objective of taking existing weed location data and making an educated prediction about the impact of a proposed activity on the weed population.

Analysis Area Boundary

Spatial Boundary: The boundary of this analysis is the East Boulder Fuels Project analysis area.

Temporal Boundary: The temporal boundary is from the present (prior to project implementation) to seven years following project implementation. It is anticipated that weeds will continue to increase through time in the project area.

Direct and Indirect Effects by Alternative

Alternative 1 - No Action

Alternative 1 (No Action) is the most protective alternative from the standpoint of short term weed invasion and spread. There would be no soil disturbance, trees would continue to grow, the canopy within stands would slowly increase in density, and conifers would continue to encroach on meadows and open areas throughout the East Boulder Drainage (assuming no stand replacing disturbance). This would create more shade, therefore, reducing the amount of habitat favorable for weeds. Over time, as the tree canopy becomes more dense, the no-action alternative would likely help to reduce the weed problem, but may also increase tree pathogens and insects. The East Boulder drainage is currently considered ripe for wildfire due to increasing numbers of tree pathogens and insects. .. Effects to noxious weed populations, were a large wildfire to occur, are discussed below in cumulative effects.

Alternative 2- Corridor Units

Alternative 2 includes a combination of tractor harvest on approximately 490 acres, skyline harvest on approximately 20 acres, and hand treatments on approximately 140 acres with up to 2.1 miles of new, low-standard temporary road, hand and machine piling, and burning of those piles. As displayed in Table 14, there would be 11 units at "Very High" risk of weed invasion, 13 units at "High" risk of invasion and 6 units at "Low" risk of invasion. The proposed treatment units along East Boulder River corridor are at the highest risk for increased noxious weed expansion due to the widespread existing seed source and suitable habitat found throughout the area. Mitigation including power washing and inspection of all off-road equipment before entering the project area, spraying weed infested areas prior to seed production (pre and post-harvest), insuring that gravel and other surfacing/fill materials are from a weed-free source, restricting service vehicles to roadways, closing re-opened and temporary roads to public use, as well as other mitigation described on pp. 49-51 would minimize noxious weed expansion.

The most protective timber harvest and fuel removal techniques or systems are those that are most protective to the soil and the existing native understory plant communities. Hand treatments create little ground disturbance. Helicopter logging was discussed for commercial harvest units but dropped due to economics, logistics, and availability. Utilization of skyline logging, where the terrain lends and deemed appropriate, would also limit potential impacts. Skyline harvest normally causes minimal detrimental ground disturbance and is likely to be more effective than ground-based machine harvest techniques in inhibiting weed colonization. With this in mind, a combination of the following techniques would be utilized to minimize ground disturbance and mitigate potential weed expansion where ground-based mechanical (tractor) harvest systems are required.

- Whole tree yarding using any logging system over 8 inches of settled snow or 4 inches of frozen ground.
- Use of dedicated skid trails for all non-winter harvesting
- Minimize the amount of new temporary road building (cut and fill, etc)
- No site prep using scarification or ripping following harvest
- Burning to occur only at the landings (limits soil disturbance to accessible areas) except in hand treatment units where piles are small
- Complete harvest and treatment in one entry, with no re-entry to further harvest damaged trees or to disturb soil at a later date.

The most protective technique for tractor harvest treatments to minimize the spread of noxious weeds is to conduct treatment activities over a minimum of 8”of snow or when the ground is sufficiently frozen (at least 4”) to minimize soil disturbance. With Alternative 2, all of the proposed tractor harvest units (except Unit 13) would require winter harvest over snow or frozen ground.

Treatment in Unit 13 (common to Alternatives 2 & 3) would likely be conducted in the fall due to heavier snow accumulations in the Lewis Gulch drainage and presence of a

low standard single lane road. Dedicated skid trails would be required, however, it is estimated that approximately 7.5 % detrimental soils disturbance would occur equating to approximately 5 acres of soil disturbance dispersed over the length of the designated skid trails (See soils analysis Table 22). Any areas of bare soil would be seeded with a weed-free native seed mix post-treatment.

The construction of up to 2.10 miles of low standard, temporary road in support of timber and fuels material removal would equate to approximately 3.6 acres of disturbed soils. This acreage is calculated based on a 14 foot road bed, which is based on the current average width for low standard temporary roads on the Gallatin National Forest (See soils analysis). In general, roads represent the most continuously disturbed soil areas available for colonization by non-native plant species. Newly disturbed roadbeds allow for inadvertent transport of non-native plant materials into relatively undisturbed areas, while providing favorable growing areas for windblown seeds that are free from competition by existing plants. As such, proposed roads are potentially the most detrimental aspect of this project from the perspective of weeds proliferation, weed control, and native plant communities. However, all newly constructed temporary roads would be closed to the public during harvest activities and permanently closed, recontoured, and rehabilitated within one year upon completion of harvest related activities. Rehabilitation would include making the new temporary roads on National Forest System lands impassable for motorized travel, as well as other necessary resource protection practices (i.e. re-vegetating disturbed areas with weed-free native seed mix and/or pre/post weed treatments) as described on pp. 49-51. These areas would be monitored and treated for weeds if populations are detected.

Piling and pile burning is also proposed with Alternative 2 in order to meet the 15 tons per acre downed fuel objectives. No broadcast burning is proposed. Hand piling and burning would occur within the hand treatment units, however piles would be small and areas of bare soil post-burn would be seeded with a weed-free native seed mix. For mechanized harvest units (tractor and skyline) piling and burning of piles would be conducted at designated landings. It is estimated that approximately 31 landing piles would be needed for Alternative 2 with an estimated size of ½ acre or less equating to up to 15.5 acres of disturbed soil (Soils calculations, Project File 10-26). Landing piles would be dispersed, located near roads, and would be seeded with a weed-free native seed mix after pile burning has been completed. These areas would be monitored and treated for weeds if populations are detected. The effects of pile burning on the proliferation of weeds are varied depending on the size of piles, burn intensity, time of year, weeds present, soil moisture at time of burn, and mitigation incorporated.

If service vehicles remain on the roadways, off-road equipment is washed before entering the project area, ground disturbing practices related to harvest and temporary road construction activities are minimized, and weeds mitigation (pp. 49-51) are adhered to, it is anticipated that the spread of noxious weeds in the treatment areas would be relatively low. The only exception would be in areas within the lower East Boulder Corridor that are currently infested with knapweed, oxeye daisy, or other weeds, or where units are immediately adjacent to areas infested with these weeds. Noxious weeds that are currently present within or adjacent to landings and/or handpiles may expand after the piles are burned. However, this would be mitigated by spraying weed infested areas prior to seed production (pre and post-harvest), and seeding these areas with native seed mixes after the piles are burned to help reduce suitable habitat for noxious weeds.

Alternative 3 –Corridor Units & Lewis Gulch

The direct and indirect effects for Alternative 3 would be of similar nature to Alternative 2. The main difference is that Alternative 3 includes five additional treatment units (3 tractor, 2 skyline) in the Lewis Gulch area with up to 1.4 miles of additional low standard temporary road needed to access the additional treatment units for a total of up to 3.5 miles of new temporary road, all of which would create some additional soil disturbance. Alternative 3 includes a combination of tractor harvest on approximately 660 acres, skyline treatments on approximately 70 acres, and hand treatments on approximately 140 acres. Treatment of the five additional units, as well as the units associated with Alternative 2 would follow the mitigation listed on pp. 49-51 to help prevent the spread of noxious weeds.

Unlike the East Boulder Corridor, the Lewis Gulch area is significantly less utilized by the public and/or those associated with the East Boulder Mine due to its higher elevations, low standard road, and remoteness. The main risk for noxious weed invasion into the Lewis Gulch area is the existing seed source and suitable habitat found in treatment areas along the East Boulder Corridor (the same as Alternative 2). Units in the Lewis Gulch area are rated at low risk for invasion because there are no mapped weeds in this area to provide a seed source. When the Lewis Gulch area was logged in the early 1980s there were no weeds recorded in the East Boulder drainage (Big Timber District Weed Program Records).

Treatment of the five additional Units 19, 21, 22A (tractor) and Units 22 and 23 (skyline) located along the Lewis Gulch Road, as well as Units 13 (tractor), 14 and16 (skyline) would likely be conducted in the fall/winter until snow accumulations prevent harvesting operations. These units are higher in elevation and are inaccessible during winter due to heavier snow accumulations coupled with the low standard Lewis Gulch Road.

As stated above, skyline harvest normally causes minimal detrimental ground disturbance and is likely to be more effective than ground-based machine harvest techniques in inhibiting weed colonization. The additional 50 acres of skyline harvest would create minimal soil disturbance and be of low concern from a weeds proliferation standpoint.

Alternative 3 includes three additional tractor units (170 acres) for a total of 240 acres of non-winter tractor harvest. Higher amounts of soil disturbance would be expected in these areas because they would not be protected by snow cover or frozen ground (See soils analysis on pp. 113-116). Dedicated skid trails would be required, however, it is estimated that approximately 7.5 % detrimental soils disturbance would occur, equating to approximately 18 acres of soil disturbance dispersed over the length of the designated skid trails (See soils analysis Tables 22 & 23). Any areas of bare soil would be seeded with a weed-free native seed mix post-treatment.

The construction of up to 3.5 miles of low standard, temporary road in support of timber and fuels material removal would equate to approximately 5.9 acres of disturbed soils. This acreage is calculated based on a 14 foot road bed, which is based on the current average width for low standard temporary roads on the Gallatin National Forest (See soils analysis). As stated with Alternative 2, roads represent the most continuously disturbed soil areas available for colonization by non-native plant species. As such, proposed roads are potentially the most detrimental aspect of this project from the

perspective of weeds proliferation, weed control, and native plant communities. However, all newly constructed temporary roads would be closed to the public during harvest activities and permanently closed, recontoured, and rehabilitated within one year upon completion of harvest related activities. Rehabilitation would include making the new temporary roads on National Forest System lands impassable for motorized travel, as well as other necessary resource protection practices (i.e. re-vegetating disturbed areas with weed-free native plant seed and/or pre/post weed treatments) as described on pp. 49-51. These areas would be monitored and treated for weeds if populations are detected.

For mechanized harvest units (tractor and skyline) piling and burning of piles would be conducted at designated landings. It is estimated that approximately 43 landing piles would be needed for Alternative 3 with an estimated size of ½ acre or less equating to up to 21.5 acres of disturbed soil (Soils calculations Project File 10-26). Landing piles would be dispersed, located near roads, and would be seeded with a weed-free native seed mix after pile burning has been completed. These areas will be monitored and treated for weeds if populations are detected. The effects of pile burning on the proliferation of weeds are varied depending on the size of piles, burn intensity, time of year, weeds present, soil moisture at time of burn, and mitigation incorporated.

Tables 15 and 16 below provide a comparison between alternatives for weed risk, detrimental disturbance expected, and potential for weed spread.

Table 15-Comparison of Alternatives for Potential of Weed Spread

Alternative	Proposed Temp. Road Miles Disturbance Acres[3]	Landing Piles Disturbance Acres[4]	Acres of Tractor Treatment (Winter)	Acres of Tractor Treatment (Non-winter) Disturbance Acres[5]	Total Acres for All Treatment Types
1	0 miles 0 acres	0 piles 0 acres	0	0	0
2	2.1 miles 3.6 acres	31 piles 15.5 acres	420	70 acres harvest 5 acres disturbed skid trails	650
3	3.5 miles 5.9 acres	43 piles 21.5 acres	420	240 acres harvest 18 acres disturbed skid trails	870

[3] Temporary road acreage calculations are based on a 14 foot road width, which is the average for existing low standard temporary roads on the Gallatin National Forest

[4] Size of landing piles is estimated at ½ acre each, generally skyline and tractor piles vary from 1/3 to ½ acre

[5] Disturbance acres are dispersed over the length of designated skid trails and calculated as 7.5% associated with non-winter tractor harvest

Table 16-Comparison of # of Units with Existing Weed Risk by Alternative

Alternative	# Units at Very High Weed Risk	# Units at High Weed Risk	# Units at Low Weed Risk
1	n/a	n/a	n/a
2	11	13	6
3	11	13	11

*n/a means not applicable for Alternative 1 because there are no harvest units associated with the no action alternative

Cumulative Effects

Alternative 1

The effect of a potential wildfire on weeds in the East Boulder drainage would be dependent on many factors such as burn intensity, time of year, weeds present, soil moisture at time of burn, burn pattern, and events following the burn (ie. rainfall which may cause soil erosion, bare ground, etc). Monitoring past fires on the Yellowstone District where the burn intensity was high concluded that existing weed patches have expanded due to the existing seed bank in the soils along with the elimination of vegetative competition. However, monitoring also indicated that if the fire was a mixed intensity creating a mosaic of post fire vegetation, there was little expansion of noxious species into weed-free areas.

Under Alternative 1, the worst-case scenario would be a catastrophic wildfire burning under very hot conditions and killing trees throughout the East Boulder Corridor. Medium to small fuels would be completely consumed leaving few woody materials for small mammal habitat, to create check dams for soil, shade the ground, or contribute to soil nutrients. The root crowns of shrubby species and herbaceous species may be killed or damaged. Seeds of both native and non-native species could be burned or reduced in numbers. Thunderstorm or rapid snowmelt events following the fire could contribute to sheet erosion, gully formation and soil and nutrient loss. Erosion also exposes subsoil, uncovers dormant native and non-native seeds, and creates bare soil as a seedbed for windblown seeds. It would be expected that recovery under this scenario would be slow and native colonizer species such as fireweed would initially dominate. Non-native, highly adapted species would also take advantage of the open canopy and lack of competition. Non-native grasses such as timothy would very likely expand in cover, not allowing the native species to colonize. In the lower portions of the East Boulder corridor (vicinity of Units 1-12) knapweed, oxeye daisy, and houndstongue would be the noxious weeds that could expand the most. In the Lewis Gulch area, oxeye daisy and Canada and Musk thistle would be the most likely to increase.

Under a more typical wildfire scenario, there would be patches of burned and unburned tree canopy with mosaic pattern of burned vegetation, under burning of some timbered areas, fire runs, and low, moderate, and high fire severity levels mixed across the burn area. Under this scenario, wildfire would likely result only in local expansion of weed coverage adjacent to existing weed patches.

With Alternative 1, the no action alternative, there would likely be a continuation of small timber harvesting activities in the future, such as the power line expansion project in 2004 and the relocation of the lower end of the Lewis Gulch Road in 2005. Thus, the

timber canopy would be modified in places and small areas of ground disturbance would be created on a piecemeal basis. The effects of these harvest activities on weeds would be related to mitigation used and individual project contract requirements. It is expected that weeds would continue to spread slowly.

Alternatives 2 & 3

In addition to the direct and indirect effects of the proposed action, other ongoing activities could contribute to a slow expansion of weeds in the East Boulder Drainage. Cumulative effects associated with Alternatives 2 and 3 would be very similar and will be discussed together. The following past, current and future activities are within the proposed project area boundary for the cumulative effects analysis: Past harvest activities on National Forest Lands; Power line Clearing and Clearing for the Stillwater Mine; Fuels Reduction; Recreational activities; East Boulder Mining Operations. All of these areas either now contain weeds or have the potential to spread weeds. In turn, these areas pose a threat to freshly disturbed areas within close proximity to introduce new seeds.

Units in the Lewis Gulch area are rated at low risk for invasion because there are no mapped weeds in this area to provide a seed source. When the Lewis Gulch area was logged in the early 1980s there were no weeds recorded in the East Boulder drainage (District Weed Program Records).

Other activities such as personal use firewood gathering, does not result in opening the forest canopy however it does have the potential to spread weeds if people drive through weed patches and then drive off established roads to gather wood. Both action alternatives would only allow motorized vehicles on existing roads. Re-opened and new temporary roads would be closed to the public.

Private land is a concern in that some private landowners treat noxious weeds and others do not. If private land is resold, new construction may occur, and/or additional miners and recreational visitors may come to the area from other places. Noxious weeds may be brought in, and populations would likely slowly expand. It is also possible that noxious weed species that are not currently present could be introduced. Currently, all species of noxious weeds expanding in the East Boulder are likely due to a combination of factors including East Boulder road relocation, recent construction at the East Boulder mine site, and power line expansions. Weed treatments and inspections in these areas are the responsibility of mixed agencies, corporate, and private individuals. Weed treatments in the proposed treatment areas are the responsibility of the Forest Service and efforts would be made to co-ordinate treatments wherever possible.

There are approximately 159 acres of noxious weeds in the East Boulder drainage. These areas have become infested over the course of the last 15 years of human activity and land use. Prior to operations at the East Boulder Mine and power line development, there were no recorded noxious weed sites on National Forest Land in the East Boulder drainage. The proposal for Alternative 2 is for up to 650 acres of timber stand treatments with up to 2.1 miles of new, low-standard temporary road, and widespread hand and machine piling and burning. The proposal for Alternative 3 is for up to 870 acres of timber stand treatments and up to a total of 3.5 miles temporary road. These alternatives represent additional human disturbance and activity. Soil disturbance is the major

contributing factor to weed infestation or expansion. New weed infestations will be minimized to the extent that soil and native vegetation remain intact.

While neither of the action alternatives (Alternative 2 & 3) would eliminate the chances for a severe wildfire in the East Boulder drainage, proposed treatments would break up the continuous vertical and horizontal fuel bed along the corridor, which would in turn lend to a lower intensity burn within the treated areas (See fuels analysis pp. 73-84).

The major contributing factor to weed proliferation under a wildfire scenario is the amount, location, and duration of soil disturbance. Ground disturbing, fire suppression activities such as hand or dozer line construction could also result in increased soil disturbance and serve as areas that would allow inadvertent transport of non-native plant materials into relatively undisturbed areas while providing favorable growing areas for windblown seeds, free from competition by existing plants.

Conclusions

Noxious weeds can have a long-term biological impact on the eco-system by displacing native plant species and reducing species diversity, reducing the quality and quantity of wildlife forage and habitat, decreasing soil stability, water quality, and by altering plant succession dynamics. It is possible that stand changes involving overstory removal, ground disturbance, and burning could result in invasion of weed species that do not currently inhabit the East Boulder project area.

Alternative 1 is the most protective alternative from the standpoint of short term weed invasion and spread unless a large wildfire were to occur in the project area. Both Alternatives 2 & 3 would likely result in some amount of increase in weed invasion and establishment. It is not possible to accurately predict the amount of weed invasion that would occur because there are too many variables. However, if weed mitigation and monitoring practices are followed for both of the action alternatives, the likelihood for noxious weed invasion and spread would be minimal. Tables 15 & 16 above provide a comparison of key differences in regard to potential for weed expansion and potential associated cost between alternatives.

Compliance with Laws, Regulations, and Forest Plan Direction

The Forest Service is directed by law, regulation and agency policy to treat weeds. A number of laws give broad authority for control of weeds on National Forest System land, and several laws and regulations provide for control of such weeds. In particular Executive Order (03 February 1999), directs Federal Agencies to prevent and control invasive species. The Federal Noxious Weed Act of 1974 (PL 93-6329), authorizes the Secretary of agriculture to cooperate with other agencies to control and prevent noxious weeds. The Montana Noxious Weed Law 1948, amended in 1991, provides for designation of noxious weeds in the State, direction of control efforts, registration of pesticides and licensing of applicators, and enforcement of statutes. The law delegates enforcement to County Commissioners. Also the Gallatin Forest Plan (page 11-28) requires the Forest to implement an integrated weed control program in order to confine present infestations and prevent establishing new areas of noxious weeds. Weed monitoring and control are an important part of the proposed action and all of the above direction will be followed. In addition, numerous mitigation measures have been established to minimize weed infestation and spread in the project area.

Direct, Indirect, & Cumulative Effects for Other Issues

a. Water Quality

Affected Environment

In cooperation with the Stillwater Mining Company, the East Boulder River has been monitored for discharge, sediment, and turbidity from 1997 to 2003, 2006, and 2010. The monitoring included sites above and below the East Boulder Mine as well as Elk Creek. Monitoring parameters include suspended and bedload sediment, turbidity, and discharge at 4 sites along the East Boulder River (4 additional sites in 2001, 2002, and 2003) and at Elk Creek. Water quality monitoring annual reports for the East Boulder River are available at the Yellowstone Ranger District and at the Gallatin SO. No changes were measured in sediment or turbidity that can be attributed to SMC/East Boulder project exploration or road construction activities. The East Boulder stream system discharge and sediment monitoring in 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2006, and 2010 has documented a stream system that is very low in suspended sediment, bedload sediment, and turbidity (USFS 2011). All of the measured parameters are well within Montana DEQ B1 water quality standards, which apply to the East Boulder River. In 2005 – 2007 proliferation of Didymosphenia germinata diatom algae had significantly impacted the East Boulder River channel. By 2010 the Diymo effect had diminished (USFS 2011). In general the East Boulder suspended and sediment yields are source limited rather than energy limited in that the ability to transport sediment is greater than sediment availability in the coarse textured stream system. Sediment concentrations in the East Boulder River are currently very low.

In an 8/23/2010 opinion for suit filed by the Northwest Environmental Defense Center (NEDC) against state regulators and timber companies in Oregon, the NEDC asserted the defendants failed to provide or obtain NPDES permit coverage for stormwater runoff that flows from forest roads associated with logging into systems of ditches, culverts and channels, and which is then discharged into forest streams. Previously, operators of logging activities, which include the construction and maintenance of access roads, were not required to obtain NPDES permit coverage for stormwater discharges, except in very specific and limited instances. This was based on 40 CFR 122.27 (the "silviculture rule") which exempted, among other things, log "harvesting operations" and "road construction and maintenance from which there is natural runoff" from NPDES permit requirements, because these activities were defined to be non-point sources. The 1990 Stormwater "Phase I" regulations require NPDES permits for stormwater discharges "associated with industrial activity," but industrial activity does not include the non-point sources defined in 40 CFR 122.27. NEDC contended that channelized stormwater runoff from these roads is a point source discharge subject to NPDES permitting. In a decision filed on 8/17/2010, the Court stated that EPA's silviculture rule, 40 CFR 122.27, only exempts natural runoff from silviculture activities until the runoff is conveyed in some way through a "discernible, confined and discrete conveyance" and discharged into waters of the U.S. The Court concluded that channelized runoff from logging roads is a point source stormwater discharge "associated with industrial activity" under the 1987 CWA stormwater amendments and implementing regulations, and is therefore subject to Phase I stormwater NPDES permitting requirements. The court directed that the Silviculture Rule could be construed as consistent with the CWA so long as the "natural runoff"

remains natural. The exemption ceases to exist as soon as the natural runoff is channeled and controlled in some systematic way through a "discernible, confined and discrete conveyance" and discharged into the waters of the United States.

The ruling is subject to further appeal and no injunction associated with the decision directly currently affects the Forest Service or the East Boulder Fuels project. In temporary guidance on 9/22/10, the EPA issued MSGP (Multi-Sector General Permit) guidance for states which are not covered by a state NPDES program. In states authorized to administer their own stormwater program, such as Montana, the EPA directs use of the appropriate state-issued permit. If a general permit similar to that currently in place for smaller construction and industrial sites is made available, it could require the filing of an electronic or paper "Notice of Intent" (NOI) for road construction, maintenance, or transport operations, together with a "Stormwater Pollution Prevention Plan" (SWPPP) that must be prepared and implemented. The State of Montana currently does not have a specific forest operations or road discharge stormwater permitting process. The closest existing permitting process is the industrial stormwater permit which is described on the Montana DEQ web site at http://www.deq.mt.gov/wqinfo/MPDES/StormwaterIndustrial.mcpx

The EPA MSGP 9/22/20 guidance directs that, for newly planned forest road projects, operators must submit a NOI at least 30 days prior to commencing construction. The stormwater permitting process is administered in Montana by the Montana DEQ Water Protection Bureau in the Permitting and Compliance Division. The DEQ Water Protection Bureau staff indicates that if the industrial stormwater form and process is used for forest road NPDES permits the NOI, the application form, and SWPPP should be filed at least 90 day in advance of logging operations.

The NEDC vs. Brown (pg. 12008) ruled that the decision applies to “navigable waters of the United States” which the Montana DEQ Water Protection Bureau further considers to be “State waters” as defined in Montana Code 75.5.101 (33) (a) as “a body of water, irrigation system, or drainage system, either surface or underground”.

The exact regulatory process, format, permitting requirements of the NEDC vs. Brown decision to the East Boulder fuels project is currently unclear but the roads associated with the project were examined in detail in a hydrology/engineering review on October 12, 2010 in order to gather the appropriate data and information that could be needed for industrial stormwater NPDES permit applications. The road system, which would be used for the East Boulder Fuels project to the GNF Forest boundary includes 61 road related drainage features including ditch relief culverts, waterbars/dips, and 1 bridge crossings. Of the 61 road drainage features, only 4 had any discernable connection to streams. Two could be eliminated via slightly enlarged berms associated with the East Boulder Mine stormwater control operations. The other two could be disconnected with small sediment traps.

All required water quality permits would be acquired by the Gallatin National Forest prior to any ground disturbance activities for the East Boulder fuels project. If logging road stormwater discharge NPDES permits are required for East Boulder fuels project,

the Gallatin National Forest will work with the Montana DEQ to obtain the permits prior to project implementation.

Effects Analysis

Methodology and Scale

The water quality analysis consists of cumulative sediment modeling of all National Forest and private lands, roads, and East Boulder Mine development. Sediment analysis was done for all activities from 1980 to 2016 at an accounting point of the East Boulder River at the Forest Boundary.

Existing and potential sediment yields were estimated using landtype acres by watershed, watershed acres, and road miles by watershed. Potential effects of the East Boulder fuels project were analyzed by an assessment of potential sediment yield effects using the R1R4 sediment model (Cline et. al, 1981) and adjusting sediment coefficients based on existing road and timber harvest unit acres and conditions. Road sediment for roads used for log hauling was adjusted upward to account for increased sediment potential from log truck road prism impacts. Baseline sediment yield coefficients are based on sediment monitoring data on the Gallatin National Forest from 1970 to 2010. The model was run assuming the East Boulder fuels project would be implemented in 2011 and 2012. The R1R4 model used in the sediment analysis is designed to address the cumulative effects of fuel project operations, temporary road construction, mining activities, and potential wildfire. The model is designed to compare relative differences among alternatives rather than to predict precise sediment and water yields that are likely to occur upon project implementation. Because the R1R4 model relies on climatic conditions over long periods, the models' accuracy is best when averaged over several years.

Sediment coefficient levels for many of the same treatment areas were adjusted using procedures in WEPP http://forest.moscowfsl.wsu.edu/fswepp/. The Water Erosion Prediction Project tool (Elliot et. al. 1999) was used for sediment delivery modeling and is a conservative approach of estimating potential erosion and sediment effects of timber harvesting, fuels treatments, and roads. The primary WEPP tools used included WEPP: Road for road sediment estimates and Disturbed -WEPP for thinning treatments and broadcast burns. The WEPP model is a scientifically-based model that predicts what sediment could enter stream courses, or drainages leading to stream courses. WEPP predictions are generally within the range of actual field observations of sediment yields. WEPP predictions represent annual averages of sediment delivery produced by runoff events based on the selected climate and site conditions. Although quantitative values for sediment are generated from this model, results are used as a tool in the interpretation of how complex physical systems may respond. The WEPP models deals with the variability by incorporating climate data tailored to the individual site using PRISM data (Daly et al., 2001) and simulates daily events for a number of years specified by the user (30 years in the East Boulder fuels analysis) to determine the probability of sediment delivery.

WEPP:Road was used to estimate road sediment changes from increased log truck use. Potential stormwater discharge points were identified in field surveys on October 13, 2010. For each site the appropriate WEPP:Road parameters were measured (road length, width, gradient, slope gradient and width, buffer gradient and width). The WEPP:Road

model incremental logging truck road sediment was run deliberately overestimating by assuming that all truck traffic during the time of the East Boulder Fuels project was due to logging trucks when in reality the main truck use on the road is and would continue to be trucks associated with the East Boulder Mine operations. Since mine traffic on roads in the East Boulder drainage is high, the incremental addition of WEPP:Road sediment model results are conservative (overestimating sediment effects). The WEPP:Road sediment use coefficients were included in the R1R4 sediment modeled amounts displayed in Tables 17-18.

Direct/Indirect/Cumulative Effects

With Alternative 1, no fuels reduction actions associated with East Boulder Fuels would be undertaken over the next 5-10 years to respond to the purpose and need identified in Chapter 1. The opportunity to reduce fuel accumulations would be deferred. There would not be any temporary road construction, or road improvements in the project area. The sediment levels for the East Boulder River would be unchanged with Alternative 1 from 2010 through 2016 assuming no wildfires occur. All drainages would meet the Category A 30% over natural sediment standard and would be in compliance with Montana Water quality standards. Alternative 1 has the lowest short term potential for turbidity and sediment increases. The R1R4 sediment modeling was run for Alternative 1 in a cumulative mode accounting for all existing roads, timber harvesting, and residential, and recreational developments in the East Boulder River. Overall sediment impacts of Alternative 1 would not change unless sediment is increased by wildfires. Since there are no direct or indirect sediment effects, no cumulative impacts with other sediment or nutrient impacting activities in the East would occur.

Alternative 1, however, has the highest risk for catastrophic wildfire in the East Boulder corridor, which could pose extensive impacts to soil erosion, debris flows, and sediment loadings to the East Boulder River. The no action alternative would forego the fuels management opportunity, which could reduce the likelihood of extensive water quality impacts from a large wildfire. A 200 acre wildfire could increase sediment yields in the East Boulder River to above the 30% over reference Gallatin NF standard. Potential 5000 and 15000 acre wildfires could push sediment levels to much above sediment standards (See Specialist Report, Project File).

Alternative 2 has a greater probability for sediment yield increases than Alternative 1 due to project-related treatments including construction of temporary roads and thinning of trees. Erosion and sediment increases from the mechanized ground based treatments and timber removal could result from skid trails, log yarding, landings, piling disturbance, temporary roads, and pile burns. With Alternative 2, the R1R4 model was run assuming all temporary roads, thinning, and pile burning activities would be accomplished from 2011-2012. It was also assumed that no wildfires would occur during 2011 – 2016 in order to display the potential sediment increases from activities associated with Alternative 2. The temporary road locations cross some swales that do not have discernable stream channels, are heavily vegetated, and would filter out any thinning related sediment. The hand treatment units have very limited potential to increase sediment due to minimal ground disturbance. Pile burns typically consume the duff and upper soil horizon, however, the piles are surrounded by unburned areas that have very short erosion slope lengths and act to contain erosion to the area of the pile. Actual areas of erosion and sediment delivery within the East Boulder fuels project area

are expected to be minor and localized. Alternative 2 would reduce but not eliminate the risk of severe or extensive wildfire and associated potential for sharp sediment increases from precipitation events impacting burned areas. East Boulder river sediment would increase from an estimated 4.3% over natural in 2010 to 5.7% in 2012, a 1.4% maximum increase. In reality, the implementation of the proposed treatments would likely be spread out over more than 2 years so the peak sediment increase would likely be less. A water balance technique (ECA method) was run for Alternative 2 to calculate potential water yield increase assuming all mechanical harvesting would act as clearcuts. The potential water yield increase for Alternative 2 would be an additional 18 acre feet of water yield in the East Boulder River or 0.06%, which combined with the current increase of 0.2% would result in an increase of 0.26%. In actuality, the partial canopy reduction methods proposed would result in only an estimated 10-20% of these projected water yield increase but a slightly earlier snowmelt in the thinned units due to the more open canopy. These potential changes are much too low to be measurable or result in low flow reductions. Nutrient increase potential is not a water quality concern with the East Boulder fuels project because no broadcast burns are planned. The R1R4 sediment modeling was run for Alternative 2 in a cumulative mode accounting for all existing roads, timber harvesting, and residential, and recreational developments in the East Boulder River. Overall sediment impacts of Alternative 2 as displayed in Table 17 pose only minor sediment increases.

Table 17-R1R4 Modeled Sediment Yield Estimates for Alternative 2

Year	Natural Sediment (tons/year)	Road Sediment (tons/year)	Thinning Sediment (tons/year)	Total Sediment (tons/year)	% Over Natural Sediment Delivery
2010	630	27.1	0	657.1	4.3
2011	630	28.2	4.6	662.8	5.2
2012	630	28.7	7.2	665.9	5.7
2013	630	27.6	4.6	662.2	5.1
2014	630	27.1	3.1	660.2	4.8
2015	630	27.1	1.5	658.6	4.5
2016	630	27.1	0	657.1	4.3

With Alternative 3, the R1R4 model was run assuming all temporary roads, thinning and pile burning would be conducted during 2011-2012. It was also assumed that no wildfires would occur during 2010 – 2016 in order to display the potential sediment increases from Alternative 3 activities. Alternative 3 has a greater probability for sediment yield increases than Alternative 1 or 2 due to additional project related treatments in the Lewis Gulch area. East Boulder river sediment would increase from an estimated 4.3% over natural in 2010 to 6.2% in 2012, a 1.9% maximum increase as shown in Table 18 below. In reality, the implementation of the proposed treatments would likely be spread out over more than 2 years so the peak sediment increase would likely be less. A water balance technique (ECA method) was run for Alternative 3 to calculate potential water yield increase assuming all mechanical harvesting and broadcast burns would act as clearcuts. The potential water yield increase for Alternative 3 would be an additional 27 acre feet of water yield in the East Boulder

River or 0.07% which combined with the approximately current increase of 0.2% would result in an increase of 0.27%. In actuality the partial canopy reduction methods being proposed will result in only an estimated 10-20% of these projected water yield increase but a slightly earlier snowmelt in the thinned units due to the more open canopy. As with Alternative 2, these potential changes are much too low to be measurable or result in low flow reductions. Wildfire growth potential and the probability of sediment increases would likely be less than with Alternative 2 due to additional fuel reduction treatments. The R1R4 sediment modeling was run for Alternative 3 (Table 18) in a cumulative mode accounting for all existing roads, timber harvesting, and residential, and recreational developments in the East Boulder River. Overall sediment impacts of Alternative 3 would be increased over pre-project conditions due to minor increase in road sediment from log hauling and thinning but pose only minor sediment increases unless sediment is increased by wildfires.

Table 18- R1R4 Modeled Sediment Yield Estimates for Alternative 3

Year	Natural Sediment (tons/year)	Road Sediment (tons/year)	Thinning Sediment (tons/year)	Total Sediment (tons/year)	% Over Natural Sediment Delivery
2010	630	27.1	0	657.1	4.3
2011	630	28.2	6.6	664.8	5.5
2012	630	29.1	10.2	669.3	6.2
2013	630	28.2	6.6	664.8	5.5
2014	630	27.1	4.6	661.7	5.0
2015	630	27.1	2.5	659.6	4.7
2016	630	27.1	0	657.1	4.3

General patterns of climate change emerge from all predictive models: some areas are likely to receive more precipitation and some less. Warming temperatures will result in less precipitation falling as snow, smaller snowpacks, earlier snowmelt, increased incidence of rain-on-snow flooding, reduced dry-season streamflows, greater moisture stress on vegetation, and increased stress on aquatic ecosystems. Areas subject to increased climatic extremes are likely to experience more frequent and larger floods and more frequent and longer droughts. Warming conditions are likely to trigger more extensive and severe insect outbreaks and more frequent, larger, and more severe wildfires, contributing to reduced water quality through increased erosion. Clean water supplies will become increasingly scarce, and water-related ecosystem services will be at greater risk http://www.fs.fed.us/ccrc/topics/water.shtml. The effects of either Alternative 2 or 3 on climate change and water quality is likely to be insignificant and very conjectural and does not provide sufficient differences to allow a reasoned difference between alternatives.

Therefore the issue of effects to water quality in the East Boulder River and its tributaries can be dismissed. A complete discussion/analysis pertaining to water quality can be found in the specialists report located in the Project File.

Compliance with Laws, Regulations, and Forest Plan Direction

Alternatives 1-3 meet all applicable water quality laws, regulations and Forest Plan Guidance for the East Boulder River and tributaries. The East Boulder River currently meets Montana B-1 Classification standards within the project area. **The Montana DEQ 2008 and 2010 303(d) and TMDL** preparation process and status are also disclosed in detail in the Applicable Laws, Regulation, and Forest Plan Direction section of this EA. No 303(d) listed streams occur in the East Boulder Fuels project area.

Projected sediment level increases in Alternative 2 and 3 have been mitigated to be very low and not readily measurable with conventional sediment measurement equipment. The estimated maximum increase in East Boulder sediment of 1.4% in Alternative 2 and 1.9% in Alternative 3 with East Boulder river sediment at 5.7% (Alternative 2) and 6.2% (Alternative 3) over natural are well within compliance with the Gallatin NF 30% over natural standard for municipal watersheds or sensitive streams.

The BMP's used in this East Boulder Fuels EA were based on the **Montana Forestry BMP's**, which form the nucleus of the Montana BMP audits, augmented by more stringent SMZ guidelines used on the Gallatin NF due to Trout Unlimited Settlement Agreement provisions. The **Trout Unlimited Settlement Agreement** is discussed in the fisheries section of this EA. In addition multiple GNF BMP reviews of fuel treatment projects and timber sales/road were used to refine the BMP's for East Boulder Fuels. All possible reasonable BMP's have been incorporated into the project design.

The Gallatin sediment standards were revised during the **Gallatin Travel Plan** process (in cooperation with the Montana DEQ) to be much more restrictive than previous standards and are based on sediment modeling and calibrated with actual GNF water quality data (instream suspended and bedload sediment), and sediment core (spawning substrate fines). This EA analysis demonstrates that the East Boulder River would be considerably below and well within compliance with the 30% over natural standard. No HUC7 sediment analysis was appropriate in the East Boulder Fuels Project watershed.

All **Gallatin National Forest Plan** standards that directly apply to East Boulder Fuels are fully met including 10.2 (BMP's) and 10.3 (cumulative effects analysis).

None of the streams in or below the East Boulder Fuels project area are 303(d) listed for sediment. The definition of "naturally occurring" allows some sediment and nutrient levels above natural providing "all reasonable land, soil, and water conservation practices have been applied" per ARM 16.20.603(11). The East Boulder Fuels BMP's use standard or in many cases more stringent BMP's than Montana Forestry BMP's or Montana SMZ rules and would certainly meet the definition of "all reasonable". The Montana Code Annotated – 2007 75-5-703 section (10)(c) additionally 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 allows for small sediment and nutrient increases project since "reasonable" BMP's are being planned and required.

As explained in the Affected Environment and Mitigation sections, all required water quality permits would be acquired by the Gallatin National Forest prior to any ground disturbance activities if logging road stormwater discharge NPDES permits are required

for the East Boulder Fuels Project. The Gallatin National Forest will work with the Montana DEQ to obtain any required permits prior to initiation of project implementation.

b. Aquatics

The analysis area for aquatic resources includes the following streams within the East Boulder drainage: East Boulder River proper downstream to the National Forest boundary, Lewis Gulch, Wright Gulch, Twin Creek, and Dry Fork Creek.

Because the project has potential to affect aquatic habitat and biota, it is important to evaluate existing habitat and population conditions and identify factors that may be limiting populations, both natural and man induced, in analysis area streams. Assessing habitat quality for aquatic biota and identifying limiting factors provides the basis from which to determine or estimate potential effects of this project. Therefore, the affected environment narrative also includes a summary of existing fish habitats and populations.

Affected Environment

Stream channels in the project area were characterized using the Level II classification system of Rosgen (1996). Four streams in the project area, Lewis Gulch, Wright Gulch, Twin Creek, and the East Boulder River have predominately A2 channel types (Table 19). Dry Fork Creek also has short interspersed A2 reaches. A2 channels are steep, entrenched and confined channels with predominately boulder sized channel material with lesser amounts of cobble and gravel. A2 channels have a high energy and low sediment supply, with relatively low bedload transport rates. The channel bed and streambanks are stable and contribute little to sediment supply. They have a very low sensitivity to disturbance, excellent recovery potential, very low sediment supply, very low streambank erosion potential and riparian vegetation exerts negligible control on streambank stability (Rosgen, 1996; see Table 19). The riparian corridor is predominately conifers with understory deciduous shrubs, grasses and forbs. The lowermost reach of Twin Creek above the East Boulder road has lower gradient and entrenchment and is considered a B2/B3 channel type. Like upstream reaches, the lower reach is also very stable.

The East Boulder River throughout the project area is also considered an A2 channel type, but has B2 and B3 reaches interspersed where entrenchment is less and gradient decreases and allows smaller substrates to be deposited. B2/B3 reaches are more prominent throughout lowermost reaches in the project area near the forest boundary. The channel bed and streambanks are stable and contribute little to sediment supply. Suspended and bedload sediment measurements for the East Boulder River were collected during 1997, 1998, 1999, 2000, 2001, 2002, 2003, and 2006. Results for each year show that the stream has very low suspended sediment, bedload sediment, and turbidity (See water quality analysis). All of the measured parameters were well within Montana DEQ B1 water quality standards, which apply to the East Boulder River (USFS 2007a). The East Boulder River has a very low sensitivity to disturbance, excellent recovery potential, very low sediment supply, very low streambank erosion potential and riparian vegetation exerts negligible control on streambank stability (Rosgen, 1996). The riparian corridor is predominately conifers with understory deciduous shrubs, grasses and forbs.

Dry Fork Creek flows through a glaciated lake bed and channel substrates are much finer. Through the project area, the stream is primarily an A3 channel type with predominately cobble and gravel substrates. A3 channel types are also steep, deeply entrenched, and confined channels typically incised through depositional soils. These channels can exhibit high sediment supplies, with correspondingly very high bedload sediment transport rates. They can have very high sensitivity to disturbances, very poor recovery potential, very high sediment supplies and high streambank erosion potential. However, riparian vegetation exerts negligible controlling influence and bank stability. Because of its geology, Dry Fork Creek naturally contributes high sediment loads to the East Boulder River during high intensity summer rainfall events. Lower gradient B3 and B4 channel types are intermittently dispersed throughout the Dry Fork reach within the project area, but more prominent in lower reaches near its confluence with the East Boulder River. In addition, few bedrock controls are located in the uppermost reach within the project area. The riparian corridor is predominately conifers with understory deciduous shrubs, grasses and forbs.

Table 19-Channel types within the project area (from Rosgen 1996)

Stream Name	Stream Types	Channel Sensitivity[a]	Recovery Potential[b]	Sediment Supply[c]	Bank erosion potential	Vegetation controlling influence[d]
East Boulder River	A2	Very low	Excellent	Very low	Very low	Negligible
	B2	Very low	Excellent	Very low	Very low	Negligible
	B3	Low	Excellent	Low	Low	Moderate
Lewis Gulch	A2	Very low	Excellent	Very low	Very low	Negligible
Wright Gulch	A2	Very low	Excellent	Very low	Very low	Negligible
Twin Creek	A2	Very low	Excellent	Very low	Very low	Negligible
	B2	Very low	Excellent	Very low	Very low	Negligible
	B3	Low	Excellent	Low	Low	Moderate
Dry Fork Creek	A3	Very high	Very poor	Very high	High	Negligible
	B3	Low	Excellent	Low	Low	Moderate
	B4	Moderate	Excellent	Moderate	Low	Moderate

[a]includes increases in streamflow magnitude and timing and/or sediment increases

[b]assumes natural recovery once cause of instability is corrected

[c]includes suspended and bedload from channel-derived sources and/or from stream adjacent slopes

[d]vegetation that influences width/depth stability

Forest Plan implementation guidelines, outlined in an agreement with the Madison-Gallatin Chapter of Trout Unlimited, classify streams into four different categories (Class A, B, C, and D) each with unique fisheries management and habitat goals. These classifications were recently modified in the Gallatin National Forest Travel Plan

Decision (Gallatin National Forest, Travel Management Plan, Final Environmental Impact Statement, Detailed Description of the Decision 2006, pages I-11 through I-13) to include only two categories, A and B (See Table 20). This recent modification is more in line with Montana Department of Environmental Quality water quality laws. Category A streams are the highest value streams from a fishery standpoint, and they include streams that are inhabited by sensitive fish species. For Category A streams, the habitat management objective is to maintain or progress toward providing habitat that is 90% or greater of its inherent habitat capability or reference condition. The fish population objectives for Category A streams are to maintain or enhance the existing population level consistent with maintaining the integrity of the individual populations and the distribution objectives for protection of the species as a whole. The management objective for Class B streams is to manage habitat conditions at a level of at least 75% of their inherent capability. Habitat management objectives and sediment guidelines for streams in the analysis area are displayed in Table 20 below.

Table 20- Habitat Management Objectives and Sediment Guidelines

Stream Class	Habitat Management Objective	Analysis Area Streams	Fine sediment concentrations in spawning gravels (*guideline)*	Annual Sediment Yield % Over Natural *(guideline)*
Class A Sensitive species and/or Blue Ribbon Fisheries	90% (of pristine)	East Boulder River	0-26% (%fines < 6.3mm)	30%
Class B Regionally or locally important fisheries and all other streams (formerly Classes B,C,D)	75% (of pristine)	Lewis Gulch, Wright Gulch, Twin Creek, Dry Fork Creek	0-30% (% fines < 6.3mm)	50%

Average stream gradient of the EBR in upper reaches within the project area is 3%. Gradient decreases some downstream near the forest boundary to 2%. Large boulders provide complex and diverse habitats throughout the stream reach in the project area. Because of high gradients, much of the LWD recruited to the channel is flushed during high spring flows or creates large debris jams that increase habitat diversity. Spawning gravels are limited, but sometimes found in depositional zones downstream of large boulders or debris jams. Spawning habitats are more common downstream of the project area from the forest boundary downstream to its confluence with the main Boulder River. Except for limited road encroachments and a short 100 yard reach where large woody debris (LWD) was removed from the channel following blowdown, physical habitats in the stream reach throughout the project area are considered to be in near pristine condition. Recent fish population surveys conducted in the East Boulder River near and below the East Boulder Mine site show the fish assemblage is comprised of rainbow trout, brown trout, and Yellowstone cutthroat trout (YCT) with few brook trout (Gillin 2001, 2003, Wood pers. Comm.. 2009). Although recent genetic testing has not been completed to determine genetic purity of YCT in the East Boulder River, it is

believed that some of the YCT population is genetically pure. Genetically pure YCT inhabit headwater reaches of the East Boulder River and tributary streams. It is reasonable to assume that downstream drift of pure YCT occurs. Because YCT inhabit the East Boulder River, it is considered a Class A stream according to implementation guidelines and the GNF Travel Plan Decision. Habitat management objectives for the East Boulder River follow Class A standards as outlined in the GNF Travel Plan Decision (See Standard E-4, Applicable Laws, Regulations and Forest Plan Direction below).

Both Lewis Gulch and Wright Gulch are ephemeral with streamflow occurring during spring snowmelt runoff and typically lasting through mid to late summer, depending on summer precipitation. Riparian logging has occurred along some segments of both tributaries. Based on observational surveys during summer 2009, previous harvest has not influenced bank stability; however, some reductions of instream LWD were noted near areas where riparian harvest has occurred. Based on observational surveys during summer 2009, there is no evidence of bank instability or increased sediment deposition resulting from past harvest. With the exception of reduced LWD frequencies in some reaches, habitat conditions are near pristine. Because of ephemeral streamflows, neither Lewis Gulch nor Wright Gulch support fish population, thus both are considered Class B streams.

Electrofishing surveys were completed for Twin Creek during spring 2009. Despite perennial streamflow and adequate habitat, no fish were found above or below the East Boulder road culvert. There was no evidence of previous riparian harvest along most of the stream, and LWD accumulations are common. However, some evidence of riparian harvest was noted for a short reach along the south fork. LWD accumulations were abundant throughout this reach. Habitat conditions are considered to be near pristine. Because no fish inhabit Twin Creek, it is also considered a Class B stream.

The upper reach of Dry Fork Creek in the project area has ephemeral streamflow, while the lowermost reach near its confluence with the East Boulder River has perennial streamflow. The stream was surveyed during summer 2009. Although there was little evidence of bank instability, fine sediment deposition is common in pool tailouts and channel margins. Fine sediments originate from an upstream reach, outside the project area, that flows through a glaciated lake bed. LWD accumulations were common throughout the canyon reach and there was no evidence of past riparian harvest. With the exception of a few cattle crossings, the stream is considered to be in pristine condition. Based on electro fishing surveys conducted during baseline studies for the East Boulder Mine, lower reaches of Dry Fork Creek support a limited fish population. Dry Fork Creek is also categorized as a Class B stream.

Although habitat management standards are slightly less stringent for Category B streams, other reasons require managing Lewis Gulch, Wright Gulch, Twin Creek, and Dry Fork Creek to a higher standard. The Stillwater Mine Corporation, in cooperation with various special interest groups and regulatory agencies have established aquatic biomonitoring sites along the East Boulder River to monitor any potential mine related impacts on aquatic life. Therefore, although these streams are considered Class B streams, habitat management objectives, including allowable sediment increases, will follow Class A standards. Thus, all streams within the project area will be managed to near pristine conditions.

Effects Analysis

Methodology and Scale

To evaluate the effects of this project on riparian integrity and fish habitats, anticipated changes associated with various treatments are first projected against the structural framework of the channels (i.e., channel types previously described). In other words, the sensitivity of individual streams or channel types were evaluated against treatment activities that may influence their stability. Because sediment increases may affect aquatic habitats and biota, potential sediment yield increases are first evaluated against channel sensitivities to changes in sediment discharge. The channel sensitivity analysis provided in affected environment descriptions are used to help predict the relative direction and magnitude of potential geomorphic change or habitat quality for pools and spawning gravels.

In addition, to estimate potential sediment effects on spawning habitat, the R1/R4 sediment yield model was used to predict sediment yield increases by alternative. Sediment coefficient levels for many of treatment areas were adjusted using procedures in WEPP http://forest.moscowfsl.wsu.edu/fswepp/. See p. 101 of the water quality section for a description of the WEPP modeling tool. Natural and predicted sediment increases are weighed against established standards. The R1/R4 sediment delivery model is a simplified approximation of complex processes that determine sediment production. Because of this, resulting values are not considered definitive or absolute; rather they are used only to evaluate the relative magnitude and direction of sediment yield change by alternative. It is important to recognize that the R1/R4 model predicts the amount of sediment delivered to channels, not instream sediment concentrations. Under equilibrium conditions, most sediment delivered naturally to a stream is flushed from the system. When sediment inputs are above a streams competence to transport them they may begin to accumulate in the system, particularly in low velocity reaches where spawning gravels are deposited. As such, predicted sediment yield increases are also compared to channel type and sensitivity analysis to determine potential for fine sediment deposition.

To estimate effects on LWD, riparian treatments are evaluated based on their potential to influence LWD recruitment to project area streams. Riparian mitigation measures are considered in this evaluation.

The spatial bounds for evaluating direct, indirect and cumulative effects to aquatic resources includes all tributary streams within the project area downstream to their confluence with the East Boulder River, and the East Boulder River downstream to the National Forest Boundary. The analysis for direct and indirect sediment effects incorporates all previous timber sale and road construction activities and reasonably foreseeable activities that have occurred or may occur within the spatial bounds of the analysis area. Thus, the direct and indirect sediment effects analysis are cumulative in nature, and the temporal bounds for direct, indirect, and cumulative effects includes all past, present and reasonably foreseeable actions.

Direct/Indirect/Cumulative Effects

With Alternative 1, no actions would be undertaken over the next few years that respond to the purpose and need of the project. No treatments such as hand piling or grapple

piling would be done on the existing ground fuels. No burning would be completed. No vegetative treatments would be undertaken to treat stands or reduce fuels. There would be no fuel reduction activities along riparian corridors of streams within the project area. Thus, there would be no potential to impact riparian areas, or fish habitat. Alternative 1 would result in no direct or indirect effects (no effect), beyond existing conditions, to fish populations or habitat relative to the vegetation treatment aspect of the proposal. As such there would be no cumulative effects to aquatics with Alternative 1.

Effects on riparian integrity and streambank stability were mitigated throughout the development of the project. Stream protection measures are considered to be an integral part of the action alternatives (Alternative 2 & 3) and effects determinations assume that these measures will be implemented. The underlying goal of protection measures for riparian and aquatic habitats is to follow a functional definition of riparian zone consistent with GNF Plan and FSM direction, and consider riparian vegetation in relation to stability, integrity, and meeting needs of riparian zone dependent species including fish and fish habitat. Unit specific mitigation measures as outlined in Table 21 below apply.

Table 21-Riparian Treatments and Mitigation for all Treatment Units

Unit #	Adjacent Stream	Unit Prescription	Riparian Treatment	Applied Riparian Mitigation[6]
1	NA	Commercial tractor	NA	NA
2	East Boulder River	Small tree thin hand treatment	Yes	50’ no treatment buffer along EBR
3	No streams, small ponds	Commercial tractor	NA	Ponds to be buffered as part of leave tree clumps
3A	NA	Small tree thin Hand treatment	NA	NA
4	East Boulder River (EBR)	Small tree thin hand treatment	Yes	Minimum 15’ no treatment along the East Boulder River; No treatment on steep slopes adjacent to the EBR Where steep slopes occur adjacent to EBR unit boundary to be located on top of terrace
5	East Boulder River, Wright Gulch	Commercial tractor	Yes	Minimum 15 feet no treatment along EBR; no treatment on steep slopes adjacent to EBR; Where steep slopes occur adjacent to EBR unit boundary to be located on top of the terrace; No treatment 50 feet either side of Wright Gulch

[6] NA implies that no riparian areas have been identified for this unit

Unit #	Adjacent Stream	Unit Prescription	Riparian Treatment	Applied Riparian Mitigation[6]
5A	Wright Gulch	Commercial tractor	Yes	50 feet no treatment along either side of Wright Gulch except adjacent to powerline.
6	Lewis Creek	Small tree thin Hand treatment	Yes	Leave clump located along Lewis Creek.
7	Twin Creek	Commercial tractor	Yes	50 feet no treatment along Twin Creek except adjacent to powerline
7A	NA	Commercial tractor	NA	NA
7B	Twin Creek	Small tree thin Hand treatment	Yes	50 feet no treatment along Twin Creek
8	NA	Small tree thin Hand treatment	NA	NA
8A	NA	Small tree thin Hand treatment	NA	NA
9	NA	Commercial tractor	NA	NA
9A	Lewis Gulch	Commercial tractor	No riparian treatment	NA
10	NA	Commercial tractor	NA	NA
11	East Boulder River	Commercial tractor	Yes	Minimum 15 feet no treatment along EBR, no treatment on steep slopes draining into EBR; Where steep slopes occur adjacent to EBR unit boundary to be located on top of the terrace
11A	East Boulder River Dry Fork	Small tree thin Hand treatment	Yes	Minimum 15 feet no treatment along EBR; No treatment 50 feet either side of Dry Fork; No treatment on steep slopes draining into EBR or Dry Fork; where steep slopes occur adjacent to streams unit boundaries to be located on top of terraces
12	Lewis Gulch	Commercial tractor	Yes	No treatment 50 feet either side of Lewis Creek
12A	NA	Small tree thin	NA	NA

Unit #	Adjacent Stream	Unit Prescription	Riparian Treatment	Applied Riparian Mitigation[6]
13	Lewis Gulch	Commercial tractor	Yes	No treatment 50 feet either side of Lewis Creek
14	NA	Commercial cable	NA	NA
16	Lewis Gulch	Commercial cable	Yes	No treatment 50 feet either side of Lewis Creek
17	East Boulder River	Commercial tractor	Limited riparian treatment	Minimum 15 feet no treatment along EBR; No treatment on steep slopes draining into EBR; Where steep slopes occur adjacent to EBR unit boundary to be located on top of the terrace
18	East Boulder River, Dry Fork Creek	Commercial tractor	Limited Riparian treatment	Minimum 15 feet no treatment along EBR; No treatment 50 feet either side of Dry Fork Creek; No treatment on steep slopes draining into EBR or Dry Fork Creek; Where steep slopes occur unit boundaries to be located on top of terraces
19	NA	Commercial tractor	NA	NA
21	NA	Commercial tractor	NA	NA
22	Lewis Gulch	Commercial cable, commercial tractor	No	No treatment 100 feet from Lewis Gulch
22A	Lewis Gulch	Tractor	No	No treatment 100 feet from Lewis Gulch
23	NA	Commercial cable	NA	NA

Similar aquatic mitigation measures were applied to treatment units along the Main Boulder River and tributaries for the Main Boulder Fuels Reduction Project. During summer 2009, the Big Timber unit of the Yellowstone Ranger District hosted a field trip with fisheries professionals representing Yellowstone National Park, Montana Department of Fish, Wildlife and Parks, Trout Unlimited, and US Forest Service. The intent of the field review was to solicit comments and input relative to the applied aquatic mitigations along the main Boulder River and its tributaries. Collectively, the group considered the mitigation effective at protecting aquatic resources. For that project, the 15 foot no cut zone was applied to all streams. Though the group considered the 15 foot distance adequate to protect aquatic resources when applied in conjunction with other mitigation (e.g., selective harvest to protect LWD recruitment), there was a

general consensus that 15 feet was the minimum distance necessary for adequate protection.

With few exceptions, the East Boulder River throughout the project area is incised between high terraces with steep slopes on either side of the stream. Riparian mitigation prohibits any treatment on steep slopes draining directly into the East Boulder River (EBR). Although there is a 15 feet no treatment mitigation that generally applies along the EBR, the steep slopes effectively limit any treatment beyond 50 feet of the stream in most areas because the lineal distance from the high water mark to the top of the terrace exceeds 50 feet. Unit boundaries are located on the top edge of the terrace. There are few short segments in some units where the stream is not incised and limited riparian treatment is needed to meet fuels objectives The 15' no cut buffer applies to these short interspersed reaches with no high terrace or steep slope draining into the river. Treatment mitigations between 15 feet and 50 feet provide additional protection to the limited reaches where steep slopes do not occur.

Likewise, riparian treatments are not prescribed within 50 feet of all tributaries to the EBR. Because tributary streams are steep and incised, a distinct riparian vegetation community typically does not extend beyond 15 feet of the high water mark of streams. As such, from a functional perspective, there will be no treatment within any distinct riparian vegetative community. Additional mitigation measures effectively protect all trees outside the riparian zone that have potential to fall towards the stream and provide a source for LWD recruitment. Likewise, standard SMZ operational restrictions adequately protect soils near stream courses.

With the exception of uppermost reaches of Dry Fork Creek, channel types in all streams have a low to very low sensitivity to disturbance and low to very low bank erosion potential. In addition, riparian vegetation exerts negligible control on channel and streambank stability. Given the high energy nature of streams during spring snowmelt runoff, the primary vegetative component influencing channel stability is LWD. Although LWD is a critical component for fisheries habitat, fish do not inhabit tributary streams in the project area. However, LWD is important for providing channel stability, sediment storage, and preventing excessive erosion during high flow events by providing flow obstructions where stream energy is dissipated. The aquatic mitigation measures inherent to the action alternatives effectively eliminate the potential to reduce LWD recruitment in all streams.

Sediment effects on adult and juvenile trout can occur when sediment concentrations exceed the capacity of the channel to flush sediment, and pools fill or riffles become more embedded. Pools are areas of higher velocity during peak flows, but at low flows their depth creates a depositional environment for fine sediment. A cursory analysis of habitat and channel type data collected for streams throughout the Gallatin National Forest shows that residual pool volume and maximum pool depth decreased slightly in channels that were more sensitive to changes in sediment yield. (i.e., lower gradient B4 and C4 channels). For A2, A3, B2, and B3 channel types, like those in this project area, there was no apparent relationship between residual pool volume or depth and road development. Based on channel surveys and observations for streams in the project area, excessive fine sediment deposits in depositional zones (e.g., pool tail-outs and channel margins) do not occur.

For Alternative 2, sediment modeling results suggest that sediment yield would increase from 4.3% over natural (existing condition) to 5.7% over natural, and for Alternative 3 to 6.2% over natural. These slight increases over existing condition for either alternative are well within natural variation for the East Boulder River and would recover to existing conditions 3-4 years post treatment. Given the high gradient nature, resiliency to changes in streamflow and sediment discharge, and low to very low sediment supplies of all channels in the project area except Dry Fork creek, the slight increases in sediment yield predicted by the R1R4 model are not expected to result in measureable changes or adverse habitat affects for any life stage in the East Boulder River.

Likewise, project related activities would have little potential to influence the integrity of existing biomonitoring sites established in the EBR to monitor mine operations. Considering the high resiliency of all channels throughout the project area, the limited treatments along riparian zones, and additional mitigation, Alternatives 2 & 3 pose little threat to the physical integrity of riparian areas or streambank stability. Channels throughout the project area generally have stable stream banks with a very low to moderate sensitivity to disturbance and riparian vegetation exerts low to negligible control on channel form and bank stability. With the protection measures included in both action alternatives, fuel treatments are designed to maximize the amount of LWD available for recruitment to stream channels. Table 20 above displays riparian mitigation associated with each treatment unit in both action alternatives. With these protection measures in place, neither Alternative 2 nor 3 would have any measurable effect on riparian integrity, streambank stability, or LWD recruitment. As such, there would be no cumulative effects associated with implementation of either alternative. Because of these findings, the issue of effects to aquatics can be dismissed. A full discussion/ analysis can be found in the specialists report (Project File).

Compliance with Applicable Laws, Regulations, and Forest Plan Direction

Forest Service Manual -FSM 2526 Riparian Area Management: Definition (2526.05) Geographically delineable areas with distinctive resource values and characteristics that are comprised of the aquatic and riparian ecosystems. Riparian ecosystems are defined as a transition area between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

The Gallatin National Forest Plan provides broad direction for the management of forest fishery resources and more specific direction for management of sensitive species. Riparian Direction: MA7 (FP, p. III-19). Refer to Item No. 29f that resolves FP discrepancy for timber management in riparian zones.

Standards have been incorporated as part of the **Gallatin National Forest Travel Management Plan signed December 18, 2006 (GNF 20**06). In the past, the sediment standard consisted of four categories of streams. Fishless headwater streams (i.e., Category C and D streams) were managed at a level below what Montana Department of Environmental Quality (MDEQ) considers as maintaining beneficial uses. This new direction formalizes these two standards for sediment. Class A streams are those streams that support a sensitive fish species or provide spawning or rearing habitat to the Gallatin, Madison, or Yellowstone Rivers, or Hebgen Lake. Class A streams are to be managed at a level which provides at least 90 percent of their inherent fish habitat capability. Class B streams are all other streams.

Trout Unlimited Settlement Agreement: The goals, policies and objectives for aquatic resources outlined in the Forest Plan have been further defined within an agreement with the Madison-Gallatin Chapter of Trout Unlimited (TU) in 1990. The intent of the Agreement was to provide more specific direction on timber harvest in riparian areas. With applied mitigation, all alternatives meet the intent of the Trout Unlimited Settlement Agreement because riparian areas and aquatic resources are protected. No effect to habitat and fish populations is expected.

Land Use Strategy for WCT and YCT: The Upper Missouri Short Term Strategy for Conserving Westslope Cutthroat Trout (UMWCT short term strategy) provides implementation direction for the MOU that was adopted in 1999. The Strategy calls for preventing habitat degradation and improving existing populations and their habitat until a long-term recovery strategy can be established and implemented. The Strategy ensures that land-use activities, like timber sales, will be implemented in a manner that results in a "beneficial impact" or "no impact" biological decision.

Cooperative Conservation Agreement for Westslope cutthroat trout and Yellowstone Cutthroat Trout in Montana: 2007: In 2007, the Gallatin and Custer National Forests joined numerous other agencies and the Crow Tribe in forming a MOU and Cooperative Conservation Agreement for Westslope cutthroat trout and Yellowstone Cutthroat Trout in Montana. This agreement establishes a framework of cooperation between the participating parties to work together for the conservation of YCT.

Executive Order 12962 (June 1995): Section 1. Federal Agencies shall, to the extent permitted by law and where practicable, and in cooperation with States and Tribes, improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities.

All alternatives comply with the laws, regulations, and Forest Plan direction described above. No effect to habitat and fish populations is expected.

c. Air Quality

Affected Environment

Concern has been raised that pile burning associated with the East Boulder Fuels Project may temporarily increase PM2.5 levels and obscure visibility along Road 205, at the East Boulder Mine, and private residences. Air quality within the East Boulder River drainage is excellent with very limited local emission sources and consistent wind dispersion. Existing sources of emissions in the East Boulder River area is primarily the SMC East Boulder Mine. The emissions from the East Bounder mine sources are predominantly dispersed to the northeast with no visible effects within the project area. No other sources of emissions occur in the analysis area other than very small local sources. Wind dispersion throughout the entire East Boulder area is robust, with no visible inversions or localized concentrations of emissions. The project area is within Montana airshed 10 (Montana DSL, 1988, p D-15). The entire project area is considered to be in attainment by the Montana DEQ.

Effects Analysis

Methodology and Scale

Smoke impacts were modeled using SIMPPLE model simulations that were estimated by running the highest decade for each of the Special Area core, core roadless, and core Wilderness and estimating potential PM2.5 concentrations at the East Boulder Mine. The air quality analysis consists of air quality modeling of each burn area at 0.1 mile to 5.0 miles with consideration to sensitive receptors at private residences and the East Boulder Mine.

Potential air quality effects for the East Boulder Risk assessment were analyzed using The Smoke Impact Spreadsheet (SIS) model (Air Sciences, 2003), which provides only simple estimates of PM2.5 concentrations as complex terrain and meteorology are only generally accounted for. The SIS model, however, is useful to estimate distance from a receptor relative to PM2.5 concentrations. The SIS model uses the CONSUME 2.1 model for pile burn emissions, and the CalPuff model for dispersion modeling.

Direct/Indirect/Cumulative Effects

In the short run, the air quality effects from Alternative 1 (no action) are less than the action alternatives (Alternatives 2 & 3) because the emissions from the pile burns would not occur. Alternative 1 (no action) would not allow the opportunity to reduce the potential of wildfire ignition in the East Boulder Watershed. Wildfire in East Boulder River drainage has the potential to result in extensive smoke and air quality impacts from PM2.5 and PM10 emissions. The no action alternative would forgo the fuels management opportunity to reduce the likelihood of intensive short term air quality impacts of a large wildfire in East Boulder Watershed.

For Alternatives 2 and 3, pile burning would include some localized visibility reduction from the plumes. Some obscuring of visibility along Road 205 and at the East Boulder Mine could occur in narrow bands during the pile burns. Dispersion of the plumes would be expected to quickly mix the project smoke to in key visibility impact levels. Pile burns are not dispersed as readily with a concentrated central plume and have an aggregation of individual pile plumes. This can result in high PM2.5 concentrations near a burn unit boundary as evidenced by the very high PM2.5 concentrations near the unit. All of the pile burns associated with Alternatives 2 & 3 met the PM2.5 standard by 0.5 mile from the burn unit. The modeling results indicate pile burns should be constrained to no more than 200 piles per day and at least 0.2 to 0.3 miles from the East Boulder mine except in Units 17 & 18 that are adjacent to the mine, where piles should be kept as small and far from the mine as reasonably possible. Piles in these units should only be burnt during times of robust wind dispersion away from the mine and there is little risk of nighttime inversions.

Generally the East Boulder drainage does not develop temperature inversions that trap smoke and reduce smoke dispersal. Dispersion of emissions within the project area is very high due to the mountainous terrain and high wind activity. The East Boulder Mine has some potential for cumulative concentrations of smoke and urban, industrial, and transportation emissions but visible inversion conditions do not occur. The East Boulder mine is very sensitive to carbon monoxide (CO) and particulates (PM2.5) since the mine pumps ambient air into the mine for ventilation.

Of particular concern in the East Boulder drainage is the potential impact of wildfire, and pile burns on the East Boulder Mine. The mine pumps ambient air into the underground mine ventilation system and is very sensitive to particulate matter and CO (carbon monoxide. The East Boulder mine, to meet health standards, must be under the Montana CO standard of 9 ppm 8 hour average and 23 ppm 1 hour average. The OSHA/PEL worker limit for an 8 hour average for CO exposure is 50 ppm. Roger Ottmar of the Forest Service's Pacific Northwest Research Station and Tim Reinhardt, Radian Corporation, conducted studies of employee exposure at prescribed and wildland fires in http://199.134.225.50/nwcc/t1_pnw2/2006/help-line/smoke-hazards.shtml.

The research team fitted firefighters with sampling packs to collect breathing-air samples. The samples were analyzed in the laboratory for respirable particulate, carbon monoxide, formaldehyde, acrolein and benzene, and other toxic compounds. The researchers found that exposure to particulate matter, carbon monoxide, and aldehydes was considerably less than anticipated. Fewer than 5% of the firefighters studied were exposed to concentrations that exceeded exposure levels deemed permissible by the Occupational Safety and Health Administration (OSHA). Although the SIS model does not provide ppm CO outputs, it does indicate that on average, CO emissions are at least 1 magnitude greater than PM 2.5 for wildfires and 40 times higher than PM 2.5 for broadcast burns but are not likely hazardous to firefighters or East Boulder mine employees unless the wildfire were within 0.1 miles of the East Boulder mine.

Air resources are somewhat unique in that the past impacts to air quality are not usually evident or cumulative. The East Boulder Fuels Project emissions with any of the alternatives would be cumulative only with the local and regional emission sources described in the affected environment of the air quality analysis in Appendix A, occurring only at the actual time of burning activities. Any cumulative effects would likely be the same as the direct and indirect effects.

In conclusion, increased smoke emissions from a large wildfire pose a direct adverse impact on the East Boulder mine from smoke and carbon monoxide (CO). Smoke modeling indicates that wildfires within 2 miles of the East Boulder mine could exceed the PM2.5 standard and within 0.1 mile could exceed the CO standard. With implementation of the air quality mitigation outlined on p. 47, air quality standards can be met with either of the action alternatives and this issue can be dismissed. A complete discussion/analysis regarding air quality can be found in the specialists report located in the Project File.

Compliance with Laws, Regulations, and Forest Plan Direction

Emissions from the East Boulder Fuels project are projected to be in compliance with the **Gallatin Forest Plan** in Forest Wide Standards pp. II-23 via compliance with the NAAQS 24 hour average PM2.5 35 ug/m3 standard where the public would have access to air via the minimum ambient distances. Current compliance with the **Montana DEQ** includes meeting NAAQS, compliance with Montana open air burning provisions and operational constraints by the Montana/Idaho Smoke Management Group.

d. Soils

Affected Environment

Proposed fuel treatments in the East Boulder Fuels Project could potentially cause long term impairment of land productivity and reduced soil quality within treatment units. Of specific interest is the level of detrimental soil disturbance created in tractor harvest areas. Measurement of detrimental soil disturbance, including the detrimental effects of compaction, displacement, rutting, severe burning, surface erosion, loss of soil organic matter, and soil mass movement, has been used in Region 1 as a surrogate measure to ensure that land productivity and soil quality are not impaired. The Region 1 standard (USDA 1999) requires that new activities are to be designed so they "do not create detrimental soil conditions on more than 15 percent of an activity area". Special provisions apply when detrimental soil conditions from prior activities exist within cutting units.

Soils in the East Boulder Fuels project area are described in general by the Soil Survey of Gallatin National Forest, Montana (USDA 1996). Eight soil map units were mapped in the soil survey as occurring within treatment boundaries of the East Boulder Fuels project. Five of these (34-1C, 34-2D, 64-2A, 85-2B, 87-1D) cover the majority of area slated for treatment. The other three map units are of minor occurrence.

The Soil Survey of the Gallatin National Forest is an order 4 soil survey. As such, it does not provide sufficient detail or accuracy for management decisions at a project scale but does provide a good starting point for understanding the overall distribution of soils in this area. Data from the Soil Survey have been supplemented by reconnaissance monitoring in treatment units where tractor harvesting is planned, and by selective field sampling of soil profiles representing the major soil-landscape/geology types in the area. All reconnaissance and soil profile sampling for this project was completed by Tom Keck, Soil Scientist for the Gallatin National Forest. The discussion of soil resources that follows is based on information from the Soil Survey as well as field observations and sampling results.

Soils at higher elevations in the project area, on moderately steep to steep slopes, have formed in glacial drift deposits. Source materials for glacial deposits are primarily granite. Soil textures in these granite influenced soils are mainly very stony, sandy loams grading to extremely stony, loamy sands. These soils have abundant rock fragments and limited clay throughout. Soil profile EBF#1 in the soil specialist report is representative of the granite influenced soils.

Coarse textures and abundant rock fragments in these soils make them extremely resilient to compaction disturbances. Because these soils have formed in glacial till, they are very deep with any underlying bedrock buried by the glacial till. Rocky, coarse textured soils coupled with very deep soil depths result in limited overland flow and reduced water erosion potential, a characteristic that is readily observable in the granitic soils of this area during high precipitation events.

Soils on the steepest slopes and on knobs and ridges are primarily derived from limestone parent materials. Soil profiles EBF#2 and EBF#3 (soil specialist report) are representative of limestone soils on very steep slopes. Soil textures in the limestone soils are mainly very channery loams grading to extremely channery, sandy loams. They

contain more clay than the granite soils but still have plenty of rock fragments. Rock fragments present are all limestone. These soils have a higher soil pH and are more fertile in general than their granitic counterparts. Soil formed in limestone, although somewhat more prone to compaction, still provides a fair amount of protection against both soil compaction and erosion. Soil depths can vary from shallow to very deep.

At lower elevations along the East Boulder Mine road, the majority of hillslopes, local alluvial fans, and colluvial deposits are comprised of mainly limestone parent materials. Soils in these areas are similar to profiles EBF#2 and EBF#3 in many respects. Those formed in local alluvial or colluvial deposits are very deep (>80" deep). Those formed on bedrock controlled mountain slopes, ridges and knobs have variable soil depths.

No soil profiles were sampled on the nearly level terraces adjacent to the East Boulder River. These soils are expected to be very coarse textured based on the abundance of large granite rocks at the surface, the presence of granite parent materials upstream, and high energy flows of the East Boulder River in this area. Two additional soil profiles will be sampled during the spring of 2011 in order to complete the project level soil survey update for the area. The first will be on a less steeply sloping glacial drift, and the second will be located on a terrace of the East Boulder River.

Traversing through treatment units during reconnaissance monitoring provided an opportunity to observe soil, landscape, and plant community relationships across large portions of the project area. Based on those observations, the limited soil profile data can be interpolated over a larger area through the combined use of terrain modeling, available bedrock geology maps, and color infrared imagery to provide landscape-scale interpretations of soils, information about soil properties, and expected effects of proposed treatments.

The two major types of geologic material, limestone and granitic glacial deposits, can be readily separated in the field and on aerial photographs due to distinct changes in slope steepness, landscape, and plant community attributes. The pattern of variability occurs on a smaller scale than presented in the Soil Survey maps but can be mapped on higher resolution imagery and used at the project level.

To summarize, soils within the East Boulder Fuels project area can be lumped into the two general soil-landscape/geology associations noted above for management purposes: soils formed from limestone parent material and those formed from granitic glacial drift or outwash. Distinct differences exist between these two groups in terms of soil texture, soil pH, inherent fertility, the amount, type, and size of rock fragments, infiltration rate, soil depth, water erosion potential, as well as other factors related to those listed.

Differences in soils are the major factor dictating whether lodgepole pine or Douglas-fir is the dominant tree species present. Nearly all soils in the project area contain abundant rock fragments, which will help limit potential soil compaction and/or water erosion problems associated with the proposed treatments.

Effects Analysis

Methodology and Scale

The spatial boundary used for this analysis is the overall project boundary for East Boulder Fuels. A reasonable temporal boundary would be 20 years out from when the

treatments in this project are complete. By that time, it is anticipated that most of the transitory impacts of this project on soil resources will have been erased due to initial remediation efforts and natural recovery. Treatment areas where tractor harvesting equipment has been used will be monitored at 2 years and 5 years after harvesting is complete. There is a temporal component as to whether a site is recovering or not. Soil compaction, as an example, can be naturally remediated if not too severe through the combined influences of freezing and thawing, wetting and drying, penetration by plant roots and the action of micro and macro-fauna. If compaction is too severe then rill and gully erosion will likely degrade the site further before recovery can occur. Sampling at 5 years will determine if the trend is improving or degrading. Twenty years will define final conditions.

Direct/Indirect/Cumulative Effects

The primary pre-existing soil disturbances in treatment areas are associated with concentrated areas of DSD, such as user created two-tracks, existing non-system Forest Service roads, and an old gravel pit in Unit #1. Detrimental soil impacts from more dispersed activities like timber harvesting or cattle grazing are scarce or non-existent within the proposed treatment units. While there has been some firewood cutting along established roads, there has been no commercial timber harvesting in the proposed mechanical harvest units and no evidence was noted of any significant grazing by domestic livestock on National Forest system lands in the area. There are no range allotments located within the project area.

Obvious linear or concentrated disturbances, such as the old gravel pit, were measured directly in the field to provide the greatest accuracy in determining their contribution to detrimental soil disturbance within individual treatment units in accordance with recommendations in the Region 1 Technical Guide for Soils NEPA Analysis (USDA 2009). Dispersed impacts were assessed by observation while traversing through those units where tractor harvesting is proposed. This approach is suitable for units where records and field observations indicate no previous ground based timber harvesting has occurred and where little or no DSD is observed during the initial walk through.

Observations were made of stand and site conditions, as well as the occurrence of any detrimental soil disturbance during traverses. GPS coordinates were collected at starting and ending locations for each treatment unit visited, as well as at locations where a change in direction was made and at selected midway locations. Dispersed impacts in the majority of tractor units were assessed in this manner. Treatment units 7A, 9, and 10 were the only proposed tractor harvest units not assessed in this manner due to early snow in 2009. A site visit or walk-through had been made in each of these units previously.

Pre-existing detrimental soil disturbances associated with roads, power lines, and the gravel pit were measured in the field and the area of detrimental soil disturbance calculated based on length, width, and the proportion of detrimental disturbance within the measured area. This provided the most accurate assessment possible for determining the aerial extent of these linear or concentrated soil disturbances relative to the allowable 15 percent maximum DSD standard.

Previous commercial timber harvesting has not occurred within proposed mechanical treatment units for any of the alternatives considered, although past timber harvesting in

adjacent areas of Lewis Gulch and along the East Boulder Road has occurred. For most treatment units, there is little or no prior activity-related soil disturbance within treatment boundaries, detrimental or otherwise. A few treatment units have a significant amount of prior detrimental soil disturbance associated with either the gravel pit, power line right-a-way, or local private or Forest Service non-system roads in the area but none of the proposed treatment units exceed the 15% maximum detrimental soil disturbance (DSD) standard for Region 1 prior to the proposed fuels treatments.

The largest treatment caused detrimental soil disturbances would be those associated with non-winter tractor harvesting. Treatment units affected include only Unit 13 in Alternative 2 and Units 13, 19, 21, and 22A in Alternative 3. The overall estimate for predicted detrimental soil disturbance associated with skid trails and dispersed impacts in the non-winter, tractor harvest units is 7.5%.

The predictions of detrimental soil disturbance used in this analysis for non-winter, tractor harvest treatments are less than those reported by Shovic in past monitoring reports for the Gallatin National Forest (Shovic and Widner 1990; Shovic and Birkland 1992; Shovic 2006). Current proposals are for partially cut fuel treatments (thinning) with a 20-60% canopy coverage retention. Previous monitoring reports were for regeneration harvest units (clearcuts). No ground scarification or broadcast burning is proposed for the East Boulder Fuels Project in contrast to the earlier areas monitored. Significant off-trail use of ground-disturbing equipment had also been allowed in the previously monitored areas, which is not allowable for the East Boulder Project.

All of the above would affect the level of soil disturbance that occurs during timber harvesting operations. Fuels treatments, in general, are considered in Region 1 to be "ground based activities with effects considered to be much less than 15%" detrimental soil disturbance (USFA-R1 2009). To date, no fuels treatments without winter tractor harvest requirements have been implemented on the Gallatin National Forest. As a result, the Gallatin National Forest, with its somewhat unique combination of soil and climate conditions has not been able to monitor actual DSD conditions for these activities. Estimates made are conservative in the sense that actual levels of treatment caused DSD are expected to be lower, and estimates for future fuels treatments may in turn also be lower once the appropriate field data can be collected on the Gallatin National Forest.

Ground-based harvesting during winter conditions has been shown to create much less ground disturbance than non-winter harvesting with ground-based methods (Philipek 1985; Page-Dumrose, et.al. 2006, Story 2006). Recent field monitoring by Lane, Page-Dumrose, Keck, and others in 2009 of a representative winter tractor partial cut unit on the Custer National Forest found no detrimental soil disturbance. During the same year, the implementation review of the Main Boulder Fuels Project found very little detrimental soil disturbance associated with tractor-harvested partial cutting except underneath burn piles where jackpot burning was used. A quantitative assessment using the Region 1 protocol for monitoring of detrimental soil disturbance at those sites will be conducted next year.

Detrimental soil disturbance associated with skid trails in the winter harvested treatment units is predicted to be 1%. Dispersed DSD between skid trails is predicted to be 0.5%, including some detrimental soil disturbance associated with the potential for a limited amount of hand piling and burning within stands. Similar low levels of dispersed

detrimental soil disturbance are predicted for skyline logging as well where the butt ends of logs are suspended off of the ground. Activity caused detrimental soil disturbance associated with hand treatments is predicted to be 1% DSD, almost entirely due to burning of the forest floor beneath hand piled slash.

The one caveat on winter logging is that it must be completed properly, when the ground surface is sufficiently frozen or covered under a settled snowpack. Tractor harvesting over snow or frozen ground in the winter should be limited to periods when there is a minimum of 8 inches of settled snow covering the ground or, in the absence of sufficient snow, when the top 4 inches of mineral soil is frozen. Harvesting should not proceed if ponding occurs at the mineral soil surface due to partial thawing of a surface frost layer.

Tables 22 and 23 below summarize the detrimental soil disturbance calculations for all proposed treatment units in the East Boulder Fuels Project. Total Post Activity DSD on the far right equals prior DSD (col. 2) plus predicted treatment DSD (col. 3, 4, 5) minus expected reductions in DSD by the second year (col. 7) due to soil remediation efforts.

Treatment DSD levels have been separated into three categories:

1) Harvest related disturbances along skid trails including dispersed disturbances between skid trails.

2) Disturbances due to temporary road construction.

3) Disturbances at landings.

Table 22- Predicted Detrimental Soil Disturbance by Unit for Alternative 2.

Activity Area	Prior DSD (%)	Potential DSD (%)			Cumulative DSD w/o Rehab.	Reduced DSD from Rehab.	Total Post Activity DSD
		Activity[1]	Landings	Temp. Roads			
1	9.7	1.5	2.0	0.5	13.7	-0.8	12.9
2	0	1.0	0	0	1.0	0	1.0
3	0.5	1.5	2.5	1.0	5.5	-1.2	4.3
3A	0	1.0	0	0	1.0	0	1.0
4	0	1.0	0	0	1.0	0	1.0
5	0.5	1.5	2.9	1.0	5.9	-1.3	4.6
5A	0.4	1.5	2.2	0.5	4.6	-0.9	3.7
6	0	1.0	0	0	1.0	0	1.0
7	1.2	1.5	3.3	0.8	6.8	-1.3	5.5
7A	4.0	1.5	6.6	0	12.1	-2.0	10.1
7B	0	1.0	0	0	1.0	0	1.0
8	0	1.0	0	0	1.0	0	1.0
8A	0	1.0	0	0	1.0	0	1.0
9	0	1.5	2.5	0.7	4.7	-1.1	3.6
9A	0.7	1.5	5.0	0.3	7.5	-1.6	5.9
10	0	1.5	3.3	0.5	5.3	-1.2	4.1

Activity Area	Prior DSD (%)	Potential DSD (%)			Cumulative DSD w/o Rehab.	Reduced DSD from Rehab.	Total Post Activity DSD
		Activity[1]	Landings	Temp. Roads			
11	1.0	1.5	2.5	0.5	5.5	-0.9	4.6
11A	0	1.0	0	0	1.0	0	1.0
12	0	1.5	5.0	0	6.5	-1.5	5.0
12A	0	1.0	0	0	1.0	0	1.0
13	0	7.5	2.9	0.6	11.0	-1.6	9.4
14	0	1.5	3.3	3.3	8.1	-2.3	5.8
16	0	1.5	6.6	0	8.1	-2.0	6.1
17	1.2	1.5	2.0	0	4.7	-0.6	4.1
18	0	1.5	2.0	0	3.5	-0.6	2.9

Table 23- Predicted Detrimental Soil Disturbance by Unit for Additional Units included in Alternative 3.

Activity Area	Prior DSD (%)	Potential DSD (%)			Cumulative DSD w/o Rehab.	Reduced DSD from Rehab.	Total Post Activity DSD
		Activity[1]	Landings	Temp Road			
19	0	7.5	2.5	0.7	10.7	-1.5	9.2
21	0	7.5	2.1	1.2	10.8	-1.6	9.2
22	0	1.5	2.5	2.3	6.3	-1.7	4.6
22A	0	7.5	2.5	0.8	10.8	-1.6	9.2
23	0	1.5	3.3	1.4	6.2	-1.6	4.6

Alternative 1, the no action alternative, will have no direct effect on soil resources in the short run but may have hidden long term costs. The no action alternative would likely pose the greatest threat to long-term soil productivity and increased detrimental soil disturbance over time due to the potential for uncontrolled severe wildfire(s) to burn through the area under extreme drought conditions.

Alternatives 2 and 3 remove an appropriate amount of timber with fuel treatments, while creating only limited amounts of detrimental soil disturbance. Alternative 2 treats less area and creates slightly less overall soil disturbance than Alternative 3, but does not reduce fuels in several lodgepole pine stands in the Lewis Gulch area that are also in need of treatment and stand renovation.

Proposed fuel treatments would have little direct effect on the probability of a fire occurring in the overall project area after treatments are completed. They are designed, however, to reduce both the fire intensity and fire severity if and when a fire occurs, thereby reducing potential cumulative effects. Large, severe wildfires if and when they occur in untreated stands, are most likely to burn under extreme drought conditions

when fuel moisture levels are at very low levels. The combination of excess accumulated fuels and uncontrolled burning during extreme drought conditions greatly increases the likelihood of detrimental soil disturbance.

Severe burning over a large area poses the greatest potential threat to long-term land productivity within the East Boulder Project Area. In that sense, the No Action Alternative (Alt 1) has the greatest probability of creating future cumulative effects that could negatively impact soil fertility and reduce land productivity.

No treatment units included with any of the alternatives are predicted to exceed the Region 1 standard of 15% maximum detrimental soil disturbance after implementation of the East Boulder Fuels Project. As such, soils are not a critical issue for this project and can be dismissed. The full analysis and discussion regarding soils can be found in the specialists report(s) located in the Project File.

Compliance with Laws, Regulations, and Forest Plan Direction

All soil mitigations and design criteria are intended to keep detrimental soil disturbance in treatment units below the 15% maximum allowable DSD as mandated by **the R-1 Supplement 2500-99-1 to FSM 2500 - Watershed and Air Management Standards.** Coarse woody debris criteria have an additional benefit of ensuring that sufficient organic matter is retained on treatment sites to maintain soil fertility and carbon cycling levels. Other criteria, intended primarily to prevent soil erosion, will maintain soil fertility and carbon cycling functions in the soil as well.

National Forests are intended to be managed for the production of goods and services. **The Multiple-Use, Sustained-Yield Act of 1960 (P.L. 86-517, 74 Stat. 215: 16 S.S.C. 528-531)** indicates that a high-level of annual or regular periodic output of renewable resources will be produced. The concepts inherent in the Multiple-Use, Sustained Yield Act are upheld in the **Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (16 U.S.C. 1600-1614) and the National Forest Management Act (NFMA) of 1976 (16 U.S.C. 472a). Forest Service Manual Chapter 2550 - Soil Management (WO Amendment 2500-2009-1)** refers to "providing goods and services as outlined in forest and grassland management plans".

Since sustained-yield cannot exist without maintaining land productivity, the importance of protecting soil and land productivity are inherent in all of the above documents. Direct references to maintaining productivity are made in the **Sustained Yield Act** "…coordinated management of resources without impairment of the productivity of the land" and in the Forest and Rangeland Renewable Resources Act "…substantial and permanent impairment of productivity must be avoided". Maintaining soil quality as a surrogate for protecting land productivity is a more recent addition to Forest Service Standards.

Many references to "soil quality" are made in the current **Washington Office Amendment 2500-2009-1 to the FSM 2500 - Watershed and Air Management Chapter 2500** - Soil Management. The relationship between soil quality measurements and maintaining land productivity is most clearly stated in the direction Amendment 2500-2009-1 gives for Forest Service Research and Development "to ensure soil quality measurements are appropriate to protect soil productivity". Clearly, the intent is to use

the measurement of soil quality attributes to indicate changes in soil productivity. Maintaining soil and land productivity is still the intended goal.

All of the previously listed soil mitigations and design features for the East Boulder Fuels Treatments meet the full intent of laws and directives for the U. S. Forest Service to protect soil and land productivity and soil health without unduly restricting production of an appropriate amount of timber products.

Alternatives 2 and 3 are both consistent with current direction in the Gallatin Forest Plan. Alternative 1 (No Action) discounts the Forest Plan direction for fuels reduction relative to other resource concerns. In addition, the soil mitigations and design features meet the full intent of relevant objectives and standards in the Forest Plan for the Gallatin National Forest. All of the above are designed to address the Forest Plan's objective for mitigating "impacts occurring to the watershed resource from land use activities". Minimizing soil erosion in treatment units through soil mitigations also helps meet the Forest Plan objective for "meeting State water quality standards".

Relevant Forest Plan directives are: 8.b.1.c. "Maintain an adequate nutrient pool for long-term site productivity through the retention of topsoil and soil organisms.", 10.8. All management practices will be designed or modified as necessary to maintain land productivity and protect beneficial uses." and 14.4. Treatment of natural fuel accumulations to support hazard reduction and support management area goals will be continued.

e. Roadless/Unroaded

Affected Environment

The North Absaroka Roadless Area # 1-371 (approximately 89,000 acres) as identified in the Gallatin NF Plan (FP, pg. V-9-10 and Appendix C-5) is located in the East Boulder Drainage, adjacent to portions of East Boulder Project Area. None of the alternatives for the project include proposed activities or treatments in the IRA.

“Unroaded areas” are defined as contiguous lands adjacent to inventoried roadless areas that may have roadless characteristics similar to the inventoried roadless areas. For the purpose of this analysis, specialists considered all areas within the project area or adjacent to the IRA, that may meet any portion of this definition.

There are approximately 3,200 acres within the East Boulder Drainage that lie adjacent to or are in close proximity to the North Absaroka IRA. This area consists of a long, linear stretch which lies along the East Boulder Road and is somewhat contiguous geographically, but is bisected by the heavily travelled road that provides access to the East Boulder Mine, private inholdings, and includes additional miles of old skid trails and designated FS Roads. This acre calculation also does not fully discount for the East Boulder Mine improvements, which include a large disturbance area consisting of the mine, outbuildings, parking lots, storage areas, large tailing pond, waste rock piles, as well as other disturbances.

This heavily travelled, bisected area is not of a sufficient size or configuration to provide for the protection of inherent characteristics associated with an “unroaded” condition and does not have the features that would make it suitable for wilderness recommendation in Forest planning. Substantial past management activities have occurred within this area,

including timber harvest, and road construction. Furthermore, the current condition and ongoing management activities within and/or adjacent to this area include those associated with the East Boulder Mine, the maintenance of a major power transmission line that lies along the entire stretch of the East Boulder Road terminating at the mine, as well as activities associated with the numerous private inholdings that are interspersed through the area.

Based on this information, the 3,200 acre area does not meet the minimum "unroaded" definition or intent. There are no "unroaded areas" meeting the criteria within proximity to this project, therefore none will be analyzed. Likewise, no unique special features are known to exist in the treatment areas. Most proposed treatment areas are interspersed within past cutting units, private property, the East Boulder Mine, and Park Electric Transmission Line. The presence of these developments dictates that the project area currently doesn't provide apparent naturalness, remoteness, or solitude.

Effects Analysis

Methodology and Scale

Unit prescriptions were reviewed relative to potential effects to roadless character and identified in the field and office during initial planning stages of this project. There are no treatments proposed within the North Absaroka IRA. There are no adjacent lands determined to have met the "unroaded lands" definition. See the Forest Service Manual FSH 1909.12 (72.1) for definitions of wilderness characteristics. Many roadless characteristic features 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 analysis area for direct, indirect, and cumulative effects on inventoried roadless areas is the North Absaroka IRA, selected because the expected direct, indirect, and cumulative effects are localized and no other IRA is in proximity. The temporal scope for the analysis is 1987–2020. This time period is chosen because it is the timeframe since the last Forest Plan decision for recommendation was needed, until the next FP decision is anticipated to be completed. Direct effects are those activities that would occur within the IRA or an "unroaded area" that would alter the roadless characteristics to prevent them from future consideration for wilderness designation. Indirect effects would cause changes to roadless character that would impact Remoteness, Solitude, Natural Integrity, Apparent Naturalness, Special Features, or Manageability and Boundaries, as well as the effects of any proposed activity that would substantially alter these characteristics as to render the area unsuitable for future wilderness designation.

Direct/Indirect/Cumulative Effects

Alternative 1 would have no effects to existing roadless characteristics within the North Absaroka IRA. The no action alternative would allow for the continuation of roadless lands within the North Absaroka IRA to retain roadless character in order to be considered for wilderness designation in the future. There would be no irretrievable or irreversible commitment of resources, which would eliminate this possibility. Alternative

1 would have no long-term or cumulative effects to roadless characteristics within the North Absaroka IRA.

Alternatives 2 and 3 propose no activities with the North Absaroka IRA, and there will be no direct, or indirect effect to that IRA or any other IRA. There would be no irretrievable or irreversible commitment of resources, which would eliminate the possibility of the Northern Absaroka IRA to be designated as wilderness at some future date. Likewise, both Alternatives 2 and 3 would have no long-term or cumulative effects to the roadless characteristics of the North Absaroka IRA, and there would be no effects to any other IRA. There would be no irretrievable or irreversible commitment of resources, which would eliminate possibility of the Northern Absaroka IRA to be designated as wilderness at some future date.

None of the alternatives would have adverse direct, indirect, or cumulative effects to inventoried roadless or unroaded areas in the East Boulder project area, therefore this issue can be dismissed. For further discussion/analysis of this issue refer to the specialists report located in the Project File.

Compliance with Laws, Regulations, and Forest Plan Direction

The National Forest Management Act and associated agency policy directs the agency to evaluate all roadless lands for their suitability for designation as wilderness within the Wilderness Preservation system. The Final Environmental Impact Statement for the Gallatin National Forest Plan approved in 1987 evaluated roadless characteristics for all inventoried roadless lands on the forest (at that time), and made recommendations for future inclusion in the wilderness preservation system. The Gallatin Forest Plan identifies Inventoried Roadless Areas (IRAs), including area 1-372, the "North Absaroka" (FP, pg. V-9-10 and Appendix C-5), which is located within or adjacent to portions of the project area. All alternatives are in compliance with laws, regulations and direction regarding roadless area concerns. Potential impacts to the North Absaroka Inventoried Roadless Area and to" unroaded areas" are non-existent.

36 CFR Part 294, Roadless Area Conservation Rule (2001 Roadless Rule) establishes prohibitions on road construction, road reconstruction, and timber harvesting in inventoried roadless areas on National Forest System lands. The intent of this final rule is to provide lasting protection for inventoried roadless areas within the National Forest System in the context of multiple-use management. The Secretary's Memorandum 1042-154 (5/28/09) is intended to assure the careful evaluation of actions in inventoried roadless areas while long term roadless policy is developed.

f. Visuals

Affected Environment

The Gallatin Forest Plan identifies visual quality objectives (VQO) for the East Boulder area. Concern was raised that project activities may include treatments that could jeopardize VQO. For the East Boulder project area, two VQOs are identified, Partial Retention (PR) and Maximum Modification (MM). Areas of PR are primarily located along the East Boulder Road and include the East Boulder Mine, as well as the East Boulder Campground. Areas of MM are above the East Boulder Road and include the upper portions of Lewis Gulch.

Effects Analysis

Methodology and Scale

To meet the Forest Plan Standard for Visual Quality Objective (VQO) for Partial Retention, human activities may be evident, but must remain subordinate to the characteristic landscape. The East Boulder corridor is not visible from areas outside of that portion of the East Boulder drainage. The project area has already experienced numerous impacts to visual quality from special uses and resource management activities such as the East Boulder Mine and associated powerline, road re-construction, and past timber management activities. Proposed treatments were analyzed for compliance with Gallatin National Forest Plan VQO standards

Direct/Indirect/Cumulative Effects

Alternative 1 (no action) would have no associated treatment activities, so it would have no direct, indirect , or cumulative effects to visual quality of the area unless a large wildfire or epidemic levels of mountain pine beetle or Douglas-fir beetle attacks were to occur along the corridor, killing large numbers of currently live conifers.

Additional fuels treatments, such as those associated with both action alternatives can be accommodated in this area and it would still remain within visual objectives provided mitigation occurs to assure that human activities, if evident, remain subordinate to the characteristic landscape. This can be accomplished by assuring that landscape modifications are not visually dominant within the Seen Areas after project related activities are completed. Visual quality objectives for Maximum Modification (MM) in the Lewis Gulch portions of the project area would not be compromised and do not need to be further mitigated.

Treatments associated with both action alternatives (Alt 2 & Alt 3) would contribute only minor amounts of direct or indirect effects to the visual quality of the corridor by applying project related design criteria and mitigation. Treatments associated with Alternatives 2 & 3 would remove insect infested (red needled and dead lodgepole pine and Douglas-fir) within the treatment areas, improving stand vigor of the remaining conifers in the treated areas.

Potential cumulative effects of implementing either Alternative 2 or 3 would include lessening the likelihood of future epidemic level insect attacks within the immediate area, thus reducing the numbers of dead and dying conifers in the area along the East Boulder Road, which would further affect the visual quality of the corridor. These treatments are also designed to lessen fuel loadings in the immediate treatment areas, so if a large wildfire were to occur, it would likely be reduced to a mixed severity (kill patches of live conifers) vs. a stand replacing fire (killing most or all conifers) in the treated areas lining the East Boulder Road.

With implementation of effective mitigation as outlined on pp. 55-56, the issue of compliance with VQOs associated with either Alternative 2 or 3 can be dismissed. A complete discussion/analysis regarding air quality can be found in the specialist report located in the Project File.

Compliance with Laws, Regulations, Policy and Forest Plan Direction

The Forest is mandated to provide Forest visitors with visually appealing scenery (FP, pg. II-1). The **Gallatin Forest Plan** emphasizes the visual resource by providing direction for activities that alter the natural landscape (FP, pg. II-3) and identifies Visual Quality Objectives (VQO) to guide management activities. All alternatives are in compliance to law, regulation and direction regarding visual quality concerns. Due to past management activities, visual quality is a relatively minor issue in regard to the project proposal and alternatives. Concerns can be easily mitigated.

g. Recreation

Concerns were raised that that fuels management activities could affect recreational opportunities by displacing recreationists, and/or creating conflicts at recreation sites in the East Boulder area.

Affected Environment

The East Boulder drainage is a lightly used recreation area with one small campground, two trails, and several private inholdings. The area is easily accessible but lacks developed recreational facilities that the nearby, popular Main Boulder drainage has. More recently the presence of the East Boulder Mine and its associated traffic also limits recreational use.

Effects Analysis

Methodology and Scale

The effects analysis is limited to recreational use within the East Boulder drainage on National Forest lands. There is one quasi-developed non-fee campground on NFS lands in the East Boulder. The three sites receive light use during the summer/fall months and virtually no use in winter/spring. Two trailheads/trails exist within the proposed project area. The Green Mountain Trail is primarily used during hunting season. ATV and motorcycle use in the Dry Fork probably attracts the highest number of forest users followed by hunting. Snowmobiling opportunities are fairly limited in the East Boulder due to inconsistent snowpack, although some snowmobile users take advantage of the East Boulder Road plowed to access the Dry Fork area. Small numbers of snowmobilers utilize the Dry Fork Trail #13 and the Placer Basin Trail #20 during the winter months. There is one fall hunting outfitter base camp in the Dry Fork drainage, about 3 miles east of the proposed project area. Other outfitted use in the East Boulder in the vicinity of the proposed project includes day-use horseback rides, fishing and hunting. Outfitter use is also considered light. Motorized use in the East Boulder is limited to existing roads, and includes high clearance opportunities on Dry Fork Road. Other recreation use is very limited. What use does occur is generally limited to local Sweetgrass County residents.

Effects Analysis

Direct/Indirect/Cumulative Effects

Alternative 1 would include no treatment activities in the project area, so would it would have no related direct, indirect, or cumulative effects to recreational use of the area.

Likewise, it is not expected that any of the proposed fuel treatments or other project related activities associated with either Alternative 2 or 3 would prevent recreational use of the area, nor would they have any major effects on dispersed recreational opportunities. Because mechanical treatments along the East Boulder Road and Dry Fork Road are scheduled to occur in the winter months, they are not likely to affect campers, hikers, hunters, etc. to any measurable degree. The East Boulder Road would remain open, as would the Dry Fork Road (areas with the greatest use by recreationalists). Any temporary roads constructed for the project would be closed to the public. The only anticipated minor effect to recreational use would be during implementation of Unit 11, an alternate parking area for vehicles and snowmobile trailers would likely be needed. Because any anticipated direct or indirect effects to recreation in the area are expected to be minor and short-term, there are not likely to be any cumulative effects.

For the above stated reasons, this issue can be dismissed. Refer to the recreation specialists report located in the Project File for further discussion/analysis regarding this issue.

Compliance with Laws, Regulations, and Forest Plan Direction

The **Gallatin Forest Plan** mandates the Forest to provide for a broad spectrum of recreation opportunities in a variety of Forest settings (FP, pg. II-1). The Forest Plan recognizes objectives for recreation settings by incorporating the Recreation Opportunity Spectrum (ROS), which provides a framework for stratifying and defining classes of outdoor recreation environments, activities, and experience opportunities (FP, pg. II-2). Furthermore, the Plan specifically identifies as objectives activities that will be managed 1) to provide for users' safety, 2) that existing recreational hunting opportunities will be maintained, and 3) that recreation trails will provide safe public access (FP, pg. II-2-3). The **2007 Gallatin Nation Forest Travel Plan** directs were specific types of motorized use can occur. All alternatives are in compliance with these laws, regulations, and direction regarding recreation concerns.

h. Special Uses

Affected Environment

Concern was raised that there is potential for authorized private facilities on National Forest System lands to be negatively impacted or damaged by proposed fuel treatment activities. Permitted facilities that exist on NFS lands in the project area include the following:

1. Park Electric 69kV power line special use permit. Power line runs parallel the length of East Boulder Road on NFS lands to the East Boulder Mine.
2. Ken Le Clair Private Road Easement. Provides roaded access to private lands from the East Boulder Road in Section 4, T4S, R13E.
3. Triangle Telephone buried telephone line special use permit to private property in Section 3, T4S, R13E (McKinsey Homestead).
4. East Boulder Mine, within Sections 2 and 11, T3S, R12E.

Effects Analysis

Direct/Indirect/Cumulative Effects

Special use authorizations specifically allow the Forest Service to partake in the administration of National Forest System (NFS) lands regardless of permitted authorization. Alternative 1 has no associated treatment activities, so would have no direct or indirect effects to special uses.

Little, if any, impact or disruption would occur to the buried Triangle Telephone line with either of the action alternatives (Alt 2 & Alt 3) because it lies underground. No treatment units associated with either of the alternatives are immediately adjacent to Mr. Le Clair's road, so any potential impacts would be minimal. Impacts from mechanical equipment use, logging, and pile burning associated with Alternative 2 & 3 could potentially harm or temporarily disrupt service on the Park Electric transmission line and have some effect on daily operations at the East Boulder Mine, however, the associated activities have been designed and mitigation is in place to keep this risk to a minimum. Therefore, the issue of potential conflicts with special uses associated with implementation of either Alternative 2 or 3 would have minimal direct or indirect effects and can be dismissed.

Cumulatively, the only measurable effect would be associated with a potential wildfire in the area along the power line. Alternatives 2 & 3 have been designed to remove excess fuels in areas that are adjacent or very near to the power line in order to reduce behavior of a potential wildfire to a ground fire in the treated area. This would in turn reduce the potential for major damage to the power line over current conditions (Alternative 1-No Action). A complete discussion/analysis regarding special uses in the project area can be found in the specialists report located in the Project File.

Compliance with Laws, Regulations, Policy and Forest Plan Direction

Various laws provide the authority for special uses on NFS lands. **The Gallatin Forest Plan** authorizes the issuance of special use permits on a case by case basis (FP, pg. II-27). Private Road Special Use Permits or easements are considered a variance to the 2007 Gallatin National Forest Travel Plan. All alternatives are in compliance to law, regulation and direction regarding special use concerns. Impacts to permittees with facilities on NFS lands can be easily avoided or mitigated with input from the permittees.

i. Lynx Habitat

Affected Environment

The Canada lynx was listed as a threatened species under the Endangered Species Act in 2000. With the protected status, there is significant public interest in federal management actions that have the potential to affect this species or its habitat. Directions for evaluating federal actions relative to lynx habitat conditions are provided in the Northern Rockies Lynx Management Direction (NRLMD) ROD (USDA 2007). In addition, the Federal Register (USDI 2009:8616) provides considerations for addressing impacts to critical habitat. Project alternatives were evaluated for compliance with applicable direction contained in the NRLMD and Federal Register recommendations for critical habitat. To address these habitat factors, effects to Canada lynx were

evaluated by assessing project impacts to lynx foraging and denning habitat, winter snow conditions and overall habitat connectivity.In February 2009, the US Fish and Wildlife Service posted the Final Rule designating revised critical habitat for lynx (USDI 2009:8616). The project is located in Unit 5, Greater Yellowstone Area designated critical habitat for lynx.

Lynx foraging habitat is that which is most likely to support year-round use by the lynx's primary prey species, snowshoe hare. Snowshoe hares select densely stocked forest stands with a high proportion of horizontal cover within approximately ten feet of the ground (Hodges 2000:184). Snowshoe hare foraging habitat in the project area is represented by densely stocked sapling to pole age conifer stands. Denning habitat is typically associated with mature forest of complex structure, particularly in the form of coarse woody debris on the forest floor.

The project is located within the East Boulder Lynx Analysis Unit (LAU). LAUs are intended to provide the fundamental scale at which to evaluate and monitor the effects of management actions on lynx habitat. Proposed treatment units are within a wildland-urban interface (WUI) as defined by the Healthy Forests Restoration Act (HFRA, Public Law 108-148) in that they are located within 1.5 miles of the boundary of an at-risk area (East Boulder road and mine) as delineated by the Sweet Grass County Community Wildfire Protection Plan.

Effects Analysis

Methodology and Scale

Effects to lynx were evaluated relative to project (alternative) compliance with direction contained in the NRLMD, and potential effects to PCEs. In depth analysis of compliance with each component of NRLMD can be found in the specialist report located in the Project File. The spatial boundary used for analysis of direct, indirect and cumulative effects for the proposed action is the East Boulder LAU; the temporal boundary for direct and indirect effects covers about a 20-year period, which includes the expected duration for project implementation (approximately 2-3 years), plus an additional 15 years or so to account for indirect effects resulting from project-related habitat alterations. A Forest-wide lynx habitat data layer was used to model lynx habitat capability in the project area. Site visits occurred during the summer of 2009 for the purpose of gathering field data to further refine habitat conditions in proposed treatment units. For each alternative, GIS technology was used to quantify potential impacts to lynx foraging and denning habitat, potential impacts to winter snow conditions, and for overall effects to lynx habitat connectivity.

Direct/Indirect/Cumulative Effects

The East Boulder LAU covers an area of about 87,789 acres at the north end of the Beartooth Mountain Range. Of this, approximately 84,764 acres (96%) is on National Forest System (NFS) lands. Lynx habitat in this LAU is patchily distributed, and tends to be concentrated in a mid-elevation band between warmer, drier montane forest near the valley bottoms, and alpine habitat above treeline in the high plateau and mountain peak areas. Because of this patchy distribution, only about 33% of the LAU (29,217 acres) is capable of providing lynx habitat in the form of moist, cool coniferous forest types, plus small inclusions of important non-forest types such as sage fields and

willow/riparian habitat. The remainder of the LAU that does not provide lynx habitat consists of dry forest types and large open areas of meadow, rock or water.

Of the mapped lynx habitat in the LAU, about 190 acres are permanently cleared of trees and/or herbaceous vegetation to facilitate East Boulder Mine operations (e.g. facilities, parking, tailings, etc). These acres were subtracted from mapped lynx habitat figures since they are considered a permanent habitat loss for lynx. Other areas along the road and power line are also maintained as clearings, but are considered to have the potential to still provide lynx habitat at some point in the future. Perpetual clearings (e.g. road and power line), recent wild fires and prescribed burns, and recent even-aged timber harvest have produced habitat that is currently considered unsuitable for lynx, in that it is in a stand-initiation successional stage and does not yet provide winter snowshoe hare habitat. Due primarily to effects from the Derby fire of 2006, there is roughly 5,858 acres of lynx habitat in a currently unsuitable condition, which affects approximately 20% of the mapped lynx habitat in the East Boulder LAU.

Of the remaining lynx habitat in the LAU, roughly 8,781 acres are mature, full-canopied forested stands that occur in habitat types that tend to produce multi-storied stands often used by snowshoe hares, and therefore provide potential foraging habitat for lynx. In addition, about 822 acres are in a sapling to pole structural stage that produce young densely stocked conifer stands, where tree heights are above the average winter snow depth. These regeneration stands are also used by snowshoe hares, and thus potentially by lynx as foraging habitat. Based on these estimates, approximately 33% (30% multi-storied, 3% stand-initiation) of the lynx habitat in the LAU is currently providing foraging opportunities for lynx. Multi-storied foraging habitat likely also provides denning opportunities for lynx. In addition, there are approximately 1,074 acres of mature, dense forest, some with recent wind events that resulted in significant amounts of blowdown that provide suitable denning habitat for lynx. The remaining lynx habitat in the LAU (approximately 12,492 acres) includes coniferous forest, aspen and sage that is intermixed with denning and foraging habitat, and is suitable for resting or travel, but not currently providing good foraging or denning opportunities for lynx.

There would be no direct effects to lynx or critical habitat under Alternative 1 because there would be no treatment activities. However, indirect/cumulative effects could result from the continued buildup of fuels with Alternative 1, should a wild fire start in the project area. A wild fire in the project area could remove large amounts of coniferous forest cover needed by lynx for denning, foraging, travel and resting purposes. In addition, wild fire in the project area could alter, remove or reduce riparian and other deciduous forest communities that also provide important habitat components for lynx. With Alternative 1, no lynx habitat would be altered due to management actions, and unless affected by natural ecological processes such as fire, insects, disease, or natural succession, lynx habitat within the project area would remain as it exists today. Insect infestations, particularly mountain pine beetle, have recently had notable impacts on forest habitat structure across the Gallatin Forest. Mountain pine beetles have just begun to infect trees in the East Boulder area, but are expected to spread quickly over the next few years. Continued fuel buildup in mature habitat due to insect activity and other factors could increase the probability over time of large-scale wildfire burning in the East Boulder LAU, which could result in dramatic increases in the proportion of currently unsuitable lynx habitat.

Alternative 2 would affect approximately 390 acres of lynx habitat plus an additional 265 acres of matrix habitat. Since all proposed treatment involves thinning, some trees and cover would be retained within each treatment unit. Project implementation would reduce cover for lynx and their prey species, but would not eliminate all cover. Although prescribed treatment may alter foraging or denning habitat, treated areas would still likely provide enough cover for travel or resting, and would not increase the amount of unsuitable stand initiation stage habitat in the East Boulder LAU.

Snowshoe hare habitat would be reduced by both mechanical and hand thinning treatments associated with Alternative 2. Although some remnant patches of foraging habitat might still exist after treatment, it is difficult to predict exact stand conditions after treatment, so it was presumed all snowshoe hare habitat within treatment units would be affected. Alternative 2 would affect up to 210 acres of multi-storied snowshoe hare habitat, which is only about 2% of the multi-storied lynx foraging habitat available in the LAU. Implementation of this alternative would not noticeably reduce the proportion of multi-storied snowshoe hare habitat, and this component would remain at approximately 30% of the overall lynx habitat within the East Boulder LAU. Young, even-aged snowshoe hare habitat would also be affected, but by only a few (3) acres. The proportion of this lynx habitat component would not be notably altered under this alternative, and would remain at approximately 3% of overall lynx habitat within the LAU. Denning habitat would be reduced by an additional 142 acres under Alternative 2, decreasing the denning only habitat component proportion from about 4% to 3% within the LAU. However, denning habitat is not limited in the East Boulder LAU, and is likely present in most, if not all of the multi-storied snowshoe hare habitat as well, which would remain at about 30% of the lynx habitat present in the LAU. About 33 acres of other lynx habitat; e.g. that which provides security cover for travel and resting, but does not present high quality denning or foraging habitat, would be treated under this alternative. Less than 1% of this habitat component would be affected by treatment. Further, treatment in existing denning and foraging habitat would likely change the character to what would be considered "other" lynx habitat, so the overall proportion of this component would actually increase in the LAU due to proposed treatment.

Alternative 3 would affect about 590 acres of lynx habitat, plus an additional 280 acres of matrix habitat. As with Alternative 2, all proposed treatment involves partial removal of vegetation, so some trees and cover would be retained within each treatment unit. Project implementation would reduce cover for lynx and their prey species, but would not eliminate all cover. Although prescribed treatment may alter foraging or denning habitat, treated areas would still likely provide enough cover for travel or resting, and would not increase the amount of unsuitable stand initiation stage habitat in the East Boulder LAU. Snowshoe hare habitat would be reduced by both mechanical and hand thinning treatment. Alternative 3 would affect up to 415 acres of multi-storied snowshoe hare habitat, which is about 5% of the multi-storied lynx foraging habitat available in the LAU. Implementation of this alternative would slightly reduce the proportion of multi-storied snowshoe hare habitat from 30% to 29% of the lynx habitat within the East Boulder LAU. Impacts to young even-aged snowshoe hare habitat, denning, and other lynx habitat under Alternative 3 would be identical to those described above for Alternative 2.

Potential cumulative effects to lynx and lynx habitat associated with Alternatives 2 or 3 would be the same. Wild fires, wind events, and insect infestations have altered the

landscape, increasing the amount of dead and down woody materials important for lynx denning habitat, but also reducing the amount of forested cover required by lynx for hunting, denning, travel and resting. Such natural ecological processes can initially result in unsuitable habitat conditions for lynx, but over time, can produce the type of mosaic habitat that is optimal for lynx; e.g. young, dense, even-aged forest, and conifer regeneration in understory, intermingled with older forests containing a larger proportion of coarse woody material, for a combination of foraging and denning opportunities.

Human-induced habitat alterations have occurred as a result of vegetation management practices such as timber harvest, prescribed burning, and vegetation clearing associated with human facilities, on both National Forest System lands and private inholdings. Some of these treatments could also eventually result in conifer regeneration over time, which could improve snowshoe hare habitat. Some of the better snowshoe hare habitat in the LAU today is a result of past timber harvest. Personal use firewood gathering has resulted in the removal of some coarse, woody material; however, this activity has occurred at low levels in the East Boulder, and since denning habitat is readily available in the LAU, the impact of firewood gathering has been immeasurable.

Winter use can affect snowshoe hare and lynx habitat through snow compaction. Most winter use in the East Boulder LAU is associated with the mine operations, and access to private property along the East Boulder Road. This use is concentrated in the lower elevation areas, where snow accumulation is not great. Winter recreation in the LAU occurs at relatively low levels compared with other areas of the Gallatin Forest. There are few restrictions on winter use outside of designated Wilderness, but warmer, drier conditions across the non-Wilderness portion of the LAU do not typically produce snow conditions highly conducive to winter recreation. The higher elevation portion of the LAU that does accumulate snow is located in the Absaroka-Beartooth Wilderness area, where snowmobile use is prohibited, and access for non-motorized winter recreation is rather limited. Scientific literature is limited regarding the effects of human activities and associated disturbance factors that might affect lynx. So far, there is little evidence that lynx are particularly sensitive to human disturbance other than near reproductive den sites (Ruediger et al. 2000: 2-8, Koehler and Brittell 1990 in: USDA 1994:88). Some authors (e.g. Staples 1995, Roe et al. 1999, Mowat et al. 2000) have even described lynx as being generally tolerant of human activities (in: Ruediger et al. 2000:1-13). Therefore, it is habitat impacts that could affect lynx access to snowshoe hares that are the key factors to address when considering cumulative effects to lynx and critical habitat. While other activities such as recreation may have some minor disturbance effects on lynx, they are probably not contributing a great deal toward cumulative effects.

Table 24 provides a summary of estimated lynx habitat composition by Alternative. The figures represent estimates of the total acres of habitat components by alternative, followed by the percentage of total lynx habitat (approx. 29,025 acres) in the LAU.

Table 24-Lynx Habitat Summary for the East Boulder LAU

Alternative	Stand Initiation Stage	Young Foraging	Mature Foraging	Denning[a]	Other
1[b]	5,860 ac 20%	820 ac 3%	8,780 ac 30%	1,075 ac 4%	12,490 ac 43%
2	5,860 ac 20%	820 ac 3%	8,570 ac 30%	930 ac 3%	12,845 ac 44%
3	5,8560 ac 20%	820 ac 3%	8,365 ac 29%	930 ac 3%	13,050 ac 45%

a. Denning habitat likely present in Mature Foraging acres as well

b. Alternative 1 represents the No Action Alternative as well as the existing condition.

Each action alternative would have potential effects on lynx due to probable impacts to snowshoe hare habitat in both young and mature stands. However, proposed treatment under both action alternatives would be within the exemptions in the NRLMD for impacts to snowshoe hare habitat associated with fuel reduction projects in WUI. All alternatives (action and no action) would be in compliance with applicable direction for lynx habitat management.

Compliance with Laws, Regulations, Policy and Forest Plan Direction

Canada lynx are listed as a threatened species under the **Endangered Species Act (ESA**) and the Forest Service must therefore ensure that any action it authorizes is not likely to jeopardize the continued existence of this species, or to destroy or adversely modify critical habitat [Section 7(a)(2)]. To comply with the ESA, effects of the preferred alternative on lynx and critical habitat will be analyzed in a Biological Assessment prepared for this project. Since lynx are a native species, the Forest Service has a responsibility under the **National Forest Management Act (36 CFR 219.19)** to provide habitat. The NRLMD ROD was published in March 2007. This decision amended the Gallatin Forest Plan by incorporating goals, objectives, standards and guidelines for lynx habitat management.

Alternative 1 (No Action) would be in compliance with all applicable law, regulation, policy and direction for lynx. Alternatives 2 and 3 would be contrary to vegetation standards in the NRLMD regarding forest thinning that would affect snowshoe hare habitat. However, the NRLMD contains exemptions that allow a certain amount of thinning in snowshoe hare habitat if the purpose is for fuel reduction within a Wildland Urban Interface (WUI). The Final Rule for lynx critical habitat identifies Primary Constituent Elements (PCE), which are those physical and biological features that are essential to the conservation of the species, and that may require special management considerations or protections (USDI 2009:8638).

Where NRLMD standards are not strictly met for this project; i.e where exemptions for standards VEG S5 and VEG S6 are applied, these factors will be evaluated in a

Biological Assessment and reviewed in consultation with the US Fish and Wildlife Service before a decision is made for the project.

j. Grizzly Bear

The grizzly bear was listed as a threatened species under the ESA in the lower 48 states in 1975 (40 Fed. Reg. 1975:31736). The Grizzly Bear Recovery Plan (USDI 1982, revised 1993) delineated grizzly bear recovery zones in 6 mountainous ecosystems in the U.S., including the Greater Yellowstone Area. The GYA grizzly bear recovery zone covers parts of Montana, Idaho and Wyoming, and includes portions of six national forests (including the Gallatin), two national parks, state and private lands, and lands managed by the BLM. Grizzly bears also frequently use areas outside the designated GYA recovery zone.

The GYA grizzly bear population met population objectives, and was petitioned for delisting by the Service in 2005. A Final Rule designating GYA grizzlies as a DPS and removing this segment was published in March 2007. However, a recent court order vacated the delisting and remanded the decision back to the Service. Therefore, as of the date of the court decision (September 21, 2009), GYA grizzly bears are again listed as threatened under the ESA.

Overall, general habitat conditions in the GYA are excellent. Within the recovery zone, there are large blocks of undisturbed and secure habitat, with low open road and total motorized access route densities in the majority of the subunits. On the Gallatin National Forest outside the recovery zone, 43 percent of the area considered occupied is in Wilderness, Wilderness Study Areas, or has poor topography for motorized access. Another 20 percent of the occupied habitat outside the recovery zone occurs in areas considered "lightly motorized", while only about 37 percent of the occupied habitat outside the recovery zone has moderate to high levels of motorized use. Access management, including construction and use of roads for administrative projects, both within and outside the recovery zone, is subject to direction contained in the Gallatin National Forest Travel Management Plan (USDA 2006).

Affected Environment (Hiding Cover)

Criteria used to evaluate existing vegetative habitat conditions for grizzly bears in the East Boulder analysis area are hiding cover, foraging habitat and motorized access route density analyses. Hiding cover is important to bears for security while feeding, resting or traveling. Blanchard (1983) reported that radio-collared bears in the Yellowstone Ecosystem were located in forested habitats 90% of the time, and grizzly bear locations in the open were generally within 325 feet of forested cover. Moist sites often provide both hiding cover and forage values for bears. In order to provide for adequate security for bears at least 30% of the moist forest types should be maintained to provide hiding cover (USDA 2006). Within the East Boulder Fuel reduction project analysis area (22,850 acres) the majority of moist forest cover types preferred by grizzly bears are located in the designated roadless areas that will not be affected by project actions. Approximately five percent of these moist forest habitats would be affected by project implementation.

Effects Analysis

Methodology and Scale

The East Boulder fuels reduction project analysis area used the fifth code watershed (22,850 acres) as the boundary of the analysis area for grizzly bears. No portion of the analysis area is within the Absaroka-Beartooth wilderness, considered occupied grizzly habitat, and the nearest boundary of the area is approximately 2 miles from the wilderness boundary. Grizzlies are well established and known to inhabit the wilderness portion of the planning area and occasionally grizzly sign or sightings occur outside the wilderness. Grizzly bears are also rarely to occasionally known to occur in the non-wilderness portion of the area surrounding the East Boulder River, but are not known to be consistently present in this narrow canyon bottom. This assumption is based on the known occurrence of bears in the Deer Creek area of the District located north of the project area. This usually occurs from March thru May during the spring emergence period where bears exit their dens and cover large areas in search of food.

Hiding cover was analyzed by assessing the amount of forested cover types available within the analysis area in comparison to the impacts to these habitats within the project area. Cover was based on successional stage and percent canopy closure. Of these habitats, the most limiting and critical is the moist forest cover type. This analysis revealed that there are approximately 2,725 acres of moist forest habitat types within the East Boulder analysis area. All of these acres are currently in a condition to provide hiding cover for bears. Approximately 6% of these habitats may be altered by project implementation. Moreover, all affected acres are within one quarter mile of the existing road infrastructure that would minimize potential use by grizzly bears.

Direct, Indirect and Cumulative Effects (Hiding Cover)

Since the proposed treatment units are oriented along a linear corridor within a quarter mile of a maintained right-off-way, have been designed to retain between 15-20% cover, represent less than 5% of available hiding cover in the analysis area, and should enhance hiding and foraging habitat in the future; none of the alternatives would have any direct, indirect or cumulative effects on important hiding cover for grizzly bears.

Affected Environment (Foraging)

Grizzly bears are omnivorous animals for which vegetation provides a large portion of diet consumption. Important vegetative dietary components include succulent plants, berries, roots, tubers, and whitebark pine (Pinus albicaulis) seeds.

The East Boulder analysis area provides suitable habitat that provides many food items preferred by grizzly bears.

Moist sites produce many of the vegetative foods preferred by bears. Over half of the East Boulder Analysis area contains moist vegetative types (both forested and nonforest types). Old growth forests with moist habitat types are important for bears because they provide both foraging opportunities and security cover. The analysis area currently provides approximately 1,200 acres of old growth forest in moist habitat types. Over three quarters of these stands include habitat types that are highly preferred by grizzly bears for foods they produce, especially berries (Vaccinium spp.) and succulent plants.

Whitebark pine, a key food source for grizzly bears, is present in the analysis area in a mostly monoculture condition without mixed confer species. Because of this, it is not as valuable for grizzly bears because squirrels will not actively colonize and cache cones in monoculture whitebark pine stands. They prefer mixed conifer stands with whitebark included (Knight et.al. 1984). Therefore, there is little evidence in the analysis area that grizzly bears are actively foraging in these whitebark pine stands.

Bears include meat in their diet whenever possible. Big Game winter ranges provide an important food source for grizzly bears in the form of carrion from winter killed ungulates. The East Boulder analysis area contains abundant big game winter range on south and west facing slopes in lower elevations.

Direct, Indirect and Cumulative Effects (Foraging)

Approximately 145 acres of the proposed treatment units (Alts 2 & 3) are located in relatively moist forest and meadow habitats adjacent to the East Boulder River. Fuel reduction operations could occur in fall, winter, or spring; but would be limited by environmental conditions and other restrictions (see mitigation in Chapter 2). Grizzly bears tend to avoid humans and are rare to infrequent visitors in the East Boulder corridor because of the amount of regular traffic associated with the East Boulder Mine and permanent and seasonal developed residences. On the other hand, the resulting enhancement to habitats from treatments associated with Alts. 2 & 3 could produce more succulent vegetation and preferred bear foods that may attract bears to the area in the future. Whitebark pine habitat will not be affected by the project. Big game winter range may be enhanced and expanded by the project. There is little berry-production in the area at this time, but actions should enhance and expand berry distribution and production in the future. Typically berry producing plants do not begin to bear fruit for several seasons after establishment.

Fuel reduction operations will likely be distributed across a 2-3 year period. However, specific mitigation, preserving 15-20% of most units in untreated clumps, were added that minimize any potential impacts to grizzly bears Effects of Alternatives 2 or 3 would be temporary with improved forage conditions persisting in the area for several years after harvest is complete.

Indirect effects to grizzly bear foraging habitat are expected to be minimal with Alts. 2 or 3. The expected establishment and enhancement of berry production in many of the treatment units could indirectly affect bears by attracting them nearer to the road. This could increase the potential for bear-human encounters that would ultimately endanger bears. However, this hypothesis is speculative and the grizzly bears natural tendency to avoid humans should prevent this from becoming an issue.

Cumulative effects to grizzly bear foraging habitat in the analysis area would be primarily be in the form of human or bear interactions elsewhere that either displace bears from high quality foraging habitat, or disperse younger bears outside the wilderness to find suitable foraging areas. The treatment area has been and is likely to be a high use area now and into the future. The likelihood of grizzly bears occupying the area is limited by the amount of activity in the area currently and the expected increased use in the future. There are no other planned activities or uses that do not currently exist in the area. Furthermore, the large expanse of inventoried roadless area incorporated in the analysis area and surrounding the area will provide protection for the majority of

grizzly bear foraging habitat. Wildfire presents the greatest threat to the area and potentially the greatest opportunity. Depending on the timing, intensity and extent of a wildfire in the analysis area, both positive and negative impacts to grizzly bear foraging habitat could be realized. There is no way to forecast a wildfire event, but if a wildfire occurs the suppression response would address impacts to all T&E species and wildlife with respect to first assessing threats to human life and property. Alternatives 2 or 3 collectively would have minimal cumulative impacts to grizzly bears because they are located in areas where grizzly bear use is extremely rare, in an area where high human activity is already present and the total extent of operations in treatment units will be limited to a restricted annual acreage.

Affected Environment (Motorized Access Route Densities)

Human access is an important factor to consider in assessing the condition of habitat for grizzly bears. There are approximately 12-15 miles of open roads within the analyses area. Many of these roads are seasonally restricted annually by environmental conditions between November and March. The East Boulder Road, Forest Road #205, is the primary route that receives regular traffic from East Boulder Mine activities, Forest recreational users and private residences. The entire East Boulder Fuels analysis area is located in area considered unoccupied by grizzly bears. However, because the analysis area is within five miles of the wilderness boundary that is considered occupied, it provides potentially suitable habitat for grizzly bears, and is occasionally occupied by grizzlies, human access was evaluated for potential effects of the project on grizzly bears or their habitat. The Interagency Grizzly Bear Committee Access Taskforce Report (IGBC 1994:1) recognized the importance of considering "total motorized access route density"; i.e. the combination of roads and trails that receive motorized use, in assessing human access impacts on grizzly bear habitat.

Direct, Indirect and Cumulative Effects (Motorized Access Route Densities)

There would be no direct/indirect or cumulative effects to motorized route densities with Alternative 1 because no roads would be constructed, re-opened, or change from current usage.

With Alternatives 2 & 3 short stretches of (approximately 0.5 to 1.5 miles) of temporary road would be required to access treatment units. A total of approximately 2.1- 3.5 miles of temporary roads would be necessary throughout the duration of the project. All temporary roads would be within 1/2 mile of the existing East Boulder Road or the Lewis Gulch Road system. This small amount of road would add approximately one to two more miles of motorized access route density annually to the 12 to 15 miles of existing motorized routes over the projected five years of project implementation.

Roads and road densities can influence grizzly bear use of otherwise suitable habitat through a number of mechanisms, including: avoidance and/or displacement of grizzly bears away from roads and associated activity; changes in bear behavior including altered habitat use patterns and habituation to human activities, and direct bear mortality due to collisions with vehicles, poaching and legal killing of bears associated with increased human access (e.g. defense of life or management removals). Road densities are relatively low in the project analysis area, due to the inclusion of Inventoried Roadless Areas and designated Wilderness. The proposed action includes up to 3.5 miles of new road construction and/or reconstruction to access treatment sites. Since

project roads would be adjacent to, or within ½ mile of existing open roads, there would be little notable change in road density within the project area. As per the Gallatin Forest Travel Management Plan, project roads would be temporary in nature, closed to public motorized use during project implementation and permanently closed upon project completion.

The Stillwater Mining Companies, East Boulder Mine facility, is located in the project area and operates 365 days a year on a 24 hour basis. Regular daily motorized traffic associated with deliveries and busing of employees on shifts occurs along the corridor and near the mine site as a result. This regular activity tends to deter the presence of wildlife that may be sensitive to these activities (grizzly bears, black bears and elk etc.) except during periods of lower activity and during nocturnal hours.

Cumulative effects on road densities within the analysis area include past road and trail development for transportation management and road improvements for access to the East Boulder Mine, as well as timber harvest on public and private land. Past road and trail development is reflected in the current open motorized access route density figure. Watershed restoration, changes in land use, and wilderness designation have resulted in decommissioning and abandonment of roads and trails in the drainage.

The Gallatin Nation Forest Travel Management Plan (USDA 2006) has a detailed description of the selected alternative that describes the travel uses available within the drainage and analysis area. The existing motorized roads and trails are limited primarily to the East Boulder Road, the Dry Fork Road and the Lewis Gulch Road system and approximately 32 miles of trail outside of the wilderness. The roads (21 miles) and trails (32 miles) emphasize mixed use opportunities for hiking, horseback, mountain biking, motorcycle, ATV and 4X4 vehicle use. Future travel management for the East Boulder analysis area will continue to emphasize this mix of non-motorized recreation and motorized OHV, motorcycle and winter (cross-country ski and snowmobile) recreation opportunities.

The major cumulative effects on human access, as measured by open motorized route densities, are primarily associated with mortality risk for bears. The presence of firearms increases the risk of human caused bear mortality in the event of an encounter. Firearms are prevalent in the East Boulder analysis area primarily during the fall hunting season, since there are no restrictions against the general public carrying firearms on the National Forest. The East Boulder analysis area is used for both hunting and recreational shooting. General recreation, firewood gathering, and livestock management are other examples of activities where people are apt to carry firearms. There are no records of grizzly bear harvest in the analysis area and no recent mortalities have occurred. In addition, no mortalities have resulted from these livestock depredation. Conflicts between hunters who leave harvested big game animal have not been documented nor expected in the analysis area.

Determination of Effects to Grizzly Bear

Grizzly bears are known to occasionally be present within the East Boulder analysis area, but have not been documented to occur in the project vicinity (i.e. along or adjacent to the East Boulder River outside the IRA). Grizzly bears typical move through the area during den emergence based on known spring sightings in the Deer Creek area located north of the analysis area. There is very low potential for grizzly bear and human

conflicts. Moreover, the activities associated with either of the action alternatives (Alternatives 2 or 3) are not expected to increase the potential for these types of conflicts. Further, because grizzly bears have a tendency to avoid human activity, the likelihood that bears will come in conflict with humans during project operations is negligible. Given the potential for impacts, however minimal, it is determined that the project may affect, but is not likely to adversely affect the grizzly bear or its habitat.

Compliance with Laws Regulations and Forest Plan Direction

Under Section 7 of the **Endangered Species Act**, each Federal agency must ensure that any action authorized, funded or carried out is not likely to jeopardize the continued existence of any threatened or endangered species. The action alternatives "may affect but are not likely to adversely affect" the grizzly bear. Based on the analysis, all applicable standards in the grizzly bear amendment would be met under all action alternatives for the project.

The National Forest Management Act (NFMA) requires that Forest plans "preserve and enhance the diversity of plant and animal communities...so that it is at least as great as that which can be expected in the natural forest" (36 CFR 219.27). Furthermore, implementation regulations for the NFMA specify that, "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area". The analyses determined that Alternatives 2 or 3 would have no measurable effect on the viability of grizzly bear populations or habitat in the area.

Forest Plan Standards for Grizzly Bear for timber and fire management, p. G-10-11, are concerned with evaluating and reviewing biological information, utilizing proposed treatments to improve habitat for bears and minimizing open road density within occupied habitat and unoccupied habitat. The project is outside of the recovery area and is consider unoccupied by grizzly bears. All standards were considered during project development and mitigation measures have been incorporated to address any specific standards and issues that were identified.

The East Boulder project area proposed vegetation units are located within Forest Plan Management Areas (MA) 3 (forest unsuitable for timber production), 8 (timber management), 11 (forested big game habitat available for timber harvest) and 12 (forested summer and winter wildlife areas). There are no standards specific to management for grizzly bears in these management areas.

k. Gray Wolf

Threatened, endangered, and proposed species 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). Section 7 of the Endangered Species Act directs federal agencies to ensure actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of their critical habitats (16 USC 1536). The gray wolf appears on the species list provided by the U.S. Fish and Wildlife Service threatened and endangered species list via the internet on January 4, 2011 (http://montanafieldoffice.fws.gov/Endangered_Species/Listed_Species/Forests.html).

Strategies to protect and recover wolf populations in MT, as well as the ecology, biology and habitat descriptions are outlined in the Northern Rocky Mountain Wolf Recovery Plan (USDI 1987). The plan delineated 3 recovery zones within Idaho, Montana and Wyoming. Gray wolves were reintroduced to the Greater Yellowstone Ecosystem in 1995 and 1996 as a non-essential, experimental population under the Endangered Species Act (USDI 2005). The Yellowstone Ranger District is within the Greater Yellowstone Wolf Recovery Area and wolves were listed as a non-essential experimental population. Since the original animals were released in Yellowstone National Park, they have spread throughout the ecosystem as expected. Wolves were delisted on March 28, 2008 from the Endangered Species Act in Montana and the management of wolves was transferred to the State. A recent Federal court decision reinstated Endangered Species Act protection for wolves again on August 5, 2010. Overall, population objectives for the recovery of the gray wolf have been met.

The Service recommends that the Forest analyze the impacts on nonessential experimental populations, along with other populations of fish and wildlife, when complying with the requirements of the National Environmental Policy Act (NEPA) and other relevant land management statutes. Any protective measures in addition to those outlined in the final rules for managing the nonessential experimental wolf populations, or additional review procedures, are at the discretion of the Forest Service.

Affected Environment

Wolves have been observed on National Forest lands in the Absaroka and Beartooth Mountain Ranges, and in the East Boulder Fuel Reduction project area. The Moccasin Lake pack was established in the vicinity in approximately 2004. Denning and rendezvous sites were located in an adjacent drainage to the north. Livestock depredations occurred and wolves were removed by 2009. Sightings continue to occur periodically in the East Boulder project area (Schacht, personal communication). Records were examined for documented presence and distribution of the gray wolf. The Montana Natural Heritage Program (MNHP) was consulted for species occurrence in the East Boulder River project area and beyond. Site visits were made to review the proposal including the actions and their locations proposed for the vegetation treatments and temporary roads. Montana Fish Wildlife and Parks (MFWP) personnel were contacted for big game use and population trend information for elk and other big game species, deer and moose.

There are no known wolf dens or rendezvous sites in the East Boulder project area at the present time although occasional sightings of individuals are reported. The closest known established pack is near Baker Mountain in the Main Boulder River drainage (MFWP 2010). The East Boulder project area is considered to be within the home range of this pack. The Montana Natural Heritage Program Tracker database indicates that wolves are generally located in the East Boulder drainage; specific occurrences are documented for the Moccasin Lake pack (2004-2006). There is also an occurrence for one individual on the north side of Green Mountain which is situated between the Main Boulder and East Boulder drainages. Over the last seven years wolves have been reported using all the major drainages in the Upper Boulder (Paugh).

Big game ungulates provide the primary prey species for wolves. The East Boulder project area provides year-round habitat for deer and moose. Winter ranges for deer are found throughout the analysis area where south and west exposure occurs and are

typically found at higher elevations during the summer months. Moose are present at low densities throughout the project area in winter and sporadically during other seasons. Elk use is not significant in the project area, but a few elk do use the area during summer. The project area does not provide winter range for elk.

Wolf pups are born in a den, where they spend the first few weeks of their lives. All pack members work together to provide food for the alpha female and pups at the den site. When pups are old enough to move around, but not yet hunting with the pack, they are moved to a rendezvous site where they begin to learn hunting skills, but are still fed and cared for by pack members.

Forest roads are not considered to have a direct impact on wolves, but high road densities and traffic rates may affect distribution and abundance of wolf prey species. Road densities are currently well within the accepted range for big game management in the East Boulder project area and the Gallatin Travel Plan has been implemented. The frequency and rates of traffic may be affecting the distribution and abundance of prey species within the project area, but is not affecting the overall abundance and distribution of prey within the analysis area as a whole. Overall, population objectives for the recovery of the gray wolf have been met.

Effects Analysis

Methodology and Scale

For assessment of direct and indirect effects, a spatial analysis area was identified including approximately 11,170 acres surrounding the proposed treatment areas. This area was selected because it encompasses all proposed treatment units, it is large enough to encompass average home range sizes reported for the focal species (deer, elk and moose), and contains seasonal habitat for big game species known to use the area. The entire Hunting District 560 (roughly 550,000 acres) was considered for cumulative effects, since this is the area used for large-scale management of big game by MFWP. Hunting District 560 includes portions of the Absaroka Beartooth Wilderness Area, the Main Boulder, East Boulder, and Deer Creek drainages.

The timeline used to evaluate past, present and reasonably foreseeable future actions includes a period of approximately 20 years, looking 10-15 years prior to project implementation and 5-10 years during and post implementation. Consideration of past management actions and natural events that have shaped big game habitat in the project area is established in presentation of baseline habitat conditions for the project area; i.e. the amount and distribution of forage and cover currently available, plus current big game vulnerability conditions. Any reasonably foreseeable future actions would account for potential lingering displacement impacts where continual disturbance factors may cause big game to leave the project area and not return for some time after project completion (thus impacting gray wolf movement).

Direct/Indirect and Cumulative Effects

Under Alternative 1 (No Action), no fuel reduction treatments would occur. Since there are no den or rendezvous sites in the Main Boulder analysis area, the project would have no direct, indirect or cumulative effects to these important reproductive sites. There would be no habitat alteration, as no fuel reduction activities would occur on National Forest System lands, and no associated disturbance factors that would affect big game

species. Ongoing disturbance from traffic and noise associated with mine activity is a factor in the analysis area, but nearby inventoried roadless and designated Wilderness areas provide a vast expanse of secure habitat with limited human disturbance. No project roads would be constructed or reconstructed under this alternative, so there would be no additional disturbance effects from construction and logging traffic on roads, nor any reduction in big game security areas due to the presence and use of new roads. Predators may be an ongoing disturbance and mortality factor, since wolves are known to be in the East Boulder drainage. Again, nearby inventoried roadless and designated Wilderness provides abundant cover and limited human disturbance, where big game can more readily adapt natural defense mechanisms against predators.

Under Alternative 1 (No Action), continued fuel buildup in the analysis area could facilitate the rapid spread of wildfire, which could significantly reduce the proportion of late-successional forest and replace it with better forage conditions for big game, at least in the short-term. Fast-moving wildfires can result in direct mortality of some big game animals. The wild fires that have occurred in the cumulative effects analysis area (Derby and Jungle fires of 2006 and Hicks Park fire in 2007) have altered big game habitat in Hunting District 560 in favor of forage production at the expense of hiding and thermal cover. These changes may have caused redistribution of elk in the area, and could be the reason for recent increases in numbers of elk in the Elk Creek/Deer Creeks herd unit in recent years (Paugh, 2010). The changes in population and distribution of elk would benefit the gray wolf.

Under Alternative 2 and 3, fuel reduction treatments would occur. Sensitivity to disturbance at den sites and subsequent abandonment varies greatly among individual wolves. One incident of human disturbance at the den may cause abandonment for some wolves, while others will tolerate some human disturbance (Thiel et al. 1998) and may not abandon dens unless there are repeated or severe incidents of disturbance. Since there are no den or rendezvous sites in the East Boulder analysis area, the project would have no direct or indirect effects to these important reproductive sites. New road construction required to access treatment units would be kept to a minimum. The small amount of road has an inconsequential effect on road densities in the analysis area. Further, new roads and skid trails constructed for the project would be closed to the public during project implementation and would be closed and rehabilitated upon project completion. Roads constructed for proposed fuel reduction activities would not be open to the public. Roads would be permanently closed and revegetated per Gallatin Travel Plan programmatic direction (USDA 2006). Human disturbance and accessibility of wolf habitats (i.e., road densities) are the principle factors limiting wolf recovery in most areas (USDI 1987). This component is associated with reducing the risk of direct human-caused mortality to wolves. Access for commercial harvest will be directed as per the Gallatin Travel Plan. Long-term, there will be no changes in open road density with the proposed fuel reduction treatment.

Proposed fuel reduction treatment in the East Boulder drainage would alter habitat for prey species as described in the big game effects analysis, at least in the short term. Forage conditions could also temporarily degrade for wolf prey species by damaging grasses, shrubs and browse trees with logging and burning operations. Short term improvements in forage availability may occur in some units, but are not expected to have notable effects at the population level for any big game species. The commercial harvest activities would likely displace and/ or disturb deer and moose from the

treatment units during winter logging operations. Hand thinning during the spring, summer, and fall may also impact them, as well as elk. Neither the disturbance impacts, nor habitat alterations would have detrimental impacts on big game habitat or populations. Overall, the gray wolf has reached recovery criteria and is being considered for delisting.

Cumulative effects to wolf prey species with implementation of Alternatives 2 or 3 include past vegetation management effects on prey habitat, effects from private lands and travel management practices. The East Boulder cumulative effects analysis area is a combination of private land, and National Forest system lands, much of which is inventoried roadless or designated Wilderness. Private lands activities have both a positive and negative impact on wolf ungulate prey. Many private land owners in the analysis area maintain pastures, irrigated land and more open landscapes. While this provides additional forage, it also may put the wolf in a closer juxtaposition with privately-owned livestock. The presence of livestock is a factor that can influence the potential for wolf mortality. Wolf depredation on livestock has occurred on private lands with resulting management removals of wolves and in some cases entire packs (MFWP 2010). Human-caused mortality of wolves is generally higher in areas with greater open motorized route densities, but may also occur in backcountry areas away from open motorized routes. Road densities are very low within the National Forest inventoried roadless or designated Wilderness portions of the cumulative effects analysis area.

Population trends for elk herds in the cumulative effects analysis area have varied in recent years. Elk wintering in this area are typically found in small herds of 5-25 animals scattered along the Main Boulder River corridor. In winter counts for 2010, the Main Boulder herd unit (winter count 206) was below State population objective (300), while the West Boulder/ Greeley Creek herd unit (winter count 518) was well above population objective (300). The Elk Creek/ Deer Creeks herd unit (winter count 120) was also slightly above objective (100) (Paugh, 2010). All counts should be considered minimum numbers since elk groups are often in the timber making total counts difficult. Abundant prey species would continue to be available to wolves.

Direct, indirect, and cumulative effects associated with all of the alternatives associated with the East Boulder Fuels Reduction Project were considered. There would be no impacts to den or rendezvous sites as none are known in the direct and indirect analysis areas. The proposed fuel reduction activities would not reduce the ability of the Baker Mountain pack to continue to use the East Boulder drainage as part of their home range. The gray wolf is a habitat generalist that prefers low road densities and needs abundant prey. There will be no increase in open road density. There would be no detrimental effects to wolf prey species. Overall, population objectives for the recovery of the gray wolf have been met.

Compliance With Laws, Regulations, And Forest Plan Direction

Under Section 7 of the Endangered Species Act, each Federal agency must ensure that any action authorized, funded or carried out is not likely to jeopardize the continued existence of any threatened or endangered species. Alternative 1 (No Action) will have "no effect" on the gray wolf. The action alternatives (Alternative 1 and 2) are "not likely to jeopardize" the gray wolf. The gray wolf in the Yellowstone nonessential experimental population area does not require consultation under section 7, nor does it

require the action agency to confer, if the determination is not likely to jeopardize the 10(j) gray wolf (USDI 2005).

The final rule published in the Federal Register defines regulations for nonessential experimental populations of the western distinct population segment of the gray wolf (USFWS 2005). This rule retains some regulation of human-caused wolf mortality (i.e. no public hunting or trapping is allowed) but it does allow for non-injurious harassment of wolves and take of wolves on both private and public lands. This rule was issued to provide additional flexibility within the experimental population areas in recognition of the fact that wolves are numerous in the experimental population areas (USFWS 2005). All alternatives for the East Boulder Fuels Reduction Project would comply with this rule.

The **National Forest Management Act (NFMA) of 1976** requires that the US Forest Service maintain sufficient habitat to sustain viable populations of native vertebrate species (36 CFR 219.19). The NFMA (1976) requires the Forest Service to provide habitat for native and desired non-native species, and there are certain species that depend on snag habitat for basic life processes, such as breeding, feeding and sheltering. All alternatives would be in compliance with applicable direction for management of big game habitat, important gray wolf prey species. In the event that the gray wolf is delisted from the Endangered Species List, it would be managed as a sensitive species. The East Boulder Fuel Reduction project would be given a "no impact" on gray wolf determination for Alternative 1 (No Action) and the determination given for gray wolf from action alternatives (Alternative 1 and 2) effects "may impact individuals or habitat". All of the alternatives would maintain sufficient habitat to sustain viable populations of native species.

The **Gallatin Forest Travel Management Plan** states that new roads built for administrative projects should be temporary in nature, and effectively gated to restrict motorized public use. Once the activity is complete, these roads should be permanently and effectively closed and re-vegetated (USDA 2006: I-II, Guideline D-7). Applicable Travel Plan standards for roads would be met with all alternatives. Road density would be managed by following the Travel Plan guideline to restrict public use on project roads during implementation and temporary roads would be effectively closed and rehabilitated upon project completion.

Effects Analysis for Sensitive and Management Indicator Species

There is a concern that the action alternatives may affect sensitive and/or management indicator species of wildlife, amphibians, or fish. Sensitive species are those animal species identified by a Regional Forester for which population viability is a concern as evidenced by a significant current or predicted downward trend in population numbers, density, or in habitat capability that will reduce species' existing distribution (FSM 2670.5.19). Management indicator species (MIS) are those species which have been identified as most likely to be affected by Forest management activities that will be monitored to determine population changes.

Removal of vegetation or habitat that supports a species life history (foraging, denning, nesting, hiding cover) and results in changed habitat conditions can result in positive or negative effects depending on many variables. Disruptions associated with human activities can disturb and/or displace wildlife. Impacts to sensitive species/MIS were

first evaluated by assessing whether suitable habitat for the focal species exists within the immediate project area to be affected and the greater analysis area appropriate for each species. Quantitative and qualitative factors relative to habitat change (e.g. loss of denning/ nesting/ foraging habitat) and the potential for displacement were analyzed for individual species. Project effects were considered in the context of a recent review of the populations and habitat (MIS) at the forest scale ((USDA unpublished paper: 16).

Methodology and Scale

All available records were examined for documented presence and distribution of Gallatin National Forest sensitive and management indicator species. Site visits were made to review the proposal including the actions and their locations proposed for the vegetation treatments and temporary roads, and to assess potential suitable habitat for the various sensitive/management indicator species (MIS) species. These field reconnaissance visits were also used to determine the existing vegetative condition within the project area and to look for evidence of wildlife use and any special features (e.g. nest sites, den sites, mineral licks, wet sites, wallows, cavity trees, foraging areas, staging areas, security cover, and travel corridors) that might need protection through mitigation or that could be affected by the proposal.

Surveys to detect northern goshawks and to quantify the presence of standing dead trees (snags) were conducted within the project area. Geographic Information System (ARCMAP) was used to analyze impacts to flammulated owl, wolverine, goshawk, and pine marten in conjunction with existing vegetation data the Timber Stand Management Record System (TSMRS) database and Region 1 Vegetation Map (R1-VMap)).

The geographic scale used to evaluate the effects of this project on sensitive and MIS species and their habitat was based on known occurrences of those species or on suitable habitat within the influence of the proposed treatment units. For flammulated owl, long-eared myotis, long-legged myotis, and northern goshawk, an area of approximately 11,171 acres was used to disclose direct, indirect, and cumulative effects. For the wolverine and marten, a larger analysis area of 36,227 acres was used to incorporate any cumulative effects within this species' potential home range. Maps of the analyses areas for flammulated owl, Northern goshawk, wolverine, and pine marten are located in the Project File.

The temporal scale for effects analysis includes consideration of past activities that may have influenced habitat for sensitive and management indicator species. It also includes the time needed to implement the proposed vegetation treatments, approximately 5 to 10 years. Most of the human actions or naturally caused forces that created existing vegetative patterns within the project area (e.g. timber harvest, road construction, fire suppression, wildfire, insect/disease outbreaks) occurred over the past 60 to 70 years. This analysis considered the estimated implementation timeframe for the project, as well as any reasonably foreseeable future actions.

l. Sensitive Wildlife, Fish, Amphibian Species

Protection of sensitive species and their habitats is a response to the mandate of the National Forest Management Act (NFMA) to maintain viable populations of all native and desired non-native vertebrate species (36 CFR 219.19). The sensitive species program is intended to be pro-active by identifying potentially vulnerable species and taking positive action to prevent declines that will result in listing under the Endangered

Species Act. Forest Service Manuals (FSM 2670) provide policy under which Forest Service projects are designed to maintain viable populations of sensitive species and to ensure that those species do not become threatened or endangered due to Forest Service actions.

As part of the National Environmental Policy Act (NEPA) decision-making process, proposed Forest Service programs or activities are to be reviewed to determine how an action would affect any sensitive species (FSM 2670.32). The goal of the analysis should be to avoid or minimize impacts to sensitive species. If impact to a sensitive species cannot be avoided, the degree of potential adverse effects on the population or its habitat within the analysis area needs to be assessed.

The Regional Forester designated sensitive species for Region 1(USDA 2011) were analyzed in this report. Three new wildlife species and one new fish species were added to the 2011 Regional Forester's list for the Gallatin National Forest effective May 27, 2011. The new wildlife species to consider include the bighorn sheep, and two bats (the long-eared myotis, and the long-legged myotis). The aquatic species is the western pearlshell mussel, however it is only found and applicable to portions of the west side of the Gallatin National Forest in the Gallatin and Madison River drainages, which are well outside of the project area so this species will not be analyzed for this project. The wolverine is proposed for listing under the Endangered Species Act and is analyzed as a sensitive species per USFS direction. The sensitive species that were considered , and the summary of project effects, are displayed in the Table 25 below.

Table 25-Gallatin National Forest Sensitive Species (2011)

Species	Habitat or Species Present in the Project Area	Effects Determination* and Summary Conclusion of Effects
Peregrine Falcon (sensitive)	Peregrine falcons select cliffs for nest sites and riparian areas for foraging. Known nest sites in the Main Boulder drainage outside of the project area.	*No impact*; no known occurrence, cliff habitat would not be impacted. No net change in riparian foraging. Not addressed further.
Trumpeter Swan (sensitive)	Habitat requirements include large streams and lakes for nesting habitat. There are no large lakes within the vicinity of the project.	*No impact*; no suitable habitat within the project area. Not addressed further.
Harlequin Duck (sensitive)	Found near large, fast flowing mountain streams. Suitable habitat does exist in the project area along the East Boulder river, but this species has never been documented in the drainage.	*No impact*; no presence documented in the project area. Not addressed further.
Flammulated Owl (sensitive)	Prefer seral and late successional forest with abundant moth species prey; no ponderosa pine in project area but Douglas fir and aspen may be used. Surveys have been conducted, but	*May impact individuals or habitat, but is not likely to cause a trend to Federal listing or loss of viability*; there may be suitable habitat within the project area that would be

Species	Habitat or Species Present in the Project Area	Effects Determination* and Summary Conclusion of Effects
	flammulated owls were not detected. Species records do not exist on the Yellowstone District. Migratory owl species.	treated. Thinning may improve nesting and foraging habitat. Snag and down woody material standards followed. Commercial winter activity would not affect this migratory owl.
Townsend's Big-Eared Bat (sensitive)	Roosts in caves, mines, rocks, tree bark, and buildings, the presence of which strongly affects its distribution (Genter and Jurist 2003). The project area does not contain high quality caves or abandoned mines for roosting habitat. Other components of suitable habitat may occur across the landscape but are not optimal. There are no records of occurrence in the project area.	*No impact*; cave habitat not impacted; habitat components are scattered and uncommon. No Townsend's big-eared bats have been identified in the East Boulder area. Not addressed further.
Long-Eared Myotis (sensitive)	This bat species uses a variety of habitats but is usually associated with coniferous forested stands containing old growth characteristics and snags. Day roosts are under loose bark, in hollow trees, and rock crevices of fissures in clay banks. Night roosts include caves and mines. Forages for insects between treetops and over woodland ponds (Genter and Jurist 2003). Prey is gleaned off foilage, tree trunks, rocks, and from the ground (Bogan et al. 2005). Suitable habitat may be available within the project area.	*May impact individuals or habitat, but is not likely to cause a trend to Federal listing or loss of viability*; may reduce potential roost sites and alter prey base. Mature and old growth forested areas with snags adjacent to proposed treatment units would continue to offer roosting habitat. No net change in riparian foraging due to mitigation. Cave, rock, and mine habitat not impacted. Snag and down woody material standards followed.
Long-Legged Myotis (sensitive)	This bat species occurs most often in montane coniferous forest. Buildings, exfoliating tree bark, snag cavities, cracks in the ground, and cliff crevices provide summer roost sites. Caves and mine tunnels serve as hibernacula	*May impact individuals or habitat, but is not likely to cause a trend to Federal listing or loss of viability*; may reduce potential roost sites and alter prey base. Mature and old growth forested areas with

Species	Habitat or Species Present in the Project Area	Effects Determination* and Summary Conclusion of Effects
	(Bogan et al. 2005). Forages in and around the forest canopy over woodland meadows or watercourses (Genter and Jurist 2003).	snags adjacent to proposed treatment units would continue to offer roosting habitat. No net change in riparian foraging due to mitigation. Cave, rock, and mine habitat not impacted. Snag and down woody material standards followed.
Bighorn Sheep (sensitive)	Occur in a diversity of habitats throughout Montana but focus on rough, rocky terrain with steep cliffs in association with meadows or grasslands. There is no bighorn sheep habitat within the East Boulder project area.	*No impact*; no suitable habitat within the project area. Not addressed further.
Wolverine (sensitive)	Large areas of unroaded habitat; secure denning habitat at upper elevations, ungulate carrion in winter; known to exist in a variety of habitat types. The project area may contain suitable habitat. This species is legally trapped per MFWP furbearer regulations.	*May impact individuals or habitat, but is not likely to cause a trend to Federal listing or loss of viability*; this project would not impact foraging habitat to a measurable degree. No change in available ungulate carrion. Denning habitat not expected to be affected.
Black-backed Woodpecker (sensitive)	Primary cavity nesters that prefer disturbed landscapes of burned or insect killed forest with numerous snags containing wood boring insects. Disease and insect killed trees provide limited suitable habitat within the project area. Optimal burned habitat was created by the Derby, Jungle, and Hicks Park Fires in 2006 adjacent to the project area.	*No impact*; no burned or substantial amounts of dead trees providing snags for nesting and foraging in the project area. Long term, thinning smaller diameter trees will maintain larger available trees for snag recruitment. Snag standards will be followed. Not addressed further.
Bald Eagle (sensitive and MIS)	Forest Plan indicator for endangered species. The bald eagle was delisted from the Endangered Species Act and is considered fully recovered. Bald eagles are irregularly seen near the Forest boundary in East Boulder river drainage. Marginal nesting habitat is present; foraging for fish and carrion may occur within the project area. Bald eagles typically winter further north along the Main Boulder river and out along the Yellowstone River.	*No impact*; no known nests or foraging in project area. Project activity would not affect nesting or foraging habitat. Not addressed further.

Species	Habitat or Species Present in the Project Area	Effects Determination* and Summary Conclusion of Effects
Northern Leopard Frog (sensitive)	Suitable wetland habitat may occur in the project area. Surveys have been conducted but species presence has not been detected. Columbia spotted frogs are currently the only amphibians known to inhabit the district	*No impact*; This species has not been found on the district or in the project area. Project activity would not affect wetlands
Boreal Toad (sensitive)	Suitable wetland habitat may occur in the project area. Surveys have been conducted but species presence has not been detected. Columbia spotted frogs are currently the only amphibians known to inhabit the district	*No impact*; This species has not been found on the district or in the project area. Project activity would not affect wetlands.
Yellowstone Cutthroat Trout (sensitive)	Streams throughout the project area are within historically occupied habitat for this species. Electro-shocking surveys have been conducted in all project area streams and the species was found.	*No Impact*, Suitable habitat exists in the project area streams and the species is present. Streams will be buffered and mitigation is in place to protect habitat. Addressed in the aquatics analysis.
Westslope Cutthroat Trout (sensitive)	This species is not native to the Yellowstone River Drainage. Electro-shocking surveys have been conducted in all project area streams and this species was not found.	*No impact*; The species has not been found in project area streams or the Yellowstone River system. Not addressed further.
Fluvial Arctic Grayling (sensitive)	This species is not native to the Yellowstone River Drainage. Electro-shocking surveys have been conducted in all project area streams and this species was not found.	*No impact*; The species has not been found in project area streams. Not addressed further.
Western Pearlshell Mussell	NA	This species is only found and applicable on portions of the west side of the Gallatin National Forest in the Gallatin and Madison River drainages Not addressed for this project

* Options in determination of effects: (1) No impact; (2) MIIH - May impact individuals or habitat, but is not likely to cause a trend to Federal listing or loss of viability; (3) Likely to result in a trend to Federal listing or loss of viability; and (4) Beneficial impact. There would be "no impact" to sensitive species determined to be absent from the project area.

As indicated in Table 25 above, the East Boulder Fuel Reduction project area does not provide suitable habitat, or will not affect habitat for the peregrine falcon, trumpeter

swan, harlequin duck, Townsend's big-eared bat, black-backed woodpecker, bald eagle, westslope cutthroat trout, or arctic grayling. Thus, these species are not further addressed. Species for which further discussion or analysis was conducted include flammulated owl, long-eared myotis, long-legged myotis, wolverine, northern goshawk, northern leopard frog, and boreal toad. Effects to Yellowstone cutthroat trout habitat and populations are discussed in the aquatics analysis.

Flammulated Owl

Agency monitoring and surveying records were reviewed for any documentation of presence or potential for presence of flammulated owl. The Montana Natural Heritage Program (MNHP) was consulted for species occurrence in the East Boulder River drainage. A literature review was conducted for additional information on flammulated owl habitat use and possible impacts associated with timber harvest and other fuel reduction activities. Suitable nesting habitat was modeled using GIS tools and photo-interpretation (PI) strata from TSMRS. Potential nesting habitat was modeled because nest site availability is a potential limiting factor, probably due to its obligatory cavity nesting behavior (McCallum 1994b:37). Flammulated owls are strongly associated with open ponderosa pine habitat, which is not found in the project area. There is some potential for flammulated owls to use aspen and Douglas fir mature and old growth forests with low conifer canopy cover on southerly slopes; therefore this analysis focused on those habitats. Proposed fuel reduction treatment units and temporary roads were overlaid to see if any of the activities would directly impact potential habitat.

Affected Environment

Associated with seral and climax late-successional forests, these owls are a secondary cavity nester which feed almost exclusively on invertebrates. The flammulated owl migrates southward probably due to their need for insect availability, or for the availability of abundant prey bases along the migratory path (McCallum 1994b:18-19). Their range is restricted to mid-elevation montane zone of western North America and they have only recently been found in Idaho and Montana (McCallum 1994a:2). The documented geographic range of flammulated owl corresponds very closely with ponderosa and Jeffrey pine distribution except for the extension of pine habitat in eastern Montana (Nelson et. al. 2009). However, he recommended that the flammulated owl map be revised to capture records of observations of the previously delineated owl range resulting from recent field surveys.

Although flammulated owls seem to prefer mature, open-grown stands of ponderosa pine, they may also use other forest types with similar features such as dry montane conifer or aspen. They prefer open habitats with cavities for nesting and denser foliage with brushy understory for roosting (McCallum 1994a:5). Although flammulated owl nest sites are not limited to cavities in snags, snags provide an important source of both nest and roost sites for the species. Samson (2006:55-63) also provides a good summary of the ecology, behavior, and habitat of the flammulated owl. Open forest types provide a dry, warm, and light physiognomy that favors high insect diversity, which is important as foraging for flammulated owls. Preferred forest types are only present in small quantities within or near the project area. One proposed fuel reduction unit (Unit #1) partially overlaps potential habitat; approximately 17 acres of flammulated owl habitat is within Unit #1. However, the forested cover within or near the project area consists primarily of a mix of lodgepole pine, Douglas fir, spruce, and subalpine fir, most of

which has a closed canopy. Therefore, the analysis area overall is considered marginal habitat for the flammulated owl due to the higher elevations and lack of ponderosa pine.

Survey efforts, conducted in the Dry Fork of the East Boulder (outside the analysis area) in 2001 and 2003 did not detect any flammulated owls. In addition, no flammulated owls were detected during a 2005 Region-wide survey effort in the adjacent Deer Creek/ West Bridger drainages. In addition, there are no element occurrence data of flammulated owls in this area recorded with the Montana Natural Heritage Program. The flammulated owl is ranked as a G4, S3b species by the MNHP which means that globally the species is apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining, while in Montana it is potentially at risk because of limited and/or declining numbers, range and/or habitat. Bush and Lundberg (2008:8) looked at Forest Inventory Analysis (FIA) data and estimated that there is approximately 1.2% or 13,790 acres of potential flammulated owl habitat on the entire Gallatin National Forest.

Samson (2006) recently conducted a region-wide conservation assessment for the northern goshawk, black-backed woodpecker, pileated woodpecker, flammulated owl based on a principle-based approach to population viability analysis (PVA). For each species, he used peer-reviewed science, all known inventory/observation data, vegetation data from Forest Inventory and Analysis (FIA), scientific information on the minimum dispersal distances for species, their home range and body sizes, and well known conservation principles to assess the availability of suitable habitat, calculate a habitat threshold, and ultimately assess short- and long-term viability on each Forest in Region One. According to Samson (2006:63), short-term viability of the flammulated owl in the Northern Region is not an issue given the following: 1) No scientific evidence exists that the flammulated owl is in decreasing in numbers; 2) Increases in the extent and connectivity of forested habitat have occurred since European settlement; 3) Well-distributed and abundant flammulated owl habitat exists on today's landscape; 4) Level of timber harvest is insignificant.

Direct/Indirect/Cumulative Effects

No direct effects on this migratory owl are predicted under any of the alternatives.

Alternative 1 would not reduce any potential flammulated owl habitat or nesting trees. In the absence of forest management, there would be an increase in stem density of trees and a corresponding decrease in understory vegetation, which could increase roosting habitat, but decrease nesting and foraging habitat.

The proposed vegetation treatments associated with Alternatives 2 & 3 could indirectly affect potential nesting, foraging, and roost sites. Some trees with potential nesting cavities may be removed and dense understory, potentially used as roosting, may be modified. Nesting opportunities would decrease with the proposed vegetation treatments, particularly in Unit #1 (both Alternative 2 and 3). However, Forest Plan standards for snag management would be met under both action alternatives. There may be an increase in nest site availability long-term because proposed thinning prescriptions would promote the growth of large trees that could be used for future primary nest building species and live snag replacement trees would be left where sufficient snags are not available. While timber harvest may slightly decrease nesting habitat, foraging opportunities would increase.

Vegetation treatments in Unit #1 (both Alternatives 2 and 3) may improve flammulated owl foraging habitat by increasing the open, park-like conditions of dry, Douglas fir and removing lodgepole. Forest/ grassland edges are preferred foraging (McCallum 1994b). Minor indirect effects of Alternatives 2 and 3 may occur by creating warmer, drier conditions, which in turn favor the owl's prey base (insects Proposed vegetation treatments in other units would create more open forested stands; however, the treatments occur in mixed conifer forest, which is not preferred flammulated owl habitat. There is no difference between Alternative 2 and 3 because Unit #1 which is common to both alternatives was the only potential flammulated owl habitat within the project area. The temporary road construction and use, additional hand treatment of activity fuels, and weed treatment would not result in measurable effects to flammulated owl foraging, nesting, or roosting habitat.

In summary, very little suitable habitat exists in or near any of the units proposed for treatment with either action alternative. Approximately 17 acres of suitable nesting habitat is within Unit #1. Forest Plan standards for snags would be followed. Foraging habitat may be slightly improved. The East Boulder Fuels Reduction Project "*may impact individuals or habitat, but will not likely result in a trend toward federal listing or reduced viability for the population or species"* of the flammulated owl.

Cumulative effects are not outlined in detail for those wildlife species that would have only minor immeasurable effects from the proposed fuel reduction treatments. There are no direct, indirect, and therefore no cumulative effects on these wildlife species and there is no difference between alternatives.

Long-eared Myotis

Agency monitoring and surveying records were reviewed for any documentation of presence or potential for presence of long-eared myotis. The Montana Natural Heritage Program (MNHP) was consulted for species occurrence in the East Boulder River drainage. A literature review was conducted for additional information on long-eared myotis habitat use and possible impacts associated with timber harvest and other fuel reduction activities.

Affected Environment

This bat species uses a variety of habitats but is usually associated with coniferous forested stands containing old growth characteristics and snags. Day roosts are under loose bark, in hollow trees, and rock crevices of fissures in clay banks. Night roosts include caves and mines (Schmidt 2003:6). It is speculated that the long-eared myotis hibernates, which is common among other temperate bats. Winter hibernacula that have been documented for other bat species are usually in caves or mines (as is suspected with the long-eared myotis) (Buseck and Keinath 2004:16). Suitable habitat for day roosting may be available within the project area. There are no caves in the analysis area so it is unlikely there is any habitat suitable for night roosting or hibernacula.

The long-eared bat forages for insects between treetops and over woodland ponds (Genter and Jurist 2003:4). Prey is gleaned off foliage, tree trunks, rocks, and from the ground (Bogan et al. 2005:1).

There are no element occurrence data of long-eared myotis recorded with the Montana Natural Heritage Program in the project area. The long-eared myotis is ranked as a G5, S4 species by the MNHP, which means that globally the species is common, widespread, and abundant. In Montana it is apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining.

Direct/Indirect/Cumulative Effects

Alternative 1 would have no direct or indirect impacts on foraging or roosting habitat, or hibernacula. There would be no effect on potential day roosting as no trees would be removed. Foraging opportunities would be maintained and bats would not be compromised in their options for selecting day roost sites. Night roosting and hibernacula, if it exists in the area, would not change from current conditions or use, as no caves would be impacted.

Proposed commercial harvest associated with the East Boulder Fuel Reduction Treatment Project would remove trees that may be providing day roosts. It is unlikely that any direct mortality would occur as this treatment would take place during the winter when bats have migrated to their hibernacula. Direct effects to cave habitat (potential night roosting sites and/or hibernacula) would not be impacted by thinning, neither commercial harvest nor hand treatments.

Indirect effects of the action Alternatives 2 and 3 may occur due to habitat alteration or disturbance. Habitat alteration refers to modification of any component of the required habitat, (e.g., presence and quality of open water, roost structures, and coniferous forest stands) that may decrease habitat suitability or prey availability (Buseck and Keinath 2004:3). Roost disturbance can encompass acts that completely destroy entire roosts, or cause a bat to relocate to a potentially less desirable site, or change the quality of why a roost was selected (Buseck and Keinath 2004:38).

Some large trees with exfoliating bark used for day roosts may be removed with the proposed fuel reduction treatments. Waldien et al. (2003:70) found that long-eared myotis used large Douglas fir stumps located in open areas after timber harvest. However, he concluded that stumps did not provide the long-term habitat value and that management of roost structures should focus on maintaining present and future availability of snags in an area. The proposed commercial harvest treatments prescribe leaving clumps of trees that would not be treated. Hand treatments would not impact the overstory trees. Forest Plan snag standards will be followed so snag bark and excavated cavities would continue providing potential day roosts.

Miller et al. (2003:35) reviewed published literature on the habitat ecology of forest roosting bats in North America and provided a critical assessment on the rigor and reliability of information upon which to base habitat management. They agreed that large snags and trees, particularly in western coniferous forests, are important roosting structures and should be retained for bats when planning forest management activities. However, they concluded that the paradigm that roosts are the primary limiting factor for bats led to a false general conclusion that timber harvest has a negative effect on habitat quality. Roosting habitat within adjacent untreated areas and riparian areas would continue to offer roosting habitat.

Sources of prey, such as tree-tops and forested edges may be disturbed and/or altered, decreasing insect populations. This may cause a bat to relocate to another, less desirable foraging area and expend more energy. The prescriptions for commercial harvest would continue to provide foraging areas in clumps of leave trees. Water sources would be protected during project activities through the implementation of identified mitigation measures which would also minimize impacts to foraging opportunities. Vegetation treatments of merchantable trees would take place during the winter when these bats are most likely migrated to lower elevations. Alternatives 2 and 3 would have similar effects although there would be a greater potential for loss of day roosting sites with Alternative 3. None of the alternatives would result in adverse modification of long-eared myotis habitat.

In summary, suitable habitat for day roosts exists in or near some of the units proposed for treatment. Day roosting and foraging habitat may be altered, forcing this bat species to expend more energy in less desirable areas. Forest Plan standards for snags would be followed. Prescriptions for commercial harvest units will leave clumps of trees; hand treatment units will not remove large trees or snags. Night roosting habitat and hibernacula would not be impacted. The East Boulder Fuels Reduction Project "*may impact individuals or habitat, but will not likely result in a trend toward federal listing or reduced viability for the population or species"* of the long-eared myotis.

Cumulative impacts are not outlined in detail for those wildlife species that would have only minor immeasurable effects from the proposed fuel reduction treatments. There are no direct, indirect, and therefore no cumulative effects on these wildlife species and there is no difference between alternatives.

Long-legged Myotis

Agency monitoring and surveying records were reviewed for any documentation of presence or potential for presence of long-legged myotis. The Montana Natural Heritage Program (MNHP) was consulted for species occurrence in the East Boulder River drainage. A literature review was conducted for additional information on long-legged myotis habitat use and possible impacts associated with timber harvest and other fuel reduction activities.

Affected Environment

This bat species occurs most often in montane coniferous forest, primarily between 1,500-3,300 meters (5,000-11,000 feet) (Warner and Czaplewski 1984). Buildings, exfoliating tree bark, snag cavities, cracks in the ground, and cliff crevices provide summer roost sites. Caves and mine tunnels serve as hibernacula to which bats migrate in the winter (Bogan et al. 2005). Cryan et al. (2001:49) found that the long-legged myotis used roost trees that were consistently among the largest available and in areas of relatively high snag densities. Large snags above the forest canopy tend to provide a more favorable (warm) microclimate for thermo-regulating roosting bats due to greater solar heat accumulation and retention than snags below the forest canopy (Ormsbee and McComb 1998:600).

Long-legged myotis select for foraging sites that are relatively close to roosting sites. The long-legged myotis forages in and around the forest canopy over woodland meadows or watercourses (Genter and Jurist 2003:3). It preys primarily on moths but

will feed opportunistically on other soft-bodied insects, termites, lacewings, leafhoppers, etc. (Warner and Czaplewski 1984:2).

There is no element occurrence data of long-legged myotis recorded with the Montana Natural Heritage Program in the project area. The long-legged myotis is ranked as a G5, S4 species by the MNHP, which means that globally the species is common, widespread, and abundant, though it may be rare in parts of its range. In Montana it is apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining.

Direct/Indirect/Cumulative Effects

Alternative 1 would have no direct or indirect impacts on foraging or roosting habitat, including hibernacula. There would be no effect on potential day roosting as no trees would be removed. Foraging opportunities would be maintained and bats would not be compromised in their options for selecting day roost sites. Night roosting and hibernacula, if it exists in the area, would not change from current conditions or use as no caves would be impacted.

Proposed commercial harvest associated with the East Boulder fuel reduction treatments would remove trees that may be providing day roosts. It is unlikely that any direct mortality would occur as this treatment would take place during the winter when bats have migrated to their hibernacula. Direct effects to cave habitat (potential night roosting sites and/or hibernacula) would not be impacted by thinning through either commercial harvest or hand treatments.

Proposed fuel reduction activities in Alternatives 2 and 3 may cause a loss of roosting habitat and alteration of the prey base (insects). Water sources would be protected during project activities through the implementation of identified mitigation measures, which would minimize impacts to foraging opportunities. None of the alternatives would result in adverse modification of long-legged myotis habitat due to mitigation for retention of snags, as well as the prescriptions to leave clumps of trees. Mature trees within adjacent untreated areas and riparian areas would continue to offer roosting and foraging habitat. This is consistent with Cryan et al. (2001:49) and Ormsbee and McComb (1998:601) who suggested that maintaining forests with high snag densities and large trees will likely benefit these bats in managed landscapes. Alternatives 2 and 3 would have similar effects although there would be a greater potential for loss of day roosting sites with Alternative 3. None of the alternatives would result in adverse modification of long-eared myotis habitat.

In summary, suitable habitat for day roosts exists in or near some of the units proposed for treatment. Roosting and foraging habitat may be altered forcing this bat species to expend more energy in less desirable areas. Forest Plan standards for snags would be followed. Prescriptions for commercial harvest units will leave clumps of trees; hand treatment units will not remove large trees or snags. Night roosting habitat and hibernacula would not be impacted. The East Boulder Fuels Reduction Project "*may impact individuals or habitat, but will not likely result in a trend toward federal listing or reduced viability for the population or species"* of the long-legged myotis

Cumulative impacts are not outlined in detail for those wildlife species that would have only minor immeasurable effects from the proposed fuel reduction treatments. There are

no direct, indirect, and therefore no cumulative effects on these wildlife species and there is no difference between alternatives.

Wolverine

Agency monitoring and surveying records were reviewed for any documentation of presence or potential for presence of wolverine. The MNHP was consulted for species occurrence in the East Boulder River drainage. Montana Fish, Wildlife, and Parks (MFWP) Trapping and Harvest Reports were consulted. A literature review was conducted for additional information on wolverine habitat use and possible impacts associated with timber harvest and other fuel reduction activities. Suitable denning habitat was modeled using GIS tools based on photo-interpretation (PI) strata from TSMRS. Denning habitat was modeled because it is concentrated in rocky basins at high elevation and is a limiting factor. In addition, areas of consistent snow pack were overlaid with the analysis area. Queries focused on high elevation, spruce/fir and mixed conifer forests on northerly aspects. Proposed fuel reduction treatment units and temporary roads were overlaid to see if any of the activities would directly impact habitat. The analysis area for direct and indirect effects is the same as for flammulated owl, Northern goshawk, and pine marten and was based on known occurrences or suitable habitat within the influence of the proposed treatment units. The cumulative effects analysis area incorporated a larger area defined by the 6th Code HUC watershed boundary, portions of the Absaroka-Beartooth Wilderness, and portions of the Custer National Forest to the east and south to better represent annual movements by wolverine.

Affected Environment

Wolverines are medium sized forest carnivores thought to be secretive and to stay in forest cover as much as possible. Copeland et al. (2007:2208) found a universal avoidance of grass and shrub types by wolverine and suggested that the avoidance may be related to a lack of snow, hot temperatures, and a general lack of prey availability. Wolverines are basically habitat generalists with an opportunistic foraging strategy so it is hard to define foraging habitat. Foraging opportunities including small, medium, and large prey animals, carrion, insects, berries, and bird eggs exist within the immediate project area. Generally speaking, wolverines are opportunistic omnivores in summer and primarily scavengers in winter. Food availability may be the primary factor in determining movements and habitat use; thus, they occupy a variety of habitats depending on the time of year.

During the summer, wolverines are associated with high elevation and alpine areas. Copeland et al. (2007:2207) found a positive correlation between increasing elevation and wolverine presence. Although a seasonal shift in elevational use occurred, it was relatively minor.

Denning habitat occurs at relatively high elevations in mature and old growth forests, as well as large-boulder talus fields and mountain cirques. Deep, soft snow is often used for tunneling and den construction. Denning females remain in the high elevation areas during the winter, while males and non-denning females occupy areas wherever prey or carrion is available. There is approximately 706 acres of potential denning habitat within the direct and indirect analysis area. The cumulative effects analysis area has a minimum of 8,611 acres available for denning. This figure is based on the potential available habitat in the 6th Code HUC alone and did not include the potential available

habitat to the south and east in the Absaroka-Beartooth Wilderness and the Custer National Forest. None of the potential denning habitat is within proposed treatment units due to relatively low elevations and lack of cirque basins and structural diversity.

Home ranges of males are larger than those of females, with home ranges of up to several hundred square kilometers. The mean annual home range of males was 422 square kilometers (104,234 acres) in Montana. Female home ranges were 388 square kilometers (95,836 acres) in Montana (Hornocker and Hash 1981:1291). The variation of home range sizes is related to differences in sex, with males ranging further than females, and in the abundance and distribution of food. Designated wilderness and roadless areas to the south and east provide seclusion during both the summer and winter. The East Boulder Mine and associated buildings, roads, and other developments likely reduce the attractiveness of this lower elevation area.

Incidental evidence from surveys conducted in the winters of 2005 and 2008 did not result in any positive identification of wolverine tracks or spore in the East Boulder Fuels project area. There is no element occurrence data of wolverine in this area recorded with the MNHP. The wolverine is ranked as a G4, S3 species by the MNHP which means that globally the species is apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining, while in Montana it is potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas.

The analysis area is located in MFWP Region 5 and within Wolverine Management Unit (WMU) 3 (Southern Core) where wolverine are considered a furbearer and allowed to be legally trapped under a limited quota system (one wolverine per year). According to the furbearer trapping and harvest reports from 1996-2006 (no report for 2004 or since 2006), there were no wolverine reportedly taken in Sweetgrass County (http://fwp.mt.gov/hunting/planahunt/ harvestreports.html#furbearer). No Furbearer Trapping and Harvest Reports have been published since 2006. As of February 16, 2011 (http://fwp.mt.gov/hunting/trapping/furbearer QuotaStatus.html), one wolverine was reportedly taken in WMU 3 during the 2011 trapping season. The wolverine was not taken in the East Boulder drainage. While trapping records indicate the presence of wolverine historically, their abundance and distribution remains uncertain.

Direct/Indirect/Cumulative Effects

Effects to wolverine were addressed by evaluating project impacts to denning and foraging habitat. Road densities were not quantified, as only temporary roads would be required to implement any of the action alternatives. The Gallatin Travel Plan management direction does allow for use of administrative roads or reopening of project roads for activities like the East Boulder fuel reduction treatments. Travel Plan standards and guidelines will be followed during and after project activities. (USDA 2006:I-10-11). No direct effects are anticipated with any of the alternatives.

Alternative 1 would have no effect on denning habitat. No fuel reduction activities would take place and high elevation denning habitat would be left undisturbed. The proposed fuel reduction treatments in Alternatives 2 and 3 would not alter or remove any suitable wolverine denning habitat. Proposed fuel reduction treatment units in Alternative 3 are at a slightly higher elevation and in closer juxtaposition to modeled denning habitat than Alternative 2. However, no potential denning habitat is within any

of the proposed fuel reduction treatment units from any action alternatives. There are approximately 706 acres of modeled denning habitat in the direct and indirect effects analysis area, and approximately 8,611 acres (a very conservative estimate as mentioned above) of modeled denning habitat in the cumulative effects analysis area. The optimal denning habitat conditions that wolverine would choose to use exist at elevations higher than the proposed fuel reduction treatment units.

Alternative 1, by not conducting the proposed fuel reduction treatments, would have indirect effects as succession would continue across the landscape. Succession would benefit some wolverine prey species and not others. Any current foraging patterns would continue unaltered. Similarly, with the proposed fuel reduction treatments, some species would benefit, while others may have at least short-term detrimental impacts. The amount of acres to be disturbed (approximately 645 and 844 acres for Alternative 2 and 3 respectively) would not reduce populations of prey species to any measurable degree. Availability of carrion would not change as vegetation treatment prescriptions and mitigation will minimize effects to wintering big game (mule deer and moose). Furthermore, the proposed fuel reduction treatment units are not substantial contributors to the forage base for wolverine due to the proximity to public roads and structures on private land and their associated activity.

The temporary road construction and use, additional hand treatment of activity fuels, and weed treatments would not result in measurable detrimental effects to wolverine foraging or denning habitat. None of the alternatives would result in adverse modification of wolverine or its associated habitat.

In summary, very little suitable foraging habitat exists in or near any of the units proposed for treatment with either action alternative. Suitable denning habitat occurs in the analysis area, but not within any proposed fuel reduction treatment units. Species presence is unknown. The project is of limited temporal and spatial scale and would have no effects on wolverine denning or foraging habitat. The East Boulder Fuels Reduction Project would have "*no impact"* on the wolverine.

Cumulative effects of the proposed fuel reduction treatments with past, present, and other reasonably foreseeable activities on the wolverine or its habitat are minor. The majority of the denning habitat is at higher elevations above which the past timber harvest has taken place. Most of these activities were long enough ago (up to 30 years) that regeneration has taken place such that cover and seclusion are not limiting. The project will not increase trapper access. Snowmobile use occurs within the cumulative effects analysis area, which is an ongoing effect. There is no denning habitat affected by this proposed fuel reduction project so there would be no cumulative effect on this attribute. The project will not add cumulative effects to the exiting situation for wolverine.

Northern Leopard Frog

Affected Environment

Northern leopard frogs breed from mid-March to early June (Maxell 2000). Mating occurs when males congregate in shallow water and begin calling during the day (Maxell 2000). Eggs are laid at the water surface in large, globular masses of 150 to 500 (Maxell 2000). Young and adult frogs often disperse into marsh and forest habitats, but are not

usually found far from open water (Maxell 2000). Overwintering habitat is the bottom of permanent water bodies, under rubble in streams, or in underground crevices. During a Gallatin National Forest amphibian survey in 1999, northern leopard frogs were found only on the Bozeman Ranger District and a second potential sighting was on the Gardiner Ranger District. None have been found in the East Boulder River drainage or elsewhere in the project area, but future additional surveys are necessary to validate their distributional range and presumed absence from the project area. Suitable habitat does exist throughout the project area.

Direct/Indirect/Cumulative Effects

Surveys for the northern leopard frog suggest that they are not present in the project area, but additional surveys are needed to validate their distributional range. Habitat degradation for this amphibian species is not likely to occur because there would be little riparian disturbance associated with the project. Treatment in wetlands is not proposed, and any wet areas found will be buffered. Thus, it has been determined that Alternatives 1 through 3 will have "*no impact on individuals or habitat*" and would have no direct, indirect or cumulative effects on northern leopard frog habitat.

Western Toad

Affected Environment

Western toads inhabit all types of aquatic habitats ranging from sea level to 12,000 in elevation (Maxell 2000). They breed in lakes, ponds, and slow streams, preferring shallow areas with mud bottoms (Maxell 2000). Western toads breed from May to July, laying long, clear double-strings of eggs (Maxell 2000). Tadpoles metamorphose in 40 to 70 days (Maxell 2000). Because of their narrow environmental tolerance (10-25 C throughout the year), adults must utilize thermally buffered microhabitats during the day, and can be found under logs or in rodent burrows (Maxell 2000). Adults are active at night and can be found foraging for insects in warm, low-lying areas (Maxell 2000). Western toads overwinter in rodent burrows and underground caverns. Boreal toads have not been found east of the Gallatin Range (Atkinson and Peterson 2000), with no observations in the project area. Suitable habitat exists throughout the project area, but additional surveys during summer 2009 did not reveal any presence in the proposed treatment units or project area.

Direct/Indirect/Cumulative Effects

Surveys for the western toad suggest that they are not present. Habitat degradation for this amphibian species is not likely to occur because little riparian disturbance will occur and wet areas will be protected and/or buffered. Treatment in wetlands is not proposed with any alternative. Thus, it has been determined that Alternatives 1 through 3 will have "*no impact on individuals or habitat*" and would have no direct, indirect or cumulative effects to western toad habitat.

m. Management Indicator Species (MIS)

Management indicator species (MIS) are wildlife species whose habitat is most likely to be affected by management practices, thereby serving as indicators of habitat quality. The Gallatin Forest Plan directs that habitat is provided for identified management indicator species and those native indigenous species that use special or unique habitats.

Five terrestrial species and wild trout are identified as MIS in the Gallatin National Forest Plan1987:II-19 (USDA 1987). The terrestrial MIS species are the grizzly bear, bald eagle, northern goshawk, pine marten, and elk. The aquatic MIS species are wild trout. Table 26 below displays presence of MIS species and their habitat in the project area.

Table 26-Presence of Management Indicator Species

Species	Habitat or Species Present in the Project Area	Summary Conclusion of Effects
Grizzly bear	Suitable habitat is present. Grizzly bears are noted infrequently, usually passing through in early spring after they have emerged from dens and are searching for food.	There is abundant habitat in the adjacent inventoried roadless areas, but grizzly presence is not being encouraged in the urban interface area along the heavily travelled East Boulder Road. Tthe project may affect, but is not likely to adversely affect the grizzly bear or its habitat.
Bald eagle	Marginal habitat is present. Bald eagles are irregularly seen north of the Forest boundary in East Boulder river drainage. They typically nest & forage along the Main Boulder River and the Yellowstone River.	There are no known bald eagle nests and eagles are not known to forage in the project area. Project related activity would not affect nesting or foraging habitat. Therefore this species will not be affected and will not be further discussed.
Elk	Elk use is not significant in the project area, but a few elk do use the area during summer, however, the project area does not provide winter range for elk.	Effects to elk would be minor and are discussed in detail in the big game analysis in this EA.
Northern Goshawk	Forest Plan indicator for dry Douglas fir old growth. Models revealed plentiful nesting and foraging/ PFA habitat with optimal characteristics. Conducted surveys detected goshawk presence during the breeding season (April-August) within the project area. No known nesting territories.	Forested stands that exhibited potential habitat would be treated. Habitat adjacent to proposed treatment units would not be affected where there is a diversity of Forest and grassland conditions. Snag and down woody material standards followed. Mitigation measures would protect goshawk spatially and temporally.
Pine Marten	Forest Plan indicator for moist spruce old growth. There is suitable habitat within the project area. This species is legally trapped per MFWP furbearer regulations.	Spruce, subalpine fir, Douglas fir, and lodgepole stands that exhibited potential habitat would be treated in both action alternatives. Snag and down woody material standards met. The project will maintain viable populations of marten on the Forest (USDA unpublished paper); the project is consistent with habitat suitability maintenance recommendations of Warren (1990:33); old growth is well distributed in the project area; and trapping mortality will not increase due to the project.

Species	Habitat or Species Present in the Project Area	Summary Conclusion of Effects
Wild Trout	Suitable habitat exists in the project area streams. Rainbow, brown, brook trout, and hybrid trout are present and reproducing in the East Boulder River and its tributaries.	Streams will be buffered and mitigation is in place to protect habitat. No effects to riparian integrity, channel or streambank stability, and aquatic habitat or biota are expected

The bald eagle was not analyzed in detail because it is not known to nest or forage in the analysis area and its habitat would not be affected by project related activities. No records exist of it occurring along the upper portions of the East Boulder River.

The grizzly bear was recently re-listed as a threatened species. Grizzly bears are not resident to the project area and are only known to occur occasionally as transients during spring snow melt. The effects to federally protected grizzly bear are discussed in the EA on pp. 138-143, in the specialist report, and in the biological assessment (Project File).

The Gallatin Forest Plan has designated elk as a MIS for big game habitat under the premise that by managing for productive elk habitat, the forest will be managed for most big game species. These species include elk, mountain goat, moose, bighorn sheep, and mule deer. Mule deer and moose are present in the project area year-round, occasionally elk are present in the project area in the summer months, and there is no bighorn sheep or mountain goat habitat in the project area. The project related effects to elk are discussed in the big game section pp. 180-193, and in the specialist report located in the Project File.

Wild trout include rainbow trout, brown trout, brook trout and hybrid trout, which are present and reproducing in the East Boulder and its tributaries. Proposed mitigation associated with the project would insure that there are no effects to riparian integrity, channel or streambank stability, and aquatic habitat or biota. Project design provides ample protections for populations of wild trout. Wild trout will not be discussed here, but are further addressed in the aquatics analysis pp. 106-116.

Migratory birds, although not considered to be MIS, are also used as an indicator group to measure effects on those habitats such as grassland, forested, and aspen habitats that are potentially impacted by vegetation treatment. Migratory birds are discussed in detail separately in this EA on pp.193-195.

Analyses of MIS species that could potentially be affected by project activities and are not addressed elsewhere in the EA (as noted above) are detailed below:

Northern Goshawk

Affected Environment

Goshawks use large landscapes, integrating a diversity of vegetation types over several spatial scales to meet their life-cycle needs (Squires and Kennedy 2006). Goshawks winter throughout their breeding range with a portion of the population wintering outside of regularly used areas (Brewer et al 2009:7-8). In the Northern Region, the goshawk breeds in mountainous or coniferous regions throughout western and southern Montana, as well as north and north central Idaho. Samson (2006:20-27) and USDA (2009) provide good summaries of the ecology, behavior, and habitat of the goshawk.

A systematic random survey in Region 1 in 2005 showed that the goshawk is relatively common and well-distributed in the Northern Region (Kowalski 2006:9). A region-wide conservation assessment for the northern goshawk was completed in 2006. According to Samson (2006:39-40), short-term viability of the goshawk in the Northern Region is not an issue. Bush and Lundberg (2008:4-6) looked at Forest Inventory Analysis (FIA) data and estimated that there is approximately 10,342 acres (0.9%) nesting habitat, 109,169 acres (9.5%) PFAs, and 311,419 acres (27.1%) foraging habitat on the Gallatin Forest. Brewer et al. (2009:24) summarized three broad level analyses for Region 1. The summary and key findings of these analyses that are pertinent to the East Boulder Fuels Reduction Project indicate that goshawk habitat is abundant and well-distributed in the more managed portions of National Forest lands; the level of timber harvest of the forested landscape in Region 1 is insignificant; forested habitat is more extensive, less fragmented than historical times, and continues to increase due to suppression of natural ecological processes (such as fire); and that habitat for maintaining viable populations is available in excess to that needed on each Forest in Region 1. In summary, the northern goshawk and its habitat appear abundant and well distributed across Region 1 of the Forest Service.

The Northern goshawk is ranked as a G5, S3 species by the MNHP which means that globally the species is widespread and abundant but not vulnerable, while in Montana it is at risk because of limited and potentially declining numbers, extent and/or habitat. This species was removed from the Regional Forester's sensitive species list in 2007 because (1) habitat exists to support reproductive individuals on each Forest; (2) habitat is well-distributed; and (3) individual goshawks can interact with one another across the Region, and therefore, does not meet the Forest Service Manual (2670.5) definition of a sensitive species (USDA 2007). The Gallatin Forest Plan lists the northern goshawk as the management indicator species (MIS) for dry Douglas-fir old growth habitats. However, there are no Forest Plan standards for the management of goshawk habitat. The status of goshawk on the Gallatin Forest was assessed in the Gallatin Forest Plan Management Indicator Species Assessment (USDA unpublished paper: 21). Based on this broad scale habitat analysis, there is more than enough suitable nesting habitat currently available on the Gallatin National Forest to support a viable population.

Effects Analysis

Methodology and Scale

Agency monitoring and surveying records were reviewed for any documentation of presence or potential for presence of goshawk. A literature review was conducted for

additional information on goshawk habitat use and possible impacts associated with timber harvest and other fuel reduction activities. The analysis area for goshawk includes both National Forest and private lands in the lower East Boulder drainage. It encompasses all proposed treatment units that may affect goshawk habitat and is large enough to provide habitat for approximately two home ranges. In 2009 and 2010, surveys were conducted using acoustical broadcast calling techniques developed by Kennedy and Stahlecker (1993). The surveys were conducted beginning in June thru early August when goshawks would be present, actively breeding, and/or nesting.

The Northern Goshawk Northern Region Overview (Brewer et al. 2009:4) suggests use of R1-VMap and inventory data to classify and assess goshawk habitat. This approach considers multiple analysis levels. The broad level analyses set the context at the Regional population level and the role the Gallatin Forest has in that Regional population, as well as addresses NFMA requirements. The smaller level analysis is appropriate for analyzing project level impacts and addresses NEPA requirements.

Suitable habitat was modeled using GIS tools based on R1-VMap. Nesting, post-fledgling, and foraging habitat was modeled. Queries for foraging habitat focused on a diversity of life forms and canopy covers to represent the heterogeneity of foraging areas and diversity of prey habitat requirements. Post-fledgling areas are also somewhat heterogeneous but some amount of mid to late seral forest with >50% canopy cover and structural diversity in the understory appear important. The nesting habitat relationship model (Brewer et al. 2009:10) describes nest area attributes for the Southern Rocky Mountain Province (which includes the Gallatin Forest) as Douglas fir, ponderosa pine, lodgepole pine, intolerant mix tree species with 40-100% canopy cover with one or two vertical stories and average (basal area weighted) diameter of >= 9 inches. Proposed fuel reduction treatment units and temporary roads were overlaid with these three levels of habitat to see if they would be impacted by any of the proposed activities.

Direct/Indirect/Cumulative Effects

Goshawks have been detected in the East Boulder drainage during individual survey efforts in 1996 and 2010. In 1996, one adult goshawk was observed in Lewis Gulch. Also in 1996 in a separate survey using play-back calls, a pair of adults was detected near the Green Mountain Trailhead. Survey efforts conducted in the Dry Fork of the East Boulder (outside the analysis area) in 2001 and 2003 did not detect any goshawk. In 2009, and 2010, surveys were conducted using acoustical broadcast calling technique developed by Kennedy and Stahlecker (1993). The surveys were conducted beginning in June thru early August when goshawks would be present, actively breeding and/or nesting. No goshawks were detected in 2009 but there was a detection the Green Mountain Trail area in 2010 based on an auditory response. There are no documented nest stands, historical or current, in the analysis area.

Goshawk home ranges consist of at least three levels of habitat during the breeding season – the nest area (stand), post-fledgling area (PFA), and some amount of general habitat used for foraging, with the diversity of forest vegetative composition, age and structure increasing beyond the nest area (Reynolds et al. 1992, Kennedy et al. 1994, McGrath et al. 2003, Squires and Kennedy 2006). Use of the overall home range during the nesting season is poorly understood (Squires and Kennedy 2006). However, habitat structure and prey abundance appear important in the selection of PFAs and nest areas in the home range.

Goshawks nest in a variety of forest types throughout their range (Squires and Reynolds 1997, Samson 2006, and Squires and Kennedy 2006). Clough (2000) found goshawks selected mature and older forests that were surrounded by a mix of younger forest and non-forested openings. No evidence exists that the goshawk is dependent on large, unbroken tracts of "old growth" or mature forest (USDI 1998) or specifically selects for "old growth" forest (McGrath et al. 2003). While the current knowledge of goshawk-habitat relationships does not allow for the use of late successional forest as a surrogate measure to infer goshawk status, population trend, or habitat quality with scientifically defensible data, goshawk use of other seral stages does not imply that late successional forests are not important factors (Anderson et al. 2003).

Generally, goshawk select nest stands in mature forest with large trees, relatively closed canopies (50-90%), and open understory. Average size of the nest area varies based on local habitat conditions and has been reported as ranging widely. For west central Montana, 40 acre nest stands were reported by Clough (2000). The nest area vegetation is described by a comparatively narrower range of structural characteristics compared to the PFA and foraging area.

The PFA surrounds the nest area and, based on studies of the family movement patterns, is defined as the area used by the family group from the time the young fledge until they are no longer dependent on the adults for food (Reynolds et al. 1992, Kennedy et al. 1994). Studies that corroborate the existence of a PFA, characterize potential or known function and habitat characteristics were summarized in Squires and Kennedy (2006) and include: 1) the PFA may represent the defended portion of the home range, 2) the PFA may serve as an area where young birds develop flying and hunting skills as well as protection/cover from predators, 3) the size, shape, habitat composition, and functional importance of the PFA may vary with local conditions, 4) the area of continuous, non-fragmented forest in the PFA that surrounds the nest varies as indicated by several research findings in different parts of the country, 5) structural components, late-seral forest, >50% canopy cover, and structural diversity in the understory appear to be important at the PFA scale.

At the foraging area scale, some studies have suggested that goshawks need a narrow range of habitat conditions, similar to those found in the nest area (Beier and Drennan 1997, Finn et al. 2002). However, a larger number of studies have reported that goshawks use a broad-range of habitat conditions in the foraging area (Reynolds et al. 1992, Hargis et al. 1994, Beier and Drennan 1997). Goshawks have been reported hunting along edges of forest/riparian, forest/clearcut, and forest/grassland-sage; in nonforested openings a long distance from cover; in dense, closed-canopy forest; and in open-canopied forest. Prey items are taken on the ground, on vegetation, in the air, and include tree squirrels, ground squirrels, rabbits, hares, songbirds, woodpeckers, and grouse species that rely on a variety of forested and non-forested habitats (Squires and Reynolds 1997; Squires and Kennedy 2006). Snowshoe hares, red squirrels, and ground squirrels are also used extensively (Clough 2000, Patla 1997:66).

Potential habitat was modeled from the R1-VMap through a geospatial interface (GI) tool (Brewer et al. 2009:30-38). The GI tool derives habitat estimates for those life forms and size classes that best describe goshawk habitat potential. This modeling effort indicated that there is approximately 9,864 acres of foraging habitat and/or PFAs across the analysis area. Table 27 displays vegetation composition of PFAs in the East Boulder

project area in comparison to the nearest geographic areas (Patla 1997 and Clough 2000) and with desired forest conditions from Reynolds et al. (1992).

Table 27- PFA/ Foraging Vegetation Diversity Matrix Comparisons Pre-Treatment

Size Class	Acres w/in East Boulder Analysis Area	% w/in East Boulder Analysis Area	Patla (1997) Southeast Idaho/ Western Wyoming (%)	Clough (2000) West-central Montana (%)	Reynolds et al. (1992) Southwestern United States (%)
Shrub and Herb	624	6.3	11.0	7.3	10
Tree 0-4.9	472	4.8	17.0	9.3	10
Tree 5-9.9	2516	25.5	6.0	65.7	20 [5-12”dbh]
Tree > 10 inches	6252	63.4	66.0	11.3	60 [>12”dbh]
Total	9,864				
Tree canopy > 40% and tree size > 5”	6386	73.0	-	69.0 [>50%]	60 [>12”dbh and >50%]

As compared to the actual research conducted by Patla (1997) and Clough (2000), the East Boulder analysis area has similar habitat features to support the breeding life cycle of goshawk with some variations appearing between classes by geographic areas. The potential foraging/ PFA habitat within the East Boulder analysis area is similar to what Reynolds et al. (1992) recommends for both foraging and PFAs. The shrub/ herb class and tree size class 0-4.9” is slightly lower than recommended and the tree size class of 5-9.9” is higher than recommended. Also, the percentage of forested areas with canopy cover of >40% with trees >5” is higher than recommended.

The GI tool can also determine potential goshawk nest stands within an analysis area. There are approximately 2,578 acres that have vegetation attributes that best represent nesting habitat and are configured in stands totaling more than 40 acres. These thirteen stands range from 40-736 acres each. Reynolds et al. (1992) recommended six 30-acre nest areas (3 suitable and 3 replacements) per 5,000 acre foraging home range. Clough (2000) found nest areas averaged 40 acres in size. Based on Brewer et al (2009), the East Boulder analysis area needs six 40-acre+ nest stands per home range or a total of 480 acres. With 13 nest stands totaling 2,578 acres, the number and size of nest areas within the East Boulder analysis area exceeds these recommendations.

Alternative 1 (No Action) would have no direct impacts on goshawk. Direct effects include such human caused mortality risks as shooting, trapping, poisoning, or collisions with motor vehicles. Naturally cased mortality risks include weather, starvation, disease, and predation, with weather being the biggest factor affecting egg and nestling survival (Brewer et al. 2009:16). These mortality risks (with the exception of predation discussed below) are independent of the treatment of vegetation to reduce fuels.

Indirect effects may occur over time due to continued forest succession and fire suppression. Lack of disturbance, such as fire, can result in increased densities of trees rendering habitats unsuitable for nesting and foraging goshawks, as well as some prey species (Reynolds et al. 1992 and Squires and Kennedy 2006). Goshawks and goshawk prey species evolved with varying intensities of wildfire. With Alternative 1, the existing vegetation diversity matrix would continue to persist in the short term but the amount of shrub/ herb class may decrease over time. The amount of 5-9.9" tree class would continue to increase as trees grow until trees move into the >10" tree class. Subsequently, the structural class of >5" trees with >40% canopy cover would also continue to increase. Clough (2000) found goshawks selected for nest stands that were surrounded by a mix of younger forest and non-forested openings. Generally, goshawk foraging areas are heterogeneous, which provides greater alternate prey availability and reflects their opportunistic, generalist diet. Therefore, continued forest succession may create conditions that are less desirable for goshawk in terms of foraging and post-fledgling in the long-term.

Similar to Alternative 1, the implementation of either Alternative 2 or 3 would have little, if any, direct affect on goshawks. Fragmentation of nest stands, which could lead to predation on goshawk nestlings, is not a concern because the size of the individual nest stands is well over 40 acres and the total amount of nesting habitat is not limiting. Mortality risks are not expected to increase with the fuel reduction activity, particularly with the mitigation in place to protect active nest stands and disturbance within PFAs (see below).

Indirect effects from the proposed fuel reduction treatments associated with Alternatives 2 & 3 could occur to both nesting and foraging habitat. Removing nest trees, modifying or removing entire nest stands, and removing canopy, mature trees, snags, and downed wood can reduce the quality and quantity of nesting and foraging habitat (summarized in Squires and Kennedy 2006). Various research studies have shown both positive and negative effects relative to modification of nesting areas from timber harvest and goshawk occupancy and production. Moser and Garton (2009) found that goshawks reoccupied breeding areas that were altered by timber harvest and goshawk nesting success and number of fledglings produced in subsequent years was not affected by timber harvesting. This contradicted findings of Crocker-Bedford (1990) and Patla (2005), who found that goshawks in breeding areas subjected to some type of timber harvest exhibited lower re-occupancy and productivity rates.

The analyses of indirect effects for Alternatives 2 and 3 were conducted following Brewer et al. (2009) project analysis process. Prescriptions for commercial timber harvest were reviewed. The commercial timber harvest overlaps foraging/ PFA habitat in every single proposed unit; units 1, 3, 5, 5a, 7, 7a, 9, 9a, 10, 11, 12, 13, 14, 16, 17, 18 (Alternative 2) plus 19, 21, 22, 22a, 23 (Alternative 3) would receive a thinning treatment to reduce overstory canopy cover. Leave trees and leave clumps are defined. Treatment of the over-stocked coniferous trees through small tree hand thinning that overlaps foraging/ PFA habitat in Units 2, 3a, 4, 6, 7b, 8, 8a, 11a, and 12a to reduce fuels may benefit goshawk in the long-term. Reynolds et al. (1992) and Graham et al. (1999) suggested that thinning may improve habitat for goshawks by creating favorable conditions for goshawks and their prey by promoting diameter growth in overstory trees; creating an open understory, downed wood, and snags; and stimulating grass/forb/shrub growth. With Alternative 2 or 3, the understory tree canopy would be reduced thus

increasing prey base and associated foraging habitat. Outside of these hand treatment units, the foraging/ PFA habitat would continue to reflect mid to late seral forest with >50% canopy cover and structural diversity in the understory that are reported as important (Finn et al. 2002, McGrath et al. 2003, Samson 2006, and Squires and Kennedy 2006). The overstory would not be affected so there is little to no effect to nesting habitat by hand thinning. Forest Plan standards for snags and down woody material would be met in hand treatment units and in commercial harvest units in both Alternative 2 and 3 providing adequate habitat for prey species.

As displayed in Table 27 above, the foraging/ PFA habitat was modeled, quantified, and compared to recommended conditions. Nesting habitat was also modeled and quantified. A PFA analysis was not conducted since there are no known or recently occupied nests in the analysis area.

The East Boulder analysis area appears to provide the vegetative diversity comparable to that found in similar geographic regions. The change in acres post-treatment for each of the vegetation attributes representing potential goshawk habitat was roughly estimated and is displayed in Table 28 below. It was assumed that the total amount of foraging/ PFA habitat would still be available although the vegetative composition of each structural class would shift post-treatment. There may be slight changes in each class depending on the individual unit prescription. For example, if the prescription calls for thinning of Douglas fir trees >7" dbh to 30-35 feet between tree boles, a stand classified as having existing vegetation of trees over 10" may move toward the 5-9.9" class. Similarly, with the small tree thinning hand treatment, the 0-4.9" class may in turn shift toward the 5-9.9" class. There are no prescriptions for clearcutting so no acres would move to the shrub/ herb layer. The class with canopy cover >40% and >=5" trees would change substantially where commercial harvest would occur but not as much within small tree thinning (hand treatment). In the commercial harvest thinning units, the prescription is written to meet the purpose and need for fuel reduction; canopy cover would decrease and average tree size may decrease (although probably not below 5"). Removal of both understory (hand treatment) and overstory (commercial harvest) may provide a more open understory where shrubs and herbs may increase due to additional sunlight and lack of competition.

Additional modeling was not conducted because the amount of acres affected would not substantially change the overall percentages of each structural class to a range that is outside that reported by research (Patla 1997, Clough 2000, Reynolds et al. 1992). For example, the structural class predicted to change the most (tree canopy >40% and tree size >5") is approximately 73% of the foraging/ PFA potential habitat. Reported recommendations for this structural class are 69% (Clough 2000) and 60% (Reynolds et al. 1992). Treatment of this class by 449 acres (Alternative 2) or 622 acres (Alternative 3) as displayed in Table 28 below, would decrease it to an estimated 66%.

Table 28-. PFA/ Foraging Habitat Diversity Matrix Post Treatment

Size Class	Estimated Shift in Structural Class with Commercial Harvest Rx	Estimated Shift in Structural Class with Hand Treatment Rx	Alternative 2 Treatment Unit intersected with Class (acres)	Alternative 3 Treatment Unit intersected with Class (acres)
Shrub and Herb	No change anticipated	No change anticipated	(57)	(59)
Tree 0-4.9	Slight Increase; no change overall	Slight Decrease; no change overall	12	22
Tree 5-9.9	Both - decrease from direct treatment, increase due to treatment of >10" size class. Increase overall.	No change or slightly increase	224	251
Tree > 10 inches	Decrease	No change or slightly increase	334	512
Total	9,864			
Tree canopy > 40% and tree size > 5"	Decrease	Canopy cover decrease, tree size increase	449	622

Indirect effects on nesting habitat were displayed spatially and quantified where potential goshawk nesting habitat intersected a proposed treatment unit. The commercial timber harvest overlaps nesting habitat in Units 1, 3, 9a, 10, 11, 12, 13, 14, 16, 17, 18 (Alternative 2) plus 21, 22a, 23 (Alternative 3). Treatment through small tree hand thinning overlaps nesting habitat in Units 6, 11a, and 12a. Table 29 below displays the number of acres of potential nesting habitat associated with each Alternative.

Table 29-Acres of Potential Goshawk Nesting Habitat within Treatment Units

Alternative	Commercial Harvest Units (acres)	Hand Treatment (acres)	Total Acres by Alternative	% of Total Nesting Habitat	Estimated Remaining Nesting Habitat (acres in >40 acre stands)
2	76	28	104	4%	2,264
3	176	28	204	8%	2,364

Under Alternative 2, approximately 104 acres of potential nesting habitat would be impacted. This is approximately 4% of the total potential nesting habitat within the analysis area. Alternative 3 would have similar effects but would impact a larger number of acres. Approximately 204 acres would be treated through either commercial timber harvest (176 acres) or hand treatment (28 acres), which is approximately 8% of

the total potential nesting habitat. As discussed above, there is approximately 2,578 acres that have vegetation attributes that best represent nesting habitat and are configured in stands totaling more than 40 acres. Brewer et al. (2009) recommends maintaining at least 240 acres (six 40 acre stands) of nesting habitat per 5000 acre foraging area (one home range) in stands at least 40 acres. The East Boulder analysis area is approximately the size of two home ranges so at least 480 acres of nesting habitat should be maintained. After treatment of Alternative 2 or 3, there would be well over 2,000 acres of nesting habitat remaining in stands >40 acres. Additionally, the nest stands are so large that fragmentation causing increased predation or competition is not a concern where treatment occurs within modeled habitat.

As disclosed above, there are no known nests within the East Boulder analysis area. However, detections have been reported in 1996 and 2010. Mitigation would require ongoing surveys to be conducted within the treatment units and near detections during project implementation. If any active nest stands are located, a minimum 40 acre buffer of no activity would maintain the existing conditions of the nest stand. In addition, because human disturbance near nests can cause nest failure, timing restrictions would apply to the hand treatment activity within the area representing the PFA around an active nest site from April 15-August 15 to protect the goshawk pair and young from disturbance during the breeding season until fledglings are capable of sustained flight. After August 15, treatment related activities may commence within the PFA, but outside the nest area, unless site-specific monitoring supports earlier entry. Commercial harvest would mostly take place during the winter so there would be no or minimal disturbance during the nesting period.

Conclusions

The East Boulder fuel reduction project (Alternatives 2 & 3) is unlikely to impact individual goshawks but would impact goshawk habitat. The proposed treatments are not expected to contribute to a loss of viability because actively nesting goshawks would be adequately protected through activity timing restrictions, occupied nest areas will not be treated, PFA and foraging area habitat are consistent with recommendations and/or actual research relevant to the analysis area, adequate nesting habitat will remain in the analysis area to support the breeding pairs, and habitat Forest-wide is abundant and widely distributed.

Samson (2006) and Bush and Lundberg (2008) recently conducted a region-wide conservation assessment for the northern goshawk. They concluded that viability of the goshawk in the Northern Region is not an issue. Brewer et al. (2009:25-27) reported this as a summary and key findings in their over view of the Northern goshawk in Region 1. This was further confirmed by Gallatin Forest Plan Management Indicator Species Assessment (USDA unpublished paper:20) which summarized survey data and habitat threshold models specifically for the Gallatin Forest. It also determined that project level management activities are relatively inconsequential compared to natural events that have or could affect goshawk habitat.

Cumulative effects of the proposed fuel reduction treatments with past, present, and other reasonably foreseeable activities were considered for the goshawk and the amount and suitability of goshawk nesting and foraging habitat. The primary influences on the amount, distribution and suitability of goshawk habitat are management treatments in forest vegetation (thinning or other timber harvest) and stand-replacing wildfires

(Squires and Ruggiero 2006). Approximately 943 acres of vegetation treatments have occurred in the East Boulder analysis area in the past 30 years. Regeneration within these harvested areas has contributed to the heterogeneity preferred by goshawk. According to the analysis conducted for this project using existing vegetation from VMap, existing canopy covers are consistent with vegetation diversity matrices where goshawks would nest and forage.

The current mountain pine beetle outbreak within the Northern Region, and the associated tree mortality, pose uncertain risks to goshawk populations as a function of habitat change and loss. It is not known how this ongoing natural disturbance will ultimately affect wildlife. The mortality of lodgepole pine will increase snag availability. Spruce, subalpine fir, and Douglas fir would continue to function under forest succession pathways. Large wildfires have occurred in the surrounding landscape; these have not been within the direct/ indirect or cumulative effects analysis area for goshawk. As discussed under Alternative 1 (No Action), ongoing fire suppression has created high tree densities and altered understory vegetation, degrading goshawk habitat.

Pine Marten

Affected Environment

The pine marten is the Forest Plan indicator for moist spruce old growth and is known to prefer structurally complex conifer forests. Martens are closely associated with late successional stands with complex physical structure near the ground (Buskirk and Ruggiero 1994:7). According to Coffin et al. (2002:14), stumps and downed logs are critical components as marten prefer sites with easy access through winter snow cover. Thompson (1994:278) found evidence that logged forests were poor habitat only used by dispersing juveniles and that these logged areas had a low population index.

However, Baker (1991:5) studied habitat use by marten in a study area that was partially logged with a mosaic of seral stages, including old growth patches. She found home ranges to be comprised of second growth and regenerating stands and suggested that use of second growth forest stands is higher than previously found. This may be due to the amount of stumps, debris piles, and root wads that provided habitat for prey species. Coffin et al. (2002:14) found that marten were not climax forest obligates but did select for high canopy cover, large live trees, abundant deadfall, and well-developed ground vegetation. Raphael and Jones (1991:68) also found that marten will use fragmented habitat but that this use of recently cutover forest was small in comparison to mature, uncut forest. In summary, while martens may use logged areas to some degree, they prefer mature to old growth forests with well developed vegetation because these habitats produce large amounts of coarse woody debris, which provide subnivean cover, security from other predators, and habitat for prey species.

Foraging sites are generally dominated by spruce and subalpine fir with large-diameter deadfall and ground cover that supports red squirrels, mice and voles. Thompson and Colgan (1994:286) studied marten activity in logged and uncut forests and determined that there were greater prey encounter and capture rates in uncut forests. In logged forests, marten consistently hunted in small residual patches of uncut conifers and they concluded that logged forests were suboptimal habitat for marten.

Denning habitat is essential to successful recruitment and persistent populations. A variety of structures are used for dens including trees, logs, rocks, or other large structures characteristic of late successional forests (Buskirk and Ruggiero 1994:17). Ruggiero et al. (1998:670-671) reported use of snags, logs from old cabin remains, or large slash adjacent to logged units for natal and maternal dens. They recommended that den sites for reproduction (natal and maternal dens) be differentiated from den sites used for resting but that all are characterized by attributes of late successional forests such as large logs, and medium and large snags.

Natal and maternal dens play a critical role in marten recruitment. Resting sites allow martens to rest, reduce their exposure to adverse weather and predators, and ideally are scattered throughout the home range near primary foraging patches to minimize travel. Relative to resting sites, Spencer (1987:617-620) documented selection and use of snags, stumps, and logs important for non-subnivean and subnivean rest sites; live trees were not used for subnivean rest sites. Subnivean rest sites are important for winter thermal cover and protection from predators. Coarse woody debris, particularly in spruce-fir stands, and its size, shape, physical properties, and position in relation to the snow surface was found to play a critical role in forming winter resting sites (Buskirk et al. 1989).

Home range sizes are very variable, particularly among males and may range from approximately 494-16,327 acres (Coffin et. al. 2002:5-6); 198-3,878 acres (Buskirk and Ruggiero 1994:27); 146-6,793 acres (Buskirk and McDonald 1989:999-1000); 568-1,186 acres (Baker 1991:5); or 1,988-3,880 (Raphael and Jones 1991:68). Home range size was about three times that predicted on the basis of body mass for terrestrial carnivores like the pine marten (Buskirk and McDonald 1989:1002). This variability has been explained as a function of prey abundance, prey availability, site quality, and habitat type (Coffin et al. 2002:6, Buskirk and Ruggiero 1989:27). Powell (1991:64) further explained the variation to be due in part to different research methods and hypothesized that female home range size is dependent on food abundance while male home range size is dependent on spacing of females.

Effects Analysis

Methodology and Scale

Agency monitoring and surveying records were reviewed for any documentation of presence or potential for presence of pine marten. MFWP Trapping and Harvest Reports were consulted. A literature review was conducted for additional information on pine marten habitat use and possible impacts associated with timber harvest and other fuel reduction activities. Suitable habitat was modeled using GIS tools based on photo-interpretation (PI) strata from TSMRS. Queries focused on mature and old growth forest types of spruce, subalpine fir, Douglas fir, lodgepole pine, and mixed conifer at elevations above 6,000 feet in elevation – and northerly aspects. Proposed fuel reduction treatment units and temporary roads were overlaid to see if any of the activities would directly impact habitat. The analysis area for direct and indirect effects is the same as for flammulated owl, Northern goshawk, and wolverine. The cumulative effects analysis area is defined by the 6th Code HUC watershed boundary which represents the variation of home range size among pine marten.

Direct/Indirect/Cumulative Effects

There is suitable habitat for foraging and denning within the analysis area. The occurrence of down woody material varies across the project area, ranging from vary sparse coverage with little more than duff and vegetation on the forest floor, to heavy pockets of blow down. Most proposed fuel reduction treatment units have at least light to moderate levels of down woody debris component. Downed woody materials are not limited in the project vicinity although some units are more depauperate than others due to even-aged (mostly lodgepole) and very dense overstory. Modeling for preferred habitat consisting of only spruce and subalpine fir forests indicated there was approximately 494 acres available in the lower East Boulder direct and indirect analysis area and approximately 905 additional acres available (total 1,399 acres) in the 6th code HUC watershed (cumulative effects analysis area).

Further modeling for potential suitable habitat including Douglas fir, lodgepole, and mixed Douglas fir/ lodgepole on northerly aspects revealed an additional 2,021 acres and 760 acres available in the direct/ indirect and cumulative effects analysis areas respectively (total 2,781 acres). The preferred and suitable habitats together offer approximately 2,515 acres in the direct/ indirect effects analysis area and approximately 4,180 acres in the cumulative effects analysis area. However, modeled habitat patches do not appear to be contiguous but exist in clumped patterns across the landscape, particularly in the higher elevation cumulative effects analysis area. While the larger area encompassed by the 6th code HUC watershed boundary provides an opportunity to consider cumulative effects, it may not contribute to adequate juxtaposition of habitat values to be viable home ranges. This is inherent in the pattern of forest types in the upper East Boulder drainage mostly untouched by human disturbances.

Based on the extremes of home range variation indicated above, the direct/ indirect analysis area could support from 0.2 to 17 home ranges for pine marten. However, Warren (1990:32) reported that a minimum habitat area required before an area will be occupied by resident reproductive marten in the northern Rocky Mountains is 1,920 acres. Using this figure, the estimate for number of home ranges within the direct/ indirect effects analysis area would approximate 1.3 home ranges.

Local knowledge indicates that the better marten habitat in the drainage exists at higher elevation, alongside drainages where sub-alpine fur and spruce dominate the canopy (Paugh, personal communication). Paugh, MFWP Area #5 biologist, trapped one marten in 2008 within the direct/ indirect analysis area. He also referenced another trapper who caught marten periodically over the years and thinks that there is considerably better habitat higher in elevation above proposed treatment units. This is consistent with the arrangement of modeled marten habitat and the proposed fuel reduction treatment units in the direct/ indirect effects analysis area.

Marten are managed as a furbearer species by the State of Montana Fish, Wildlife, and Parks. Furbearer trapping season dates for District 5, which includes the project area, are December 1 to February 15. There is no limit on the number of marten that may be taken. According to the furbearer trapping and harvest reports from 1996-2006 (no report for 2004 or since 2006), there were no marten reportedly taken in Sweetgrass County (http://fwp.mt.gov/hunting/planahunt/ harvestreports.html#furbearer). No Furbearer Trapping and Harvest Reports have been published since 2006. However, according to the Gallatin Forest Plan Management Indicator Species Assessment (USDA

unpublished paper:21), data received from MFWP indicate that since 2006, the statewide marten harvest continues to remain relatively stable and that pine marten population trends on the Gallatin appear to parallel statewide trends. Trapping is a mortality variable that may play a role in population trends but is dependent on pelt prices, proper reporting, accessibility, and overall trapping pressure. Therefore, populations trends are not necessarily a function of habitat; quantity and distribution of habitat across the Gallatin as a whole does not appear to be the limiting factor (USDA, unpublished paper:23). It also determined that project level management activities are relatively inconsequential Bush and Lundberg (2008:11) looked at Forest Inventory Analysis (FIA) data and estimated that there is approximately 33.5% or 384,965 acres of pine marten habitat on the Gallatin Forest. There is no global, state, or agency ranking that indicates a concern for the viability of this species.

Conclusions

No direct effects on the pine marten are anticipated under any of the alternatives. Open road density would not be increased by treatment activities; therefore trapper access would not increase. Temporary roads will not be open to the public and will be effectively closed and revegetated after their use per the Gallatin Travel Plan programmatic management direction (USDA 2006:I-11).

Alternative 1 would have no indirect effects as no treatment would occur. Indirect effects to denning and foraging habitat would occur with Alternative 2 and 3 from the removal of overstory and understory trees that could eventually contribute to coarse woody debris, a habitat component important to martens for den sites and prey habitat. Maintaining woody structure provides access beneath the snow, as well as habitat for prey species. Intersection of proposed fuel reduction units and potential pine marten habitat indicate that approximately 249 and 366 acres would be impacted with Alternative 2 and 3 respectively in the direct and indirect effects analysis area. No additional acres would be impacted in the cumulative effects analysis area.

Fuel reduction treatments may increase populations of some small mammal species, especially deer mice, and thus increase foraging opportunities. However, these species are not important prey for martens (Buskirk and Ruggiero 1994:21). Martin and Barrett (1991:56) found that voles were utilized more than expected and specifically sought out, while deer mice were utilized less than expected, even when deer mice were available in forested habitat.

There may be some effect to individual home ranges, but this is expected to be minor. Using Warren's (1990:32) minimum habitat area of 1,920 acres, 13-19% of a home range may be affected. Recommendations for evaluating habitat suitability of pine marten and marten prey suggest maintaining 50% of marten home ranges in mature and old growth (Warren 1990:33). The fuel reduction treatments will reduce available snags, downed woody debris and overhead cover for marten. However, the analysis area meets recommendations of Warren (1990:33) post treatment. Approximately 2,515 acres or 100% (Alternative 1); 2,266 acres or 90% (Alternative 2); and 2,149 or 85% (Alternative 3) will remain in mature to old growth, preferred and/or suitable habitat after fuel reduction treatments.

Forest Plan standards for snag and down woody debris management would be met under both the action alternatives. There would be 10-15 tons per acre of woody material 3"

and greater left on the ground after treatment. In the short-term all units would continue to meet the Forest Plan standards for snags and down woody debris. Burned areas, insect infestations and natural forest succession will continue to provide forest structure that eventually produce snags and down woody material.

None of the alternatives would result in adverse modification of pine marten or its associated habitat. The proposed fuel reduction treatments will maintain viable populations of marten on the Forest because the project is consistent with Forest Plan standards for snag and down woody debris; habitat suitability maintenance recommendations of Warren (1990:33); and trapping mortality will not increase due to the project. The Gallatin Forest Plan Management Indicator Species Assessment (USDA unpublished paper:23) concluded that pine marten populations will continue to follow statewide trends as influenced by furbearer management with well-distributed, plentiful habitat available across the Gallatin National Forest.

Cumulative effects of the proposed fuel reduction treatments with past, present, and other reasonably foreseeable activities on the pine marten or its habitat are minor. Recreational hunting and trapping will continue to occur. This project would not increase access to trapping and would not increase road densities long term. Past timber harvest has impacted pine marten in the past through uneven aged logging and permanent clearing of 943 acres for timber harvest and powerline service. Regeneration is occurring in these units and now provide seedling to pole sized cover and foraging habitat. The remainder of the cumulative effects analysis area is mostly roadless or wilderness and provides undisturbed habitat.

Compliance with Laws, Regulations, and Forest Plan direction for Sensitive/MIS Species

The National Forest Management Act (NFMA) of 1976 requires that the US Forest Service maintain sufficient habitat to sustain viable populations of existing native and desired non-native vertebrate species. While the proposed fuel reduction treatments could impact habitat components to some degree, the amount of habitat affected is relatively small. Habitat for the Northern goshawk and pine marten is present and well distributed on the Gallatin National Forest. Project activities are relatively inconsequential in terms of maintaining a viable population (USDA unpublished paper).

There are currently 11 terrestrial species identified as "Sensitive" that are known or suspected to occur on the Gallatin National Forest (USFS 2011). A “no impact” determination was given for bald eagle, peregrine falcon, trumpeter swan, harlequin duck, Townsend’s big-eared bat, bighorn sheep, black-backed woodpecker, or wolverine. It was determined that the proposed East Boulder Fuel Reduction project “may impact individuals or habitat” for flammulated owl, long-eared myotis, and long-legged myotis. All of the alternatives would maintain sufficient habitat to sustain viable populations of native species.

The National Environmental Policy Act (NEPA) of 1969 requires an assessment of the impacts of human activities upon the environment. All of the alternatives comply with NEPA.

Forest Service Manual (FSM 2670) provides policy under which Forest Service projects are designed to maintain viable populations of sensitive species. Sensitive

species are those animal and plant species identified by the Regional Forester for which population viability is a concern as evidenced by a significant current or predicted downward trend in population numbers, density, or in habitat capability that will reduce a species' existing distribution (FSM 2670.5.19). Protection of sensitive species and their habitats is a response to the mandate of the National Forest Management Act (NFMA) to maintain viable populations of all native and desired non-native vertebrate species (36 CFR 219.19). All of the alternatives comply with FSM2670.

Migratory Bird Treaty Act (16 USC 703-712) and Presidential Executive Order: Potential effects of the project were evaluated in a separate report which focused on migratory birds. The proposed action would be in compliance with applicable direction.

Gallatin Forest Plan – General Direction Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.7 – Standards for snag and down woody material will be utilized. Snag habitat needs were considered for flammulated owl, long-eared myotis, long-legged myotis, northern goshawk, and pine marten. Forest Plan standards for snag and down woody debris management would be met under both the action alternatives. Snag habitat would remain well distributed across the landscape within all forest types.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.8 – Emphasis will be given to the management of special and unique wildlife habitats such as wallows, licks, talus, cliffs, caves, and riparian areas. Mitigation would protect key components such as moist areas and riparian areas. The proposed fuel reduction treatments would not impact cliffs, caves, talus slopes, or other unique habitats. None of the alternatives would result in adverse modification of big game or its associated habitat.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.12 – Habitat that is essential for species identified in the Sensitive species list developed for the Northern Region will be managed to maintain these species. Sensitive species were addressed as part of the analysis for proposed fuel reduction treatments in the East Boulder project area. All terrestrial sensitive species were dismissed or analyzed in detail. Mitigation measures were identified as appropriate.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.13 – Indicator species will be monitored. Indicator species (bald eagle, Northern goshawk, and pine marten) were identified and addressed as part of the analysis for proposed vegetation treatment in the East Boulder project area. Mitigation measures were identified as appropriate. Grizzly bear and elk were analyzed in separate reports.

Gallatin Forest Plan – Management Area Direction:-The East Boulder project area proposed vegetation units are all located within Forest Plan Management Area (MA) 8 (timber management), MA 11 (big game habitat) and very small amounts of MA 12 (summer and winter wildlife) and MA 3 (non-forested areas). Standards relative to wildlife within MA 8 include incorporating considerations for wildlife in project plans. Detailed analysis was completed to identify and mitigate for any adverse affects. Standards relative to wildlife within MA 11 were addressed in the big game specialist report. MA 12 and 3 have no specific management direction for wildlife that pertains to the proposed East Boulder fuel reduction activities.

The Gallatin Travel Plan provided programmatic management direction for all transportation, including roads necessary for project implementation (USDA 2006).

There are no applicable **Gallatin Travel Plan** standards for wildlife. Any new or reconditioned roads would follow the programmatic direction in the Gallatin Travel Plan. Long term, roads would be permanently and effectively closed and revegetated; open road densities would remain the same. From a wildlife perspective, the project would be consistent with our Travel Plan direction.

n. Big Game

Fuel reduction treatments such as mechanical thinning can alter big game habitat by reducing cover, affecting quantity and quality of forage production, and consequently influencing the proportion and juxtaposition of cover and forage within a project area. Habitat alterations associated with fuel reduction projects could influence predator-prey relationships through various mechanisms, including hunter access. Increased human presence and noise associated with proposed actions can cause disturbance and/or displacement of big game animals. Combined effects of habitat alterations and disturbance factors could ultimately affect big game distribution patterns within and near the project area.

Affected Environment

Moose and mule deer use the project area year round, although deer are typically found at higher elevations during the summer months (Paugh, personal communication 2009). The East Boulder River corridor and associated tributaries (specifically Twin Creek, Wright Gulch, and Lewis Gulch) contain important winter range for mule deer and moose. About 100 mule deer and a few moose consistently winter within the project area. Mule deer utilize areas along streams with dense canopy cover to escape deep snow conditions. Forest canopy cover in these areas intercepts snow, and provides protection from wind and sun, which can reduce snow crusting, and make movement less difficult. These features create an environment where deer can move around more easily, and find suitable bedding and loafing areas, thus reducing energy costs. Forest structure along Twin Creek, Wright Gulch and Lewis Gulch, particularly the lower reaches near the confluence with East Boulder River provide winter travel corridors and resting areas for deer, while the river bottom produces good browse material for winter forage. Higher elevation areas along these tributaries accumulate more snow and are not used as much by wintering deer. There is also suitable winter range for deer northwest of the project, in the Green Mountain area (Paugh, personal communication 2009). Although there is some winter range on these lower elevation National Forest lands (below 6,000 feet elevation), most winter range is on low elevation private lands (Paugh, office memorandum 2010b). A few moose occupy the project area year round. They forage mainly on browse and perhaps some aquatic vegetation in summer, and use forested areas for thermal regulation. Moose winter in the project area and are better able to deal with deep snow conditions than deer. Browse provides winter forage for moose.

The project area does not provide winter range for elk, but a few elk do use the area during summer. Elk use in the larger vicinity is concentrated in the Main Boulder, West Boulder and Elk Creek drainages which basically defines HD 560. Mid-winter flights do not record population numbers for the East Boulder project area because elk do not spend the winter in this area.

The status of elk on the Gallatin Forest was assessed in the Gallatin Forest Plan Management Indicator Species Assessment (USDA unpublished paper: 5-16). It indicated that many elk population levels are increasing and above state population objectives on the Gallatin National Forest. Habitat on the Gallatin National Forest includes many areas with high security (low road density) and abundant hiding cover. The recovery of hiding cover from past clearcut timber harvesting, and the recent travel management plan decision has improved habitat quality for elk on the Gallatin National Forest. Therefore, these populations are influenced by multiple variables, but generally not by a lack of habitat quantity or quality.

Effects Analysis

Methodology and Scale

For this analysis, both hiding and thermal cover were evaluated by assessing structural characteristics of forested habitats, including successional stage, dominant tree species, and canopy cover. The Forest Plan (Amendment No. 14) further defines 'hiding cover' as *"Vegetation capable of concealing 90 percent of a standing adult big game animal from the view of a human at a distance equal to or less than 200 feet; generally, any vegetation used by big game for security or escape from danger. Hiding cover is a site-specific component of security."* This definition is consistent with Black et al. (1976:19) who found that in the Blue Mountains, elk hiding cover requirements are met, they will be exceeded for deer as deer are much smaller.

Thermal cover is a habitat component that provides structure necessary to ameliorate effects of ambient temperature on big game species, thus reducing the amount of energy expenditure required for thermoregulation. Thermal cover requirements vary by season, with warmer, drier aspects typically selected for winter thermal needs, and cooler, moister types serving as summer thermal cover. The Forest Plan (Amendment No. 14) defines thermal cover as *"Cover used by animals to ameliorate chilling effects of weather; for elk and grizzly bear, a stand of coniferous trees 40 feet or taller with an average crown closure of 70 percent or more. For deer, thermal cover may also include saplings, shrubs, or trees at least 5 feet tall with a 75 percent crown closure. In some cases, topography and vegetation less than specified may meet animal needs for thermal regulation."* This definition is also consistent with Black et al. (1976:19) who found that deer use small conifers and shrubs on winter range so there is a wider range of conditions that provide thermal cover for deer relative to elk. Therefore, thermal cover was modeled using the definition for elk (and grizzly bear) based on Black et al. (1976:19) who state that "if optimal thermal cover requirements for elk are provided, the requirements for deer are more than adequately met".

Field site visits were made to proposed treatment units in 2009 and 2010 to collect data and evaluate existing conditions. During these visits, presence of big game species was recorded based on sightings, scat, and track detections. Vegetative conditions were evaluated for cover and forage availability. Habitat components located in the field were documented and mapped. Hiding cover assessment field surveys using protocols described in literature (Lyon and Marcum 1986, and Smith and Long 1987) and outlined in detail in the Gallatin National Forest Plan Hiding Cover Assessment (USDA unpublished paper) were conducted in the project area and are located in the Project File. Sample points were selected in or adjacent to proposed treatment areas in proportion to the PI strata represented in the analysis area. Emphasis for choosing sampling points

was placed on strata codes that do not meet Smith and Long's (1987) minimum stand density threshold for hiding cover based on previous stand exam data. Field data was summarized in a spreadsheet, averaged over each stratum.

The Gallatin Forest Plan Hiding Cover Assessment (USDA, unpublished paper) provides interpretation and guidance on compliance of the Forest Plan hiding cover standard for use in project analyses. Although the definition of hiding cover as "cover capable of concealing 90% of an elk at 200 feet" has been largely accepted as the "objective" of hiding cover, there has been a historical correlation with using vegetation attributes, and specifically the canopy cover stand attribute data kept by the Forest Service Timber Stand Management Record System (TSMRS) as an acceptable proxy. This assessment effort tested the use of the TSMRS photo-interpretation (PI) types to accurately depict forest stands with at least 40% tree canopy cover as a reliable and valid proxy for the literal definition of hiding 90% of an elk at <=200 feet. The field validation studies from four project areas, including the East Boulder field surveys conducted in fall of 2010, indicate that PI stratum that are classified as >=40% canopy cover, are indeed capable of hiding 90% of an elk at <=200 feet (USDA, unpublished paper:16-21).

The Gallatin Forest Plan Management Indicator Species Assessment (USDA unpublished paper: 15-16) analyzed hiding cover across the Forest. An estimate of the current Forest hiding cover is 89% of the total acres capable of providing hiding cover. Given that Thomas et al. (1979) described optimal conditions for big game as 40% cover and 60% forest, forage, not cover, may be more limiting on the Gallatin National Forest (USDA unpublished paper).

A literature review was conducted to obtain range-wide habitat relationship information for elk, moose and deer. Montana Fish Wildlife and Parks (MFWP) personnel were contacted for big game use and population trend information for elk as the Management Indicator Species. As noted above, elk use is not significant in the immediate project area. Population trends for elk herds in the project vicinity have varied in recent years. In winter counts for 2010, the Main Boulder herd unit (winter count 206) was below state population objective (300), while the West Boulder/Greeley Creek herd unit winter count (518) was well above population objective (300). The Elk Creek/Deer Creeks herd unit was slightly up in 2010 (120), the highest ever recorded, but still close to objective (100). MFWP reports indicate that moderate access and heavy hunting pressure are keeping the Elk Creek/Deer Creeks herd unit (including project area) near population objectives (Paugh, office memorandum 2010a).

Mule deer in HD 560 have seen fluctuating trends in the population. Since 1998, mule deer numbers have been relatively stable with counts ranging from 307 to 387 for the period 1999-2007. Surveys in the spring of 2009 and spring of 2010 produced stable deer numbers with 307 deer observed in 2009 and 310 observed in 2010, down from the long-term average of 377 (Paugh 2010b).

This analysis framework was used to analyze and demonstrate compliance with this Forest Plan Standard for the East Boulder proposed fuel reduction treatments. GIS technology was used to assess existing habitat patterns such as cover, forage and other key habitat component availability and distribution, as well as to evaluate potential impacts of the proposed fuel reduction treatments on big game habitat. The TSMRS database was used to estimate the availability of forage and cover component based on best strata codes that reflect dominant tree species, size class, and canopy cover. Queries

used to model all of these habitat attributes were documented and were spatially represented as recommended (USDA unpublished paper: 9-11, 15).

GIS technology was also used to evaluate big game security habitat and associated vulnerability relative to road access. Based on the Hillis et al. (1991) model, existing open roads and proposed project roads were buffered by ½ mile to estimate impacts on habitat security and resulting potential for increased vulnerability.

In addition to the quantitative measures described above, a qualitative narrative of the effects of the proposed fuel reduction treatment on big game was provided. Mule deer is the featured species due to the potential to impact the use and quality of winter range. Elk and moose are also briefly discussed. Proposed mitigation to meet Forest Plan standards, particularly for hiding cover and areas within MA 11, was discussed.

Extreme individual variation in home range size is reported in the literature for big game, including seasonal variation between summer and winter habitat for migratory species. The only consistent factor regarding home range size is that males typically have larger ranges than females for all species considered in this report. Home range size can vary based on the geographic area considered, local habitat conditions, weather fluctuations, migration patterns, sexual dimorphism, reproductive status, and other factors. Lyon and others (1982:viii) reported average summer range size for elk in Montana at approximately 5,000 acres. Mule deer home ranges were reported from 100 to 900 acres (Mackie et al. 2003:896). Moose had the largest variation reported at 890 to 22,733 acres (Bowyers et al. 2003:941). Based on these figures, a project analysis area of approximately 11,171 acres was identified including all proposed fuel reduction treatment units and surrounding habitat to be used for evaluation of direct and indirect effects to big game for this project. This area was determined to be an appropriate scale for analysis based on the following factors: The analysis area is large enough to encompass average home range sizes reported for the focal species (deer, elk and moose) and contains all proposed treatment units and seasonal habitat for big game species known to use the area. The entire Hunting District 560 (approximately 558,145 acres) was considered for cumulative effects because this is the area used for large-scale management of big game by MFWP. Hunting District 560 includes portions of the Absaroka Beartooth Wilderness Area, the Main Boulder, East Boulder, and Deer Creek drainages. These analyses areas were agreed upon by MFWP through consultation with Justin Paugh, Region 5 Area Biologist (Paugh, personal communication 2011).

Consideration of past management actions and natural events that have shaped big game habitat in the project area was established in presentation of baseline habitat conditions for the project area (i.e. the amount and distribution of forage and cover currently available, plus current big game vulnerability conditions). Ongoing and reasonably foreseeable future actions were considered for ten to fifteen years from present to cover the expected project duration of up to five years, and to account for potential lingering displacement impacts where continual disturbance factors may cause big game to leave the project area and not return for some time after project completion.

Direct/Indirect/Cumulative Effects

The project area provides key habitat features for big game; these areas were mapped and quantified where possible and the maps are located in the Project File. Moist sites may be point source locations including streams that supply water, succulent forage, and

wallows; as well as cover. These moist sites, along with non-forested foraging areas, are relatively rare habitat components in the project area. Non-forested foraging habitat consisting of natural meadows and parks, and relatively recently burned or harvested areas, represent less than 4% of the project analysis area. Open forest types (with less than 40% canopy cover) provide the majority of foraging habitat, and currently represent approximately 12% of the project area. The total proportion of foraging habitat is 16% of the project analysis area. Cover is not limited in the project area, with approximately 76% of the area currently dominated by, or capable of providing dense conifer habitat at various stages of succession. Of this, approximately 36% currently serves as thermal cover as well. The remaining portion of the project area (approximately 8%) is covered by rock, water or permanent development, which do not provide cover or forage for big game.

The project area contains habitat for big game during transitional periods such as seasonal migrations. Migration typically occurs as elevational movements between summer and winter ranges, but some lateral movement across slopes occurs as well. Big game migration is primarily influenced by weather patterns and associated factors such as temperature and snowpack. There are no definitive migration routes known to exist within the project area. There are no known identifiable staging areas used by big game in the project area. Rather, individuals and small groups of animals select and use staging areas as available. Travel corridors, used within each season of use (i.e. not used for migration), are widespread and available for wildlife use in roadless and wilderness areas in the project vicinity; although these become more limiting during the winter months for mule deer due to snow depth. Approximately 100 mule deer spend the summer and fall in Dry Fork until the snow gets deep enough that they need to come down in elevation. During the winter, they utilize timbered canopy cover where the snow is intercepted and not impacted by wind or crusting. There is no forage here per se but the timbered canopy cover provides thermal amelioration and areas to bed down and move about without expending energy. They browse along the creek bottom where there are various shrub species. The season of use is approximately 12/1-4/1 (Paugh, personal communication 2009).

Secure habitat for elk was defined by Hillis et al. (1991:39) as areas at least 250 acres in size and at least one half mile from an open road. These authors recommended that at least 30% of an analysis area should be comprised of secure habitat in order to mitigate human hunting impacts. Big game security habitat within the analysis area is heavily influenced by the location of existing infrastructure, which is centered around the East Boulder and Lewis Gulch road systems; there are relatively few roads in the East Boulder drainage. The Gallatin National Forest has a generic standard to manage roads and forest cover to provide security. Security areas were mapped per the Hillis et al. (1991) model and quantified for this project, as well as by hunting districts as part of the Gallatin Travel Plan Environmental Impact Statement (EIS) (USDA 2006a:3-47). In addition, the overall motorized route densities were calculated. Big game secure habitat in the project analysis area is approximately 46%. Road density in HD 560 is 0.3 mi/mi^2 and has 80% security.

Alternative 1 (No Action) would not include fuel reduction activities on National Forest System lands in the project area. Thomas (1979:121) suggested the optimal mix of habitat for elk and deer is 60% forage to 40% cover. While this may be an optimal mix where there are few disturbance factors, cover may be more important in areas of high

predator densities, or where human disturbance factors are a major consideration (Peek, 2003:884). The existing forage:cover ratio is 19:81 (excluding rock, water, and permanent development). Increased conifer growth (both overstory and understory) at the expense of forage production, would not benefit big game in the project area, since cover is not currently a limiting factor. Disturbance from traffic and noise associated with mine activity is a factor in the immediate project area, but nearby roadless and wilderness areas provide a vast expanse of secure habitat with limited human disturbance. Predators may also be a factor, since wolves have re-established in the larger cumulative effects area. Again, nearby Inventoried Roadless and Wilderness provides abundant cover and limited human disturbance, where big game can more readily adapt natural defense mechanisms against predators. No project roads would be constructed or reconstructed under Alternative 1, so there would be no additional disturbance effects from construction and logging traffic on roads, nor any reduction in big game security areas due to the presence and use of new roads.

Continued fuel buildup in the analysis area could facilitate the rapid spread of wildfire, which could significantly reduce the proportion of late-successional forest and replace it with post-fire habitat, which generally provides better forage conditions for big game, at least in the short-term. Lyon et al. (2000:56) reported that grass and forb biomass generally increase for the first five to ten years post fire. Tyers (2003:159) cited numerous studies that showed an increase in seral shrub communities with extensive concentrations of moose forage following wildfires. Fire is an integral ecological process to which big game species have adapted in this ecosystem. While fire may benefit big game species through increased forage production, a large-scale fire event in the project area could have negative consequences as well.

Direct effects common to Alternatives 2 & 3 that would occur as a result of habitat alteration and disturbance include an increase in the amount of forage available for big game species. Deer and elk would benefit from increased grass, forb, and shrub production, while moose would benefit primarily from increased woody browse. Overstory removal can cause a change in understory species composition to dominance by unpalatable plants (Lyon et al. 2000:56), however these undesirable changes are typically associated with large scale projects where all or most of the forest overstory is removed. Given the relatively small size of the proposed actions, and prescriptions for thinning rather than regeneration harvest, major changes in species composition are not expected to occur. Proposed treatments would likely provide additional forage for mule deer wintering in the project area, as deer could be attracted to lichen on the branches of felled trees. Snow compaction from harvest activities would facilitate deer movement in treatment units and make it easier for them to get to lichen on felled materials (Paugh, personal communication 2009).

Fuel treatments associated with both action alternatives (Alternatives 2 & 3) could also improve habitat for big game by increasing the amount of forest/no forest edge. Such ecotones are important to big game because they provide foraging opportunities in close proximity to security cover. Foraging habitat created by proposed treatments would typically be within 600 feet (three site distances) of cover due to retention of strips and clumps of untreated timber. Increased edge could also promote habitat diversity, which would be beneficial for most big game species in that heterogeneity provides a wider variety of forage species. Foraging habitat for big game would be increased, and well over two thirds of the hiding cover associated with foraging habitat would be maintained

within the project area through retention of dense untreated clumps of conifers and leave strips along streams, numerous project related mitigation measures, and existing cover that is adjacent to treatment areas. See Table 30 for a comparison between the alternatives.

Implementation of Alternative 2 or 3 would reduce available security cover in the project area. Elk, moose, and deer are occasionally present in the project area during summer, but better quality summer range is available at higher elevations for all three species. Therefore, loss of cover due to proposed treatments should have little impact on big game summer range. The project area does not contain elk winter range, but about 100 mule deer and a handful of moose winter in the project area. Canopy cover reduces snow depth, which facilitates travel for deer and moose. Deer particularly use this feature for travel corridors along Twin Creek, Wright Gulch, and Lewis Gulch. Mechanical thinning in these areas could have negative impacts on wintering deer in the project area (Paugh, personal communication 2009). Therefore, project design criteria includes untreated buffer strips along these creeks, as well as the East Boulder River to mitigate potential effects by retaining dense canopy cover along important winter travel routes and foraging areas for deer and moose. In addition, treatments within harvest units are designed to maintain approximately 15-20% of forested cover (including riparian buffers) in untreated clumps that exhibit hiding and/or thermal cover characteristics.

Moist to wet areas are present in the project area along streams and associated with naturally occurring ponds, seeps, and cool, protected sites. Moist areas were mapped from modeled queries and data was taken in the field during habitat reconnaissance within proposed treatment units. These areas are particularly important to big game in summer and fall, but may also be used in winter and spring. Moist sites would be protected through project design. For example, some treatment units or portions of units were dropped during project design due to an abundance of these wet micro sites. Where moist to wet micro sites still occur within proposed treatment units, mitigation measures and use of best management practices (BMPs) would maintain hiding cover associated with these features. Black et al. (1976:28) suggest that travel lanes, or timbered "stringers" could be used to conceal deer and elk moving across areas that otherwise lack cover, particularly if located seeps, springs, and riparian zones. Non-treated buffers along the East Boulder River and major tributaries would also help to protect key habitat features.

Noise and increased human presence associated with proposed actions could have disturbance effects on big game, which may trigger physiological responses such as increased heart and respiratory rates that pose an energetic cost on animals. Disturbance could also cause behavioral responses such as forced escape, changes in habitat use patterns, and changes in daily use patterns (e.g. foraging at night). Behavioral responses to human disturbance could cause animals to use suboptimal habitats, resulting in increased competition, and/or increased vulnerability to predators if animals are pushed into unfamiliar areas. Disturbance factors could ultimately result in displacement of big game animals from the project area, at least for the duration of project activities. Displacement results in a reduction of useable habitat and increased stress on animals. Lyon and others (1985:2) reported that for relatively small timber harvest operations, particularly where project roads are not open for public use (such as the East Boulder Fuel Reduction Project), elk are typically displaced less than ½ mile from logging

operations. Reduction of hiding cover adjacent to roads could possibly influence the displacement factor associated with road use. However, the vast majority of treatment units are within ½ mile of an existing road, where the heavily traveled East Boulder Road is already a disturbance factor, and big game use is not occurring at high levels. Security cover is abundant within the project area and surrounding vicinity.

Disturbance during winter could affect big game survival rates. Forced movement away from treatment areas would place energetic demands on animals during a time when food resources are more limited and thermo-regulatory demands are already high. Most deer activity in old harvest units along the East Boulder Road in the project area occurs at night, as deer avoid disturbance from the heavy volume of mine traffic during the day. Deer could adopt a similar habitat use pattern for new treatment units during and after project implementation. One possible short-term effect of the proposed treatment could be increased hunting mortality of deer within the project area. If deer move into the area to take advantage of lichen on downed timber, logging activity would probably keep them away while harvest operations are active. However, deer would be likely to use the areas during day time on weekends or when no equipment is operating, thus making themselves more vulnerable to hunters during big game seasons (Paugh, personal communication 2009). Big game vulnerability is influenced by both habitat alteration and disturbance factors. Reduced security cover could impact big game movement patterns and increase vulnerability to predation and hunting.

In addition to cover removal, increased road density could facilitate hunter access and may also provide travel routes for predators such as wolves and bears. Temporary roads constructed or reopened for equipment access to the project area would not be open to public motorized use, but could present easier travel routes for big game hunters on foot or horseback. Big game vulnerability to predation and hunting mortality is largely influenced by the combination of security cover and hunter access. Mechanical thinning can increase site distance for hunters and predators, and make travel easier through areas that would otherwise be packed with dense trees, branches, and woody debris. Big game vulnerability has traditionally been described in the literature relative to mortality caused by humans during legal hunting seasons.

With increasing populations of natural predators including wolves, bears and possibly mountain lions, big game vulnerability is potentially more of an issue year round. Christensen et al. (1993) provided considerations for evaluating and managing elk vulnerability to human-caused mortality during hunting seasons. They recommended considering road access and juxtaposition of secure habitat. The East Boulder Road, Lewis Gulch Road, Dry Fork Road, proposed temp roads for project access, and private spur roads would influence secure habitat and big game vulnerability in the project area. Security areas as defined by Hillis et al. (1991) would remain well over 30% with either of the action alternatives (Alternative 2 or 3). In addition to maintaining secure habitat within the project area, large secure areas are available in Inventoried Roadless and Wilderness areas adjacent to the project. These secure habitats provide areas of retreat for big game that could be displaced from the project area by disturbance factors associated with project activities.

Finally, logging operations would mostly occur during the winter months. By this time, elk will have moved out of the project area to winter ranges. Deer that winter here may be impacted both positively, through enhanced short-term (lichen) and long-term (grass/

shrub) forage availability, and negatively through short-term disturbance. Mitigation would retain travel corridors within treated units and retain hiding and thermal cover values.

Alternative 2 would affect up to approximately 637 acres. Project design features and associated mitigation measures call for retaining untreated clumps and strips of dense trees within proposed fuel reduction treatment units. Some of these retention patches would still provide hiding cover, but cover connectivity would be affected. Since it is difficult to estimate the amount and types of cover that would be left in each treatment unit, it was assumed for quantitative analysis purposes that all cover would be impacted within a treatment unit. Based on this assumption, hiding cover would be reduced by up to 569 acres, thus retaining 90% of the available hiding cover in the project area. Of the 569 acres, approximately 257 acres of treatment could also affect summer thermal cover; however, the project area is not considered important summer range for any of the focal big game species. Only about 38 acres of winter thermal cover would be affected under Alternative 2. Project design features are specified to leave important deer wintering areas untreated. Thinning would reduce cover, but would increase forage availability by opening up the canopy, allowing more light to reach the forest floor, thus stimulating production of grasses, forbs and shrubs, which provide forage for big game. Alternative 2 would convert up to 569 acres of existing cover to potential foraging habitat. This scenario would increase the forage to cover ratio from the current 19:81 to 25:75, which is more in line with Thomas' (1979) recommended optimum (60:40) for deer and elk. Woody shrub production would be increased in some units, which would provide additional forage for moose. Alternative 2 includes up to approximately 2.1 miles of new temporary road construction to access treatment units. New roads would reduce the amount of security habitat in the project area temporarily. Currently, the project area contains about 46% secure habitat (e.g. areas at least ½ mile from an open road). Under Alternative 2, secure habitat would be temporarily reduced to approximately 45% in the project area, which is still well above the recommended minimum of 30% by Hillis et al. (1991) and Christiansen and others (1993). According to Black et al. (1976:20), found that removal of cover could cause a decline in potential habitat use but that silvicultural treatments would not reduce long-term use provided that such practices still allow the area to meet the definitions for cover. The East Boulder proposed fuel reduction projects meets the definition of both thermal and hiding cover under both Alternative 2 and 3.

Cumulative effects associated with Alternative 2 include past natural events and management actions that have shaped the current habitat present within Hunting District 560. Such processes include natural forest succession, wildfires, wind events, insects, disease, housing and business development, road construction, timber harvest and agriculture. Much of the cumulative effects analysis area is in designated Wilderness or Inventoried Roadless areas, where human-influenced habitat alterations have been minimal. However, large wildfires including the Derby and Jungle fires of 2006 and Hicks Park fire in 2007 have dramatically altered big game habitat in the Hunting District, by reducing considerable acreages of cover, while notably increasing forage in some areas. Smaller, prescribed fires in 2008 and 2009 have had similar effects, but at a much smaller scale. Some timber has been harvested from both public and private lands in the Hunting District, but has occurred at a very small scale relative to the effects of wildfires in the area. Natural events and vegetation management such as timber harvest and prescribed burning typically produce habitat changes that are temporary in nature. Human developments such as housing, ranching, agriculture, mine development and

associated roads have resulted in permanent habitat alteration within Hunting District 560. Most of the permanent developments have occurred on private lands. Implementation of the Gallatin Forest Travel Management Plan will influence road and trail configuration on NFS lands within the Hunting District. Within HD 560, the Travel Plan will result in approximately 0.2 mi/mi^2 of open road density (including public and private roads). Adding motorized trail routes to the calculations, total motorized route density in HD 560 under the Gallatin Travel Plan becomes 0.3 mi/mi^2. Construction and use of the few miles of temporary road associated with the East Boulder fuel reduction project would not appreciably change overall road or motorized route density at the large scale covered by the Hunting District. Approximately 80% of HD 560 is retained in secure habitat for big game. Since project roads would be adjacent to, or within ½ mile of existing roads, again, there would be no measurable change to secure habitat at the HD scale associated with temporary roads for the East Boulder project.

Big game winter range is widely distributed across HD 560, and varies by species. There is considerable overlap between elk and mule deer winter range in HD 560; however, elk do not winter in the direct and indirect effects analysis area. Mule deer and a few moose are the big game species known to utilize the project area in winter. Habitat alterations can affect winter range conditions. Wildfires, prescribed burns and timber harvest have all reduced the availability of hiding and thermal cover, but have also increased winter forage availability in some areas. Cover is not a limiting factor for big game in HD 560. Winter travel on roads and off roads for access and recreation can affect wintering big game. Disturbance caused by human presence and associated noise can cause wildlife to flee the disturbance, which increases energy demands during a critical time, and can also cause animals to move away from preferred areas into lower quality habitat. Winter logging operations proposed for the fuel reduction project could add to disturbance factors in the project area. Under the Gallatin Forest Travel Management Plan, there are approximately 0.4 mi/mi^2 of designated winter travel routes in moose winter range, and 0.2 mi/mi^2 in elk/mule deer winter range in HD 560. However, approximately 53% of moose winter range, and 17% of elk/deer winter range are closed to snowmobile use in HD 560 (USDA 2006a). Proposed winter logging operations for the East Boulder fuels project would not measurably change these figures across the entire Hunting District. According to the Gallatin Forest Plan Management Indicator Species Assessment – Population and Habitat Trends (USDA unpublished paper: 16), habitat on the Gallatin National Forest includes many areas with high security (low road density) and abundant hiding cover. The recovery of hiding cover from past clearcut timber harvesting, and the recent travel management plan decision has improved habitat quality for elk on the Gallatin National Forest.

Alternative 3 would affect up to approximately 858 acres. Of this, hiding cover would be reduced by up to 788 acres, retaining 88% of the available hiding cover in the project area. Of these 788 acres, 371 acres of treatment could affect summer thermal cover. Again, the project area is not considered important summer range for any of the focal big game species. Roughly 139 acres of winter thermal cover would be affected under this alternative. As with Alternative 2, project design features are specified to leave travel corridors in important deer wintering areas untreated. Thinning would reduce cover, but would increase forage availability by opening up the canopy, allowing more light to reach the forest floor, thus stimulating production of grasses, forbs and shrubs, which provide forage for big game. Alternative 3 would convert up to 788 acres of existing cover to potential foraging habitat. This scenario would increase the forage to cover

ratio from the current 19:81 to 27:73, which moves this alternative closer to Thomas' (1979) recommended optimum (60:40) for deer and elk. Woody shrub production would be increased in some units, which would provide additional forage for moose.

Alternative 3 includes about 3.5 miles of new road construction to access treatment sites. New roads would reduce the amount of security habitat in the project area. Under this Alternative, secure habitat would be reduced to about 43.5% in the project area, which is still well above the recommended minimum of 30% by Hillis et al. (1991) and Christiansen and others (1993).

Cumulative effects of Alternative 3 would be similar to those described above for Alternative 2.

Conclusions

Alternative 1 (No Action) would have no direct impact on big game species. Deer are the main big game species using the project area in winter (along with a few moose). Alternatives 2 and 3 would have some impacts, both positive (increased forage) and negative (disturbance and/or displacement). Alternative 2 would focus treatment along the East Boulder Road, mine facilities, and powerline in areas that are already influenced by traffic and mine operations. Alternative 3 would extend treatment further up into Wright Gulch, Lewis Gulch, and Twin Creeks. These areas contain travel corridors used by wintering deer to travel between cover above the river and foraging areas in the river bottom. Alternative 3 would have greater impact than Alternative 2. However, project design criteria to retain cover along travel corridors should minimize negative impacts. Forage:cover ratios would increase; security cover would remain within recommended levels. In addition, hiding cover will remain plentiful across the analysis area and habitat components associated with hiding cover will be maintained through unit prescriptions and mitigation. Table 30 displays the quantitative measure of hiding cover over time by alternative. The project effects are relatively minor; use of habitat by deer and population levels would remain relatively constant.

Table 30-Quantitative Measure of Hiding Cover Over Time by Alternative

Quantitative Measure of HC Over Time	East Boulder Fuels Reduction Project EA		
	Alternative 1 - (No Action)	Alternative 2 – 637 acres	Alternative 3 – 858 acres
Project Area Acres	11,171	11,171	11,171
Acres of Forested Stands capable of providing hiding cover (HC), i.e. Baseline HC	8,528	8,528	8,528
Acres of Baseline not serving as existing HC	174	174	174
Acres and Percent of Baseline serving as Existing HC	8,354 98%	8,354 98%	8,354 98%
Acres Needed to Maintain 2/3 HC	5,685	5,685	5,685
Acres of HC within Proposed Units	0	569	788
Acres of HC Post-treatment	8,354	7,785	7,566
Percent of HC Post-treatment	98%	91%	89%
Meet FP standard?	Y; more than 2/3 of baseline maintained	Y; more than 2/3 of baseline maintained	Y; more than 2/3 of baseline maintained

Compliance with Laws, Regulations, and Forest Plan Direction

All of the alternatives would be in compliance with applicable direction for management of big game habitat.

The National Forest Management Act (NFMA) of 1976 requires that the US Forest Service maintain sufficient habitat to sustain viable populations of existing native and desired non-native vertebrate species. While the proposed fuel reduction treatments could impact habitat components to some degree, the amount of habitat affected is relatively small. Under each alternative, there would be adequate habitat maintained in the project area and surrounding vicinity for increasing populations of big game species.

Gallatin Forest Plan – General Direction-Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.3 – Big game winter range will be managed to meet the forage and cover needs of deer, elk, moose, and other big game species in coordination with other uses. Winter range would be managed to meet the forage and cover needs of deer, elk and moose, with increased forage:cover ratios under both action alternatives (Alternatives 2 & 3).

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.5 – Maintain at least two thirds of the hiding cover associated with key habitat components over time. Habitat components were mapped per queries in the Gallatin Forest Plan Hiding Cover Assessment (USDA, unpublished paper:A:15). Non-forested forage included natural openings and forage areas created by fire or past timber harvest (the latter of which may also be baseline hiding cover). The major streams were mapped (East Boulder River and Dry Fork of East Boulder); any smaller stream reaches that contributed to moist areas

were addressed in the site-specific project mitigation via Stream Management Zone (Montana State law) requirements. Additional moist sites were added from field habitat reconnaissance data. The area encompassing the East Boulder mine was removed from any habitat component layer. Habitat components were not mapped on private lands. The Forest Plan standards to retain 2/3 of the hiding cover associated with key habitat features would be met through unit layout, design, and mitigation.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.8 – Emphasis will be given to the management of special and unique wildlife habitats such as wallows, licks, talus, cliffs, caves, and riparian areas. Mitigation would protect key components such as moist areas and riparian areas. The proposed fuel reduction treatments would not impact cliffs, caves, talus slopes, or other unique habitats. None of the alternatives would result in adverse modification of big game or its associated habitat.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.11 – Roads and forest cover will be managed to provide habitat security and diverse hunting opportunity. Elk populations will continue to be managed by the Montana Department of Fish, Wildlife, and Parks (MFWP) to provide diverse hunting and viewing opportunities. Security areas (per Hillis et al. (1991) were modeled and all alternatives are well within the recommended 30% security cover level.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.13 – Indicator species will be monitored to determine population change. Elk (indicator species for big game) was addressed as part of the analysis for proposed fuel reduction treatment in the East Boulder project area. The Montana State Elk Plan has stated objectives, including population ranges that are desired. According to the Gallatin Forest Plan Management Indicator Species Assessment – Population and Habitat Trends (USDA unpublished paper:16) these populations are influenced by multiple variables, but generally not by a lack of habitat quantity or quality. Elk populations are managed by the MFWP to include a harvestable surplus, but to be sensitive to the tolerances of private landowners as well. MFWP adjusts harvest quotas to stay within an agreed upon population level for each elk management unit (EMU).

Gallatin Forest Plan–Management Area Direction-The East Boulder project area proposed vegetation units are all located within Forest Plan Management Area (MA) 8 (timber management), MA 11 (big game habitat) and very small amounts of MA 12 (summer and winter wildlife) and MA 3 (non-forested areas). Standards relative to wildlife within MA 8 include incorporating considerations for wildlife in project plans. Detailed analysis was completed to identify and mitigate for any adverse affects. Standards relative to wildlife within MA 11 were addressed in the big game specialist report. MA 12 and 3 have no specific management direction for wildlife that pertains to the proposed East Boulder fuel reduction activities. Proposed treatment within MA 11 is designed to enhance winter range capability by leaving key areas untreated to retain vital cover, while at the same time increasing forage production in areas where the forest canopy is opened. The Forest Plan standard in MA11 to ensure no even-aged openings are more than 600 feet from cover would be met through unit layout design.

Gallatin Travel Plan-Any new or reconditioned roads would follow the programmatic direction in the Gallatin Travel Plan. Road density would be managed by following the Travel Plan guideline to restrict public use on project roads during implementation.

Long term, roads would be permanently and effectively closed and revegetated; open road densities would remain the same.

o. Migratory Birds

The Gallatin National Forest provides habitat for dozens of migratory bird species. Many migratory bird species use habitat within the Gallatin Forest as breeding grounds, while others breed in more northern climes and winter here. This extremely diverse group occupies all types of habitat within or near the project area, including ponds, streams, wetlands, riparian areas, grasslands, shrub lands, deciduous forest, coniferous forest, mixed forest, recently burned forest, and rock outcrops. Forested habitats provide trees, shrubs, snags, and surface vegetation as nesting habitat for birds. Open meadows provide habitat for ground nesters and shrub/foliage nesters.

Affected Environment

The East Boulder River and associated tributaries provide riparian habitat for a wide variety of birds. Cliffs and rock outcrops in the project area provide ledges, cracks and crevices as nesting areas for a number of bird species. Forage is abundant in the project area with birds, small mammals, fish and invertebrates providing prey species for many birds. Seeds, berries and other vegetative food sources are also abundant. The species of concern (SOC) identified for this report occupy a range of habitat conditions (See Table 30 below).

Migratory bird species of SOC that might occupy the project vicinity occur in three basic habitat conditions. Brown Creepers and Winter Wrens are relatively restricted to older, intact, mesic coniferous forest types, primarily spruce/fir forest. These species are more common in old growth than mature forests, and mostly absent from logged areas (Hutto and Young 1999:38, 40). Open coniferous forest, with a high proportion of edge and openings of grass, shrub, rocks and cliffs provide habitat for Cassin's Finch, Clark's Nutcracker, Golden Eagle, Great Gray Owl, Olive-sided Flycatcher and Williamson's Sapsucker. Openings may occur as naturally non-forested types such as meadows, water and rock formations, or may result from natural processes such as fire, wind, insects and disease. However, openings created by past timber harvest are also commonly occupied by this suite of species. The third general habitat condition that may provide habitat for bird species of concern is comprised of non-forest types. These sites include cottonwood, aspen, willow, dogwood, and other deciduous tree and shrub species commonly associated with riverine, riparian or wetland features, in addition to upland meadows, agricultural fields and human developments. Willow Flycatchers are found almost exclusively in willow riparian types. Calliope Hummingbirds are strongly associated with riparian habitat, but also occur in upland shrub fields often associated with moist to wet micro-sites. Gray-crowned Rosy Finches might be found wintering in riparian shrub communities, upland brush fields, crop lands, and/or vacated human structures (USDA 1991, Erlich et al. 1988, Hutto and Young 1999).

The project area could provide year round habitat for some SOC (Brown Creeper, Clark's Nutcracker, Golden Eagle, Great Gray Owl and Winter Wren), while others would likely only be present during breeding season (Calliope Hummingbird, Cassin's Finch, Olive-sided Flycatcher, Williamson's Sapsucker and Willow Flycatcher). Gray-crowned Rosy Finches breed in alpine tundra habitat, well above timber line. They would likely only be present in the project area during the non-breeding season.

Migratory behavior can vary considerably between individuals of the same species. Some members of short-distance migrants or resident species may occupy the project area during breeding or winter season and move out of the area for part of the year, while other individuals of the same species may be present year-round. The project area could also provide only short-term, stop-over habitat for migrating birds, including some SOC.

Effects Analysis

Methodology and Scale

Effects to migratory birds were addressed by evaluating how project activities might alter nesting, foraging, migratory stop-over, and/or wintering habitat of various species or guilds, and also how timing and methods of treatment might produce disturbance impacts. Many species of concern (SOC) are addressed in separate reports for sensitive species (trumpeter swan, harlequin duck, bald eagle, peregrine falcon, black-backed woodpecker, and flammulated owl) and Management Indicator Species (northern goshawk). Others, addressed here, were identified from state and federal lists coupled with the availability of suitable habitat within or near the project area.

Project actions that are implemented during the breeding season would have disturbance impacts, and potential for occupied nest destruction, which could affect reproductive success of any migratory bird species in the activity area. Implementation during late summer, fall and/or winter would have minimal disturbance effects to breeding birds, but could affect energy reserves of migrating and/or wintering birds. Proposed treatment would reduce suitable habitat for two of eleven SOC, potentially improve habitat for eight of the eleven SOC, and have little or no habitat impact on one SOC. Resulting habitat alterations would reduce suitable habitat for forest interior species, but could be attractive for migratory bird species that prefer more open forest structure and/or a higher proportion of edge habitat. Table 31 provides a summary of habitat requirements and potential project impacts to migratory bird SOC.

Table 31-Habitat Requirements and Project Related Impacts for Migratory Bird Species

Species	Habitat Features Present in Project Area	Assoc. w/ Harvest[1]	Habitat Impacts[2]	Disturbance Impact Season[3]
Brown Creeper	Old growth, forest interior	N	-	N, F, W
Calliope Hummingbird	Deciduous, riparian, open conifer	Y	+	N, F
Cassin's Finch	Open forest, burns	Y	+	N, F
Clark's Nutcracker	High elevation open forest	S	+	F, W
Golden Eagle	Open, mature forest, cliffs, rocks	U	+	N, F, W

1Association with past harvest: Y = yes, N = no, S = some, U = unknown
2Habitat Impacts: - = negative, + = positive, 0 = little or no impact
3Disturbance Impact Season: N = nesting, F = foraging, W = wintering

The spatial scale of evaluation for this project included the entire project analysis area, which includes approximately 11,170 acres of national forest and private lands. By definition, migratory bird species may occupy habitat in different countries during different seasons, sometimes moving thousands of miles between breeding and wintering grounds. Because they are so wide-ranging, the geographic scope of evaluation could conceivably be huge, and include multiple continents. Therefore, we limited the geographic scope of cumulative effects analysis to lands within the project area

Direct/Indirect/Cumulative Effects

Proposed treatments would have short term disturbance effects on migratory bird species present during project implementation. Longer term habitat alterations could potentially benefit the majority of migratory SOC addressed in this report, by creating a more open forest structure. Resulting habitat alterations would reduce suitable habitat for a couple of SOC that might use the project area, but there is abundant closed-canopy forest interior habitat in the project vicinity.

Alternative 1 (no action) would have no disturbance impacts or direct bird mortalities associated with fuel treatment projects on National Forest System land, and would have no habitat alterations that would be either favorable or detrimental to migratory bird SOC. Alternatives 2 and 3 would result in some habitat alteration and disturbance impacts to migratory bird species. Of the action alternatives, Alternative 2 would have the lesser disturbance impacts due to fewer treatment units and shorter implementation time requirements. However, Alternative 3 would create more of the open forest structure apparently preferred by a larger number of SOC.

Proposed actions have the potential to negatively impact individual migratory birds, but due to the relatively small scale of proposed treatment on the landscape, coupled with treatment location in areas already impacted by past and ongoing land uses, the project would have no measureable impacts on any known migratory bird SOC at the population

level and this issue can be dismissed. A complete discussion/analysis regarding migratory birds is located in the specialist report located in the Project File.

Compliance with Laws, Regulations, and Forest Plan Direction

Management of migratory bird species and their habitats are governed by a wide range of authorities. Most direction regarding conservation of these species falls under the umbrella of the **Migratory Bird Treaty Act (16 USC 703-712)** and an associated **Presidential Executive Order. 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 species of concern. **The Gallatin Forest Plan (USDA 1987)** contains standards for retention of snags and down woody debris (Amendment No. 15), which are important habitat components for a number of migratory bird SOC (See Issue N-Snags, pp. 3-95 through 3-97). The Plan also contains a standard to maintain suitable habitat for those species of birds, mammals and fish that are totally or partially dependent upon riparian areas for their existence (p. III-19). The proposed actions would be in compliance with applicable direction. Potential effects of the project have been evaluated, with focus on migratory bird species of concern. Standard operating procedures and project design criteria would be implemented to reduce potential impacts of fuel treatment, and meet Forest Plan direction.

p. Snags and Downed Woody Debris

Snags are defined in the Gallatin Forest Plan as standing dead trees at least 18 feet tall and at least 10 inches in diameter at breast height (dbh). Down woody debris includes logs and other woody material that is no longer standing or attached to standing trees. Direction for both snag management and down woody debris outlined objectives, guidelines, and standards to meet the goal of maintaining sufficient snag and down woody debris habitat components to accommodate the needs of cavity nesting birds, other snag or down woody debris dependent wildlife species in conjunction with the timber harvest program (USDA 1993). Snags (standing dead trees), and the down woody debris produced when they fall, are important habitat components for a wide range of wildlife species including lynx, grizzly bear, bald eagle, black-backed woodpecker, wolverine and pine marten, as well as numerous species of birds and small mammals. Species assessments are presented in separate issues. Wildlife use snags and down woody debris for nesting, denning, perching, roosting, escape cover and foraging. Snags and down woody materials and are an integral part of forested environments and contribute not only to wildlife habitat structure, but also to vital ecological processes such as nutrient cycling.

Affected Environment

The project area is primarily a forested environment, with a complete range of successional stages and a variety of habitat characteristics. The area is influenced by the East Boulder Mine and associated facilities (roads and powerlines), which represent permanent vegetation clearings on the landscape. This has been the primary disturbance in the East Boulder project area, along with past timber harvest. Other private lands in the project vicinity have been altered for residential and agricultural purposes. The East Boulder River and associated tributaries influence the environment, and contribute not only water resources, but also coniferous and deciduous riparian habitats. Large wildfires (Jungle and Derby wildfires of 2006), and prescribed burns being conducted in Elk Creek, have produced the vast majority of snag habitat in the landscape adjacent to

the project area. There has been no large wildfire activity in the project area. Insect activity has recently begun to affect trees in the project area, but as of the summer of 2009 and 2010, tree mortality due to insect infestation had been relatively light compared to other areas on the Gallatin Forest.

Effects Analysis

Methodology and Scale

In July 2009, a field survey was conducted to estimate snag occurrence in proposed treatment units. This survey used a random point location system based on a chain grid system. Snag density estimates for treatment units were then made using stand table factors presented by Dilworth (1973:267). Additional snag and down woody debris information was collected in stand exams conducted for each proposed treatment unit. The document Estimates of Snag Densities for Eastside Forests in the Northern Region (Bollenbacher et al. 2008) was consulted for insight into snag density estimates for a variety of landscapes and habitat conditions on the Gallatin Forest. Forest Inventory and Analysis (FIA) data were used to estimate average snag densities, and live replacement tree availability in the 5th Code Hydrologic Unit for the Absaroka-Beartooth Mountain Range (Lundberg 2011). Results of this exercise were used to evaluate snag abundance and distribution within the project area and surrounding vicinity, in order to assess potential impacts from loss of snags and reduction of replacement trees due to project activities, and to ensure Forest Plan snag management direction would be met.

For assessment of direct and indirect effects, a spatial analysis area was identified including approximately 11,170 acres surrounding the proposed treatment areas. This area was selected because it encompasses all proposed treatment units, and contains seasonal habitat for the majority of snag-dependent wildlife species; e.g. passerine birds and small mammals. The entire 5th code hydrologic unit (HUC) for the East Boulder River was considered for cumulative effects analysis, because factors that affect snag abundance and distribution are typically ecological processes that operate at very large scales. Further, in order to obtain a statistically valid estimate of snag densities in the project vicinity, a large landscape was required due to a relatively small sample size of available data regarding snag occurrence in the project area.

In addition, Bollenbacher et al. (2008) stated that understanding how snags are distributed spatially across the landscape is as important as the distribution of snags and large-live remnant trees over time during various stages of succession. The identified direct and indirect analysis areas represent the warm and cool habitat type groups; the majority of the cumulative effects analysis area represents cool and cold habitat type groups.

The timeline used to evaluate past, present and reasonably foreseeable future actions includes a period of approximately 20 years, looking 10-15 years prior to project implementation and 5-10 years during and post implementation. This timeframe allows for consideration of past actions and natural processes that have weakened or killed trees, snag longevity, and snag retention and replacement resulting from and after project implementation.

Direct/Indirect/Cumulative Effects

A recent analysis was conducted to evaluate snag habitat conditions for the eastern portion of the USFS Northern Region. This assessment produced estimates of snag densities for eastside forests, including the Gallatin (Bollenbacher et al. 2008). The Regional eastside assessment looked at a broad range of conditions and a variety of factors affecting snag habitat. This assessment identified that snag densities, on average, are higher in designated Wilderness and inventoried roadless areas than in managed areas. Although there was some degree of uncertainty on what factors played a role, the analysis helped to understand differences between areas that have been influenced by management and unmanaged areas.

The assessment also looked at habitat type groups with similar biophysical and disturbance regime characteristics. For most coniferous species, snag densities differed based on site characteristics such as temperature and moisture levels. The habitat type groups of cold forest, cool forest, and warm forest have characteristic disturbance regimes, which create snags and are related to the density of snags. Generally speaking, cool, dry sites tend to produce the highest snag densities, since snags persist for longer periods due to cooler temperatures, which curb decomposition rate, and longer intervals between stand replacing events. Snag and live tree estimates for the project area are displayed in the next section.

Timber harvest and human access can have considerable effects on snag density and longevity (Wisdom and Bate, 2008). As Bollenbacher (2008) confirmed, nearby inventoried roadless and designated Wilderness would be expected to have more natural snag abundance and distribution than harvested areas and areas with open road access. Mature forest habitat in the project area contains sufficient size and densities of live replacement trees to provide adequate snag habitat over time. The occurrence of down woody material varies across the project area, ranging from inherently sparse coverage with little more than duff and rock on the forest floor, to heavy pockets of blow down.

Snag occurrence, abundance and distribution on the landscape is influenced by a number of factors including site productivity, climate, land management activities and natural ecological processes to name a few. Table 32 displays a summary of the average number of snags and live trees per acre for warm, cool and cold habitat type groups across the Gallatin National Forest (Bollenbacher et al. 2008:34, 36) in both unroaded and managed areas. Displaying estimates both within and outside of the wilderness/ roadless areas provides context into the current condition of snag and live tree distributions and provides insight into the range of snags that may be desirable to leave within a project treatment area, and, potentially, live trees to serve as remnant trees, which will eventually be recruited into snags. The identified direct and indirect analysis areas represent the warm and cool habitat type groups; the majority of the cumulative effects analysis area represents mostly cold habitat type groups.

Table 32-Snag and Live Tree Density per Acre Estimates for the Gallatin National Forest

Gallatin Forest	Habitat Type Group	*Snags per acre >=10" dbh*	*Snags per acre >=15" dbh*	*Snags per acre >=20" dbh*
Inside **Wilderness or Roadless**	Warm	5.3	2.4	0.8
	Cool	23.2	6.1	1.6
	Cold	14.8	3.8	1.2
Outside **Wilderness or Roadless**	Warm	2.2	0.8	0.4
	Cool	12.0	3.6	0.3
	Cold	10.9	6.0	1.0
Gallatin Forest	**Habitat Type Group**	***Live Trees per acre >=10" dbh***	***Live Trees per acre >=15" dbh***	***Live Trees per acre >=20" dbh***
Inside **Wilderness or Roadless**	Warm	45.7	14.8	3.9
	Cool	69.0	18.1	4.9
	Cold	64.7	13.2	2.1
Outside **Wilderness or Roadless**	Warm	40.4	16.8	5.7
	Cool	50.2	12.7	3.5
	Cold	40.6	22.3	11.6

Based on field surveys conducted in 2009, snag presence within proposed treatment units was very variable. Snag survey data indicates 0-21 snags per acre across all units. The proposed treatment units consist of either warm or cool habitat types; cold habitat types are only represented outside the proposed treatment units and at higher elevations. Therefore, it would be expected that the units would reflect an average of 5.3-23.2 snags per acre in the warm and cool habitat types inside unroaded areas and 2.2-12.0 snags per acre in the managed areas. In summary, the proposed treatment units are not within the ranges of average snags per acre expected for the Gallatin Forest in the warm and cool habitat types and where snags exist, they are not distributed equally across the units. This condition is likely due to past harvest, where many of the proposed treatment units were either thinned, cut or partially cut. Also, proximity to the road, powerline, and mine facilities may have resulted in removal of hazard trees (often snags), vegetation clearing for administrative purposes, and/or firewood gathering, all of which would indiscriminately reduce the amount of snags currently present. Some of the proposed treatment units consist of conifer regeneration stands, where trees have not yet grown to a size capable of producing snags suitable for providing wildlife habitat. Similarly, most

proposed treatment units have at least light to moderate levels of down woody debris component, much of which was created from the previous harvest activity.

Although snag abundance in the immediate project area is relatively low, snags are not limited in the larger landscape. Average snag densities were estimated in the Absaroka Mountain Range using Forest Inventory and Analysis (FIA) data (Czaplewski, 2004). Table 33 displays these data that indicate on average, forested habitats in the Absaroka Range, at the 5th Code Hydrologic Unit scale, have estimated snag densities of 7.6 snags >=10" dbh per acre, 1.8 snags >=15" per acre, and 0.8 snags >= 20" dbh per acre and approximately 50.7 live trees (>= 10" dbh), 11.7 live trees >=15" per acre, and 3.2 live trees >= 20" dbh per acre per acre as replacement trees (Lundberg 2011). While the snag estimates for the Absaroka Mountain Range lump the habitat type groups, they appear to be lower (particularly for the cool and cold habitat types) than estimates on average across the Gallatin Forest (Table 31 above). Live tree estimates for the Gallatin portion of the Absaroka Mountain Range indicate that there are less live trees in the >=15" and >=20" dbh classes but about the same number of the total live trees (>=10" dbh) as the average of all habitat type groups and inside/ outside wilderness/ roadless categories on the rest of the Gallatin.

Table 33-Snag and Live Tree Density per Acre Estimates for the Absaroka Mountains

Absaroka 5th Code HUC Area	***Snags per acre >=10" dbh***	***Snags per acre >=15" dbh***	***Snags per acre >=20" dbh***
BOTH *Inside and Outside* Wilderness or Roadless	7.6	1.8	0.8
Absaroka 5th Code HUC Area	***Live Trees per acre >=10" dbh***	***Live Trees per acre >=15" dbh***	***Live Trees per acre >=20" dbh***
BOTH *Inside and Outside* Wilderness or Roadless	50.7	11.7	3.2

Relative to current Forest Plan snag management direction, the snag density estimates for the proposed treatment units appear to not meet the Forest Plan snag standards in all the units. However, the Forest Plan snag standard states that if there are not sufficient dead trees meeting this size criteria, the largest available dead trees (<10" dbh, <18' in height) will be left as snags. Live trees may also serve as replacement snags.

With Alternative 1 (No Action), no fuel reduction treatments would occur. Without fuel treatment, snags, downed logs, and live replacement trees in would remain on the landscape at a level comparable to what currently exists. With the advent of recent insect infestations, tree mortality is expected to naturally increase in the project area, although the rate of spread and overall degree of mortality is difficult to predict. At any rate, the amount of snags and down woody debris is expected to increase under the No Action Alternative, both within the units and across the landscape. Cumulative effects would result from the continued occurrence of natural processes such as insects, disease, drought, fire and wind, which can weaken or kill trees, adding to snag and down woody habitat components. Fuels would continue to build within the project area, producing conditions more conducive to carry wild fire through the project area and potentially into

adjacent forested areas. Forest fires create an abundance of snags, and eventually, add down woody materials to the forest floor. While fire-created snags and logs are a natural and important habitat component for many wildlife species, fire-created snags can have different attributes than snags created through other mechanisms. Fires kill or weaken trees, which attracts insects and provides a vital food source for many wildlife species. On the other hand, fire can actually case-harden snags, making them more resistant to decay (Bull et al. 1997:21). Softer interior wood resulting from decay is often required for cavity excavation in snags. Cavities are used for nesting, denning and security habitat by a number of species. Insect-caused mortality would continue without wildfire, creating snags that may be relatively easy to excavate.

With implementation of either of the action Alternatives 2 and 3, large and small live trees would be removed to reduce hazardous fuel loading in close proximity to the East Boulder Road, powerline, and mine operations. Alternative 3 would also reduce additional fuels in areas along the Lewis Gulch Road. Snags and down wood are not necessarily targeted for removal, but would be taken if their presence contributes to undesirable fire behavior, or if they present a safety hazard to workers during project implementation. Proposed fuel reduction treatments may somewhat reduce the number of existing snags, and would decrease the supply of live replacement trees. Project related mitigation would reduce the risk of snag removal for firewood.

Most cavity-nesting species prefer large-diameter snags. Larger snags last longer, can accommodate larger cavities, and provide a more stable environment due to the thickness of the wood insulation (Bull et al. 1997:26). However, some species actually select smaller-diameter snags for nesting, and smaller snags provide valuable foraging strata for a number of species. Due to the complex relationship between a wide variety of snag-dependent species and their preferred habitats, it is desirable to have a range of snag conditions (tree species, size, structure, degree of decay) across the landscape. Prescriptions for fuel treatments typically favor tree species capable of producing the largest snags (e.g. Douglas fir and spruce) by identifying them as preferred conifer tree leave preference species. Prescriptions also call for leaving clumps of trees that have no treatment, interspersed amongst thinned areas. Leaving dense clumps of live trees around retention snags would help protect snags not only from environmental factors that would reduce longevity, but would also help shield them from view of potential firewood cutters.

Several of the proposed treatment units currently have few snags available and do not currently meet the Forest Plan snag standard of 30 snags per 10 acres. Snag poor units have typically had past management (thinned, cut, or partially cut within the past 20 years or so) resulting in younger, healthy trees, with few snags. In some cases (e.g. conifer regeneration stands scheduled for hand thinning) few or no mature trees exist that could produce suitable snags (at least 10” dbh and 18 feet tall) in the near future. Other developing stands in treatment units inventoried in 2009 had few existing snags, but had early signs of insect infestation which will promote snags over time. While some trees are capable of surviving insect attacks, tree mortality has been high in other areas of the Gallatin Forest, particularly in areas of mountain pine beetle infestation. With the recent appearance of mountain pine beetle in the project area, it is likely that snag availability will increase in proposed treatment units before project implementation is complete. Snags and live trees of various species and sizes would be left in untreated clumps as per mitigation. Where units do not have 30 snags per 10 acres existing, the

largest snags will be left and a minimum of 30 live replacement trees per 10 acres will also be left to meet the Forest Plan snag standard.

To further evaluate project compliance with Forest Plan snag standards and best science across the landscape, we compared the estimated average snag densities in the Absaroka Mountain Range (Table 33). Estimates of snags and live trees in three diameter classes, independent of seral stage, for the Absaroka Mountains are well over the 30 snags and 30 snag replacement trees per 10 acres (or 3.0 and 3.0 per acre) required by the Forest Plan. The East Boulder thinning prescriptions will move each respective stand towards a late seral condition by removing smaller diameter trees and leaving on average the larger trees. This information provides current snag information and analysis for consideration by the Forests, based on best science. Mitigation was incorporated to address the potential need for greater numbers of snags both within and outside the proposed fuel reduction units. Regardless, the East boulder fuel reduction project will meet Forest Plan snag standard within the units through prescriptions (clump retention, thinning specifications, tree species preferences, etc.) and mitigation.

Effects to snags, downed wood, and suitable replacement trees in the project area have been largely a result of past management practices; e.g. timber harvest, hazard tree removal, and vegetation clearing. These actions have reduced snag abundance in treated areas within the project area, and have influenced snag distribution in close proximity to roads within the project area. Alternatives 2 and 3 could further reduce snag numbers in treatment units if snags must be removed to meet fuel reduction objectives or for worker safety considerations. Proposed treatments would also further reduce the number of live replacement trees available to perpetuate snag habitat in the project area. However, within the cumulative effects analysis area, natural processes will continue similar to that of Alternative 1 (No Action) that have (or soon will produce) abundant snags. Snags are typically created by ecological processes that result in a naturally "clumpy" distribution on the landscape. Other than continued tree mortality expected to result from insect activity, there are no reasonably foreseeable future actions that would influence snag occurrence, abundance or distribution in this watershed. Lastly, downed woody materials are not limited in the project vicinity. Burned areas, insect infestations and natural forest succession will continue to provide an abundance of such material over time.

Compliance with Laws, Regulations and Forest Plan Direction

The National Forest Management Act (36 CFR 219) requires the Forest Service to provide habitat for native and desired non-native species and there are certain species that depend on snag habitat for basic life processes, such as breeding, feeding and sheltering. While the proposed action could reduce current snag densities and would reduce availability of future snag replacement trees in the project area, the proposed treatment would affect a relatively small area (645 acres in Alternative 2 or 865 acres in Alternative 3). Snag habitat in adjacent forested areas would not be treated.

The Gallatin Forest Plan Snag Management (Amendment No. 15, USDA 1993) contains direction to accommodate the needs of cavity nesting birds and other snag-dependent species in conjunction with timber harvest activities This direction would be met by project design criteria and other mitigation. Between retention clumps and remnant trees in thinned areas, there would be no problem meeting the Forest Plan requirement for replacement trees within units. Regenerating stands scheduled for hand

thinning (Units 2, 3A, 4, 6, 7B, 8, 8A, 11A, 12A) currently have no snags available for retention, but would meet requirements for replacement trees.

Gallatin Forest Plan – General Direction-Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.7 – Standards for snag and down woody material will be utilized. Snag habitat needs were considered for the snag resource per Forest Plan snag management direction and for snag habitat requirements for flammulated owl, long-eared myotis, long-legged myotis, northern goshawk, and pine marten. Forest Plan standards for snag and down woody debris management would be met under both action Alternatives 2 and 3.

Gallatin Travel Plan-Applicable Travel Plan standards for snag management would be met. There are no designated firewood cutting areas but "no firewood cutting signs" will be posted within the sale area to protect snags retained to meet the Forest Plan snag standard. From a snag management perspective, the project would be consistent with Travel Plan direction.

Snag Density Estimates for Eastside Forest in Region 1- In 2000, the USDA Forest Service Northern Region developed the Northern Region Snag Management Protocol as "an optional snag retention standard… to replace the Upper Columbia River Basin interim standard for National Forests that choose to use it" (USDA 2000:3). The Gallatin National Forest chose not to adopt the 2000 snag protocol because the analysis used to develop it focused on forested habitats west of the Continental Divide, which contain substantially different habitat types than are found on the Gallatin and other national forests east of the divide. In 2008, the USDA Forest Service Northern Region produced Estimates of Snag Densities for the various Eastside Forests in the Northern Region (See Table 31 above). This document "does not set forth mandatory or required direction, but rather provides current snag information and analysis for consideration by the Forests" (Bollenbacher et al. 2008:1).

q. Vegetative Structure/Diversity/Old Growth

Affected Environment

The Douglas-fir old growth type (code 1) for the East-side Montana zone occur where Douglas-fir is the seral and climax dominant. Prior to 1900, cool underburns at 5 to 20 year intervals on dry sites and at 35 to 40 year intervals on the moist sites promoted open, single-storied stand conditions. Single-storied stands are common during seral stages or in climax stands with frequent fires. The average litter and duff depth for the Douglas-fir old growth types is approximately 3 inches.

Lodgepole pine old growth (code 6) for the East-side Montana zone has been observed on mostly subalpine fir habitat types. Lodgepole pine is a seral species on these habitat types. Subalpine fir old growth (code 9) for the east side of Montana is the climax species on these subalpine fir types, while whitebark pine old growth (code 11) for eastern Montana is found on mostly subalpine habitats where whitebark pine is a seral coniferous species. Lodgepole pine old growth is found at all elevations and aspects and has had a natural fire frequency that ranged from thinning fires on a 35 to 40 year frequency to stand replacing fires spaced around 150 to 200 years. Without periodic disturbances like fire, subalpine fir will eventually dominate. Subalpine fir old growth is found at all elevations and aspects, also and has had a natural fire frequency that ranged

from thinning fires on a 35 to 40 year frequency to stand replacing fires spaced around 150 to 200 years. Without periodic disturbances like fire, subalpine fir will eventually dominate, but where there is fire disturbance, lodgepole pine will often dominate. Whitebark pine old growth is found at the higher elevations, but on all aspects. Because of the range of fire frequency (reported from 35 to 300 years from a few trees to an entire stand), the concept of fire frequency does not apply well in these upper elevation stands (Fisher and Clayton, 1983). On these higher elevation sites, whitebark pine will eventually be overgrown by subalpine fire if no fire disturbances occur.

Douglas-fir old growth is defined as stands with the following minimum characteristics:

- 4 trees per acre 17 inches DBH or more,
- large trees 200 year old or more,
- basal area 60 square feet per acre or more,
- down log pieces (low to moderate probability of abundant material), and
- 4 to 18 snags per acre (Green et al. 1992).

Lodgepole pine old growth is defined as stands with the following minimum characteristics:

- 12 trees per acre 10 inches DBH or more,
- large trees 150 year old or more,
- basal area 50 square feet per acre or more,

Subalpine fir old growth is defined as stands with the following minimum characteristics:

- 10 trees per acre 13 inches DBH or more,
- large trees 160 year old or more,
- basal area 60 square feet per acre or more

Whitebark pine old growth is defined as stands with the following minimum characteristics:

- 11 trees per acre 13 inches DBH or more,
- large trees 150 year old or more,
- basal area 60 square feet per acre or more

Questions were raised pertaining to how harvest activities would affect old growth populations and vegetative diversity within the analysis area for the project. The Forest-wide standard for vegetative diversity (FP standard 6.c., page II-19 and 20), states:

1) Forest lands and other vegetative communities such as grassland, aspen, sagebrush and whitebark pine will be managed by prescribed fire and other methods to produce and maintain the desired vegetative conditions

2) In order to achieve size and age diversity of vegetation, the Forest will strive to develop the following successional stages in timber compartments containing suitable timber: 10% grass-forb, 10% seedlings, 10% sapling, 10% pole, 10% mature and 10% old growth.

Effects Analysis

Methodology and Scale

The project analysis area for vegetative structure and diversity includes timber Compartments 112, 113, 114, and 115 (See Map 6), however, the majority of the treatment units lie within Compartment 112. The structural stage components that currently meet these Forest Plan standards to strive for are as follows: Compartment 112 contains: pole (24%), mature forest (42%), and old growth forest (22%); Compartment 113 contains pole (23%) and mature forest (59%); Compartment 114 contains pole (27%), mature forest (40%), and old growth forest (27%); Compartment 115 contains pole 16%, mature forest (55%), and old growth forest (27%).

The vegetative structural stage conditions that are currently below the diversity standard by compartment are as follows: Compartment 112-forest grassland (<1%), seedling (4%), and sapling (7%); Compartment 113-forest grassland (0%), seedlings (5%), saplings (6%), and old growth (8%); Compartment 114-forest grassland (0%), seedlings (5%) and saplings (2%); and Compartment 115-forest grasslands (<1%), seedlings (1%) and sapling (<1%) See Map 7, Forest Structural Stage Map for approximate locations of each forest stage.

Because old growth is often an issue of concern above and beyond the Forest-wide standard for vegetative diversity, old growth is being addressed in more detail. Old growth forest by timber compartment in the analysis area is currently as follows: Comp.112-22%, Comp. 113-8%, Comp. 114-27% and Comp. 115---27%. Old growth stands were queried using ArcView and the TSMRS and SILC3 database. Ground truthed data were used when available. The Forest Plan (page III-41) requires that we strive to maintain at least 10% old growth by compartment. Presently all compartments except for 113 are above the 10% standard. The analysis for both old growth and vegetative diversity were developed from data gathered from the Timber Stand Management Resource System (TSMRS) and SILC3. TSMRS stores practically all information related to individual forest stands delineated by human photo interpretation. Information such as slope, aspect, forested cover type, elevation, and activities completed (logging, pre-commercial thinning, stand exams, etc.) to name but a few are stored in this database. The SILC3 classification system was started in the early 1990s using satellite imagery to create regional land cover types (including tree size and canopy cover) and also defines slope, aspect and elevation. For this project, SILC3 data was used where private lands exist and no TSMRS data is available. Based part on field exams and part from photo interpretation old growth and other forest successional types were identified.

Direct/Indirect/Cumulative Effects

Forest-wide on the Gallatin National Forest (using Forest Inventory Analysis (FIA) data) the amount of old growth calculated is approximately 28% with a confidence interval of 24% to 32% at the .90 confidence limit. For a large area in and around the East Boulder area (which includes seven 5th code HUCs) old growth averages (using FIA data) 23% with a range at the .90 confidence limit of between 15% and 33%.

The old growth in these compartments is considered to be old growth as defined by Region 1 Guidelines (USDA, Green et. al.). Currently, all compartments except for 113 are well above the 10% standard for old growth. It is important to note that there are no

old growth stands located in Compartment 113 proposed for treatment with either Alternative 2 or 3. The only proposed treatments in old growth stands would occur within Compartment 112, which currently contains 22% and is well above the Forest Plan standard.

Alternative 1 would not include any treatment activities so would have no direct or indirect effect to vegetation.

Alternative 2 will only slightly change the forested vegetative structural composition in the overall project area. The majority of the proposed treatments would occur in Compartment 112. The treatment activities associated with Alternative 2 would cause a slight decline in old growth (approximately 55 acres or 0.5%) dropping the old growth from 21% to 20.5%, while mature forest will increase (approximately55 acres or 0.5%) from 43% to 43.5% in Compartment 112 (See Table 34).

Table 34-Alternative 2 Post-Treatment Structural Stage Changes in Compartment 112

(No Structural Changes in Compartments 113, 114 115).

Project Area	Compartment	Project Acres by Structural Stage BEFORE Treatment	Project Acres by Structural Stage AFTER Treatment	Summary of Structural Stage Acreage Changes
East Boulder	112	For Grass: 7 Seedling: 473 Sapling: 789 Pole: 2,623 Mature: 4,551 Old Growth: 2,357	For Grass: 7 Seedling: 473 Sapling: 789 Pole: 2,623 Mature: 4,608 Old Growth: 2,350	For grass: 0 Seedling: 0 Sapling: 0 Pole: 0 Mature:+57 Old Growth:-57

The treatment activities associated with Alternative 3 would also cause a small decline in old growth (approximately 135 acres or 1.3%) dropping the old growth from 21% to 19.7%, while mature forest would increase (approximately 135 acres or 1.3%) from 43% to 44.3% in Compartment 112. No vegetative structural types would be affected by Alternative 2 or 3 in Compartments 113, 114 or 115 (See Table 35).

Table 35-Alternative 3 Post-treatment Structural Stage Changes in Compartment 112 (No structural changes in Compartments 113, 114 or 115).

Project Area	Compartment Project Located	Project Acres by Structural Stage BEFORE Treatment	Project Acres by Structural Stage AFTER Treatment	Summary of Structural Stage Acreage Changes
East Boulder	112	For Grass: 7 Seedling: 473 Sapling: 789 Pole: 2,623 Mature: 4,551 Old Growth: 2,357	For Grass: 7 Seedling: 473 Sapling: 789 Pole: 2,623 Mature: 4,688 Old Growth: 2,220	For grass: 0 Seedling: 0 Sapling: 0 Pole: 0 Mature:+137 Old Growth:-137

Generally speaking, all stands dominated by Douglas-fir, Douglas-fir/lodgepole pine or lodgepole pine will continue to be dominated by that species mix. What would change is the percent canopy cover present after units are treated. For the Douglas-fir and mixed species stands, thinning of 13-15 feet between crowns would lower the canopy coverage post-treatment to approximately 50%- 60%.

For many of the mature/pole lodgepole pine units where overstory canopy coverage currently varies from 70% to 90% (MA8 up Lewis Gulch and east of the mine site), after thinning canopy coverage will vary from 35% to 45%. In the younger stands of lodgepole pine (classified as sapling to pole) canopy coverage will change from the current 55% in the primary size class to an after thinning canopy coverage of approximately 25% to 30%.

The project area contains only a small percentage of each of the timber compartments that were analyzed for vegetative structure. The scope of the project was defined to allow treatment of areas that are within the wildland urban interface. Within this limited scope, there is very little opportunity to notably affect the structural diversity in Compartment 112 (majority of the treatment acres) or any of the other affected compartments (113, 114, or 115). The shifts in structural diversity do not move treatment areas from over represented structural stages to stages that are less represented or equally represented. With either Alternative 2 or 3, only a small amount of old growth is being changed from old growth to mature, therefore any direct or indirect effects to structural diversity/old growth would be expected to be minimal.

There are some private developments within the analysis area. These private lands are scattered throughout the East Boulder drainage area and have had a slight effect to the structural diversity and old growth on the forested lands found within Compartment 112. It is likely some changes to forested structure types would occur into the future, but it is expected that such changes will not significantly alter the current percentage of structural types. The analysis completed for direct and indirect effects includes past and

present changes to forested stages on public and private lands and actions proposed by the USFS in this document. There is virtually no change to structural diversity as it relates to the dominant size class in a stand with any of the alternatives, so the consequential cumulative effect would also be minimal and the issue of vegetative structure/diversity/old growth can be dismissed.

Vegetation and Climate Change

In addition to the discussion concerning structural diversity and old growth, global climate change and how it relates to this project will be briefly discussed here. Based on literature (Running, S. 2006) the area in and around the Pacific North West has been warming with slightly below average amounts of precipitation also occurring. This climatic change is likely to continue into the foreseeable future (50 to 100 years). Assuming such climatic trends continue, we can expect our proposed treatments to create a more resilient forested ecosystem better able to handle potential outbreaks of insects (bark beetles) and moderate to severe wildfire. Maintaining mature and old growth forest from such disturbances is ecologically unrealistic since such disturbances are likely to increase with warmer and possibly drier conditions. Scattered throughout the literature is the notion that generally, old growth forests store more carbon than younger forests. While this notion seems reasonable, the studies for these conclusions were based in western Washington and western Oregon. These areas are much different than in eastern Montana where disturbance and succession dynamics and thus carbon dynamics are substantially different.

Although not a statutorily defined purpose of National Forest System management, forests provide a valuable ecosystem service by removing carbon from the atmosphere and storing it in biomass. The Gallatin National Forest currently stores an estimated 68 million metric (Mt) of carbon (Carbon On-Line Estimator, ncasi.uml.edu/Cole). This represents about 0.0016 of the total of approximately 41,385 Mt of carbon in forests of the coterminous United States (USDA News Release 2010).

The long-term ability of forests to sequester carbon depends in part on their resilience to multiple stresses, including increasing probability of drought stress, high severity fires and large scale insect outbreaks associated with projected climate change. Management actions such as those in the Lonesome Wood proposed action plan that maintain the vigor and long-term productivity of forests, reduce the likelihood of high severity fires and insect outbreaks and store carbon in harvested wood products help increase 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 improve the overall capacity of the forest to sequester carbon while also contributing other multiple-use goods and services.

Mark Harmon, Professor in Forest Science at Oregon State University stated at a relatively recent Testimony before the Subcommittee on National Parks, Forests, and Public Lands: “My greatest concern: with continued warming forests can shift from being part of the carbon solution to being part of the carbon problem. Forests cannot continue to accumulate carbon forever, so it can be part of a bridging strategy, but we need to use the time it buys us wisely. This brings me to my greatest concern which involves the role forests will play if the climate continues to warm as projected under a business as usual scenario. If we do not act soon to reduce the rate the carbon dioxide and other greenhouse gases are released, we may create a climate that will make forests

start a net release of carbon to the atmosphere. This could come about in several ways, but many of the effects are likely to be caused indirectly by increased drying of forests. This will mean that wildfires become more extensive and more severe, that insect outbreaks become more extensive and more severe, and that even trees in so-called "undisturbed" forests start to die at faster rates. If this starts to happen then the leaks from the forest carbon system will increase and eventually less will be stored. Not all the carbon will be released all at once as is often implied, it will happen gradually, but if forests reach this point then they will start to contribute to the problem we are trying to solve. Further, it may also become part of a vicious cycle in which more trees die which releases more carbon which warms the climate even more which causes more drying, which causes more trees to die, etc. Forests are not the only part of the natural world that may act in this manner; thawing currently frozen soils in the north could cause yet another vicious carbon release cycle to begin. To assure that this does not happen we need to act on a number of fronts and to decrease carbon dioxide and other greenhouse gas concentrations in the atmosphere as fast as we possibly can" (Harmon, 2009).

For a further discussion/analysis of vegetative structure/old growth, see the specialists report located in the Project File.

Compliance with Laws, Regulations and Forest Plan Direction

The **Gallatin Forest Plan** standard for vegetative diversity/old growth (FP standard 6.c., page II-19 and 20), states: "(1) Forest lands and other vegetative communities such as grassland, aspen, sagebrush and whitebark pine will be managed by prescribed fire and other methods to produce and maintain the desired vegetative conditions; (2) In order to achieve size and age diversity of vegetation, the Forest will strive to develop the following successional stages in timber compartments containing suitable timber: 10% grass-forb, 10% seedlings, 10% sapling, 10% pole, 10% mature and 10% old growth.

r. Insect & Disease (MPB & DFB)

Epidemic levels of mountain pine beetle attacks could kill many lodgepole pine and whitebark pine within the East Boulder Compartment 112 (majority of the project area) and adjacent timber compartments (113, 114, & 115) within the foreseeable future (next 2 to 5 years) on approximately 7,900 to 9,900 acres (based on a recent analysis of the amount of lodgepole pine and whitebark pine present within this area). There is also concern that moderate levels of Douglas-fir beetle mortality could occur throughout this drainage in the larger Douglas fir trees (>15" dbh). Large acreages of dead and dying trees (lodgepole pine with some amounts of Douglas-fir) would increase the difficulty of fighting fire safely and using the East Boulder Road to more easily evacuate the area in the event of wildfire.

Affected Environment

The mountain pine beetle, which attacks all western pine species, is the most aggressive, persistent, and destructive bark beetle in the United States. Normally, this insect is at low populations or endemic levels but as trees increase in size, age and density over a broad area, beetles can become epidemic. Mountain pine beetle outbreaks typically occur in mature to overmature forests where growth rates slow and thus its ability to defend against this insect declines. Long-term (preventative) forest management is the best strategy to keep beetle populations at endemic levels because when enough area exists that is suitable for the mountain pine beetle, population explosions can occur.

Lodgepole pine become suitable hosts for the beetle when trees are greater than 8 inches in diameter and average 80 or more years old (trees greater than 5 inches diameter) (Amman 1978, Safranyik, 1976). Susceptibility increases with diameter and basal area (Amman 1978). Thinning overstocked, mature and overmature lodgepole pine stands to near 80 square feet of basal area per acre can greatly reduce beetle-caused mortality (USDA 1994).

The Douglas-fir bark beetle is the most destructive bark beetle attacking Douglas-fir in the Northern Region. Beetle populations can build up in host trees following drought, blowdown, fire, logging, severe defoliation, or in association with root disease. Beetle populations build in down material (greater than 8 inches diameter) and then attack surrounding green trees. Douglas-fir beetles tend to favor dense stands, stands with average ages greater than 120 years, and stands with root disease or injury. Stand density reduction has been shown to be the most effective method of reducing beetle-caused mortality by reducing tree competition for moisture and exposing material to sunlight (USDA 1994, Leslie E. and Bradley, T. 2001

Effects Analysis

Methodology and Scale

Recent (2008-2009) Aerial Detection Surveys and field visits were used to determine the levels of current mountain pine beetle and Douglas-fir beetle in the project analysis area. The analysis area used for insect and disease analysis was Compartment 112 and adjacent timber Compartments (113, 114 and 115). The timeframe for insect and disease analysis was the next 5-10 years because insect and disease epidemics are normally cyclical and it would be difficult to make meaningful projections beyond this timeframe.

Direct/Indirect/Cumulative Effects

The 2008-2009 Aerial Detection Surveys and field visits show moderate amounts of mountain pine beetle activity within timber Compartment 112 and adjacent timber Compartments (113, 114 and 115). These surveys also note Douglas-fir mortality in small pockets at the lower elevations within these compartments. Much of the mortality from the Douglas-fir beetle (from 5 to 15 trees per pocket) is likely the result of recent years of drought conditions and increased temperatures that occurred throughout much of this part of the United States. Douglas-fir bark beetle activity is currently low within the project area, but is apparently on the increase with several 'pockets' of recent killed Douglas-fir (over 15" dbh) scattered the East Boulder drainage.

Within those stands in the East Boulder project area that contain lodgepole pine and/or larger Douglas-fir, no action (Alternative 1), would moderately increase the chances that many additional trees in this area would be killed by the mountain pine beetle or Douglas-fir beetle within the next 5 to 7 years. If large numbers of trees are killed, most of these dead trees would be left to accumulate as additional fuel loadings that would elevate the risk and likely intensity of a future wildfire in the East Boulder Corridor.

It would be expected that the two action alternatives (Alternatives 2 & 3) would better reduce the incidence of potential insect damage in the immediate area of those units being treated (local scale). Reducing forest area densities to a maximum of 80 sq.ft. of basal area per acre (as is prescribed with the East Boulder Project) for both Douglas-fir and lodgepole pine stands, documented evidence indicates that insect damage is often

severely curtailed. In an area that is just beginning to see mountain pine beetle and Douglas fir mortality, which lies within a state where state-wide mortality levels have been at near all time highs, it seems prudent to anticipate and attempt to reduce the effects of insect mortality by lowering forest stand densities. Alternative 3 will thin approximately 240 more acres than Alternative 2 (or around 36% more acres when compared to Alternative 2).

At a much broader scale, Compartment 112 for instance (112 has around 10,800 forested acres), the treatment of around 900 acres amounts to approximately 8% of the area while the treatment differences between Alternative 2 and Alternative 3 amount to just over 2%. The scale of the project is small enough that little in the way of reducing a projected outbreak of mountain pine beetle is likely within the greater East Boulder drainage. However, along and near the main East Boulder road, and where the majority of proposed units are planned, moderate levels of protection from these two beetles can be expected for many years with implementation of either Alternative 2 or 3.

Cumulative effects would be based on the additional small areas of possible future harvest (either by thinning or even-age harvesting where most of the forest is removed on private land) and past harvests. Little in the way of reducing a projected outbreak of mountain pine beetle is likely within the greater East Boulder drainage. However, along and near the East Boulder Road, and where the majority of proposed units are planned, moderate levels of protection from these two beetles can be expected for many years with implementation of either Alternative 2 or 3.

The complete analysis/discussion for insect and disease can be found in the specialist report located in the Project File.

Compliance with Laws, Regulations, and Forest Plan Direction

Gallatin Forest Plan-Forest Management Direction, Objectives, h. Timber: Emphasis will be placed on the harvest of lodgepole pine stands infested or the potential of infestation by the mountain pine beetle.

Gallatin Forest Plan-Appendix A. I. Criteria for Selecting Preferred Silvicultural System: The system should develop stand conditions required to meet management area goals over the longest possible time. The system should permit enough control of competing vegetation to allow establishment of an adequate number of trees growing at acceptable rates. The system should promote stand structures, compositions and conditions that minimize damage from pest organisms, animals, wind and fire.

s. Sensitive Plants

Affected Environment

Forest Service Manuals (FSM 2670) provide policy under which Forest Service projects are designed to maintain viable populations of sensitive species and to ensure that those species do not become threatened or endangered due to Forest Service actions. As part of the National Environmental Policy Act (NEPA) decision-making process, proposed Forest Service programs or activities are to be reviewed to determine how an action would affect any sensitive species (FSM 2670.32). There are currently nineteen plant species designated as sensitive on the Gallatin National Forest.

Effects Analysis

Methodology and Scale

Impacts of the proposed actions to sensitive plant species were first evaluated by assessing whether suitable habitat exists within the immediate project area to be affected. Surveys and monitoring for sensitive plant species have occurred on the Gallatin NF since 1988 and include basic inventories conducted by qualified individuals to determine species distribution across the forest. Surveys were conducted in the summer of 2009 in all of the potential treatment units to determine presence of sensitive plants.

Direct/Indirect/Cumulative Effects

Surveys within the proposed treatment areas determined that there is some potential habitat for 5 species within the proposed treatment areas: Small-flowered columbine (Aquilegia brevistyla), small yellow lady's slipper (Cyoripedium calceolus var. parviflorum), Northern rattlesnake plantain (Goodyera repens), Hall's Rush (Juncus Hallii), California false hellborine (Veratrum californicum). Two populations of Beaked spikerush (*Eleocharis rostellata)* were found in poorly drained bogs along the fringes of two fairly large ponds that lie along the east edge of Section 11, which is located to the east of proposed treatment Unit 18. These areas were already purposely excluded from Unit 18 because they were determined to be too wet for any ground disturbing activities. No other similar or suitable habitat for populations of beaked spikerush was found in any areas proposed for treatment. All of the above-mentioned species were targeted during field surveys. No sensitive plants were found in any of the proposed treatment areas. The Regional Forester for Region 1 recently released an updated sensitive species list for wildlife, fish, and plants that will become effective on May 27, 2011. No new sensitive plants were added to the list for the Gallatin National Forest.

It is highly unlikely that any of the vegetation treatments associated with any of the alternatives would have any direct, indirect, or cumulative effects, nor would they negatively affect any sensitive plant populations. Mitigation designed for this project states "In the event that sensitive plant species are found in any affected area, measures will be taken to protect them. If these measures are not adequate to provide protection, the Forest Service may cancel or modify units within the fuel reduction project." Therefore, it is unlikely that implementation of any of the action alternatives would affect sensitive plants.

Potential habitat and surveys were considered to determine that vegetation treatments, weed treatments, pile burning, construction and rehabilitation of temporary roads and/or maintenance of existing roads combined with any past, current, or reasonably foreseeable activity would not result in detrimental effects to sensitive plant species or their habitat. No sensitive plants are known to exist within any of the treatment areas and mitigation has been incorporated into project design to protect any sensitive plant populations that may be found in the future; therefore, there would be *"no impact*" on sensitive plant species suspected or known to occur on the Gallatin National Forest and this issue will not be further addressed. A detailed sensitive plant discussion/analysis, as well as copies of the surveys conducted can be found in the specialists report located in the Project File.

Compliance with Laws, Regulations, and Forest Plan Direction

The National Forest Management Act (NFMA) of 1976 requires that the US Forest Service maintain sufficient habitat to sustain viable populations of native species (see 4 below). All of the alternatives will comply with NFMA requirements.

Forest Service Manual (FSM 2670) provides policy under which Forest Service projects are designed to maintain viable populations of sensitive species. Sensitive species are those animal and plant species identified by the Regional Forester for which population viability is a concern as evidenced by a significant current or predicted downward trend in population numbers, density, or in habitat capability that will reduce a species' existing distribution (FSM 2670.5.19). Protection of sensitive species and their habitats is a response to the mandate of the National Forest Management Act (NFMA) to maintain viable populations of all native and desired non-native vertebrate species (36 CFR 219.19).

In accordance with the **Gallatin Forest Plan**, a biological evaluation (BE) must be completed prior to implementation of activities that have the potential to affect sensitive species. As part of Forest Service Region 1 streamlining policy (August 17, 1995), we are no longer required to produce a "stand alone" biological evaluation for sensitive species. Affects of the proposal to sensitive species are therefore only disclosed in this section.

t. Economics/Mine

Affected Environment

NEPA requires that consequences to the human environment be analyzed and disclosed. The extent to which these environmental factors are analyzed and discussed is related to the nature of public comments received during scoping. NEPA does not require a monetary benefit-cost analysis. If an agency prepares an economic efficiency analysis, then one must be prepared and displayed for all alternatives (40 CFR 1502.23).

Effects Analysis

Methodology and Scale

A project feasibility analysis was used to determine if the project is feasible-would sell given current market conditions. The Region 1 Transaction Evidence (TE) apparaisal model was used to estimate project feasibility. The TE uses a regression analysis of recently sold timber sales to predict bid prices. The project is considered to be feasible if the predicted high bid value exceeds the base rates. For this project both Alternatives 2 & 3 have predicted high bids well in excess of the base rates.

OMB circular A-94 promotes efficient resource use through well-informed decision-making by the Federal Government. It suggests agencies prepare an efficiency analysis as part of project decision-making. It prescribes present net value (PNV) as the criterion for an efficiency analysis.

The economic impacts analysis calculated the jobs and labor income associated with the harvesting and processing of the timber products and fuel reduction piling and burning activities, such as best management proactive road maintenance, slash disposal, weed

spraying, and monitoring. Timber products harvested from the proposed project and the forestry activities would have direct and indirect effects on local jobs and labor income.

Changes in timber market values since the original analyses were examined in March of 2011. This was done to determine if any measureable change in the potential sale value had occurred since the original analysis was completed in October of 2009. Our examination revealed that there was no significant difference in timber values that would require additional economic analyses at this time.

Direct/Indirect/Cumulative Effects

The PNV is one indicator for comparing the financial efficiency between alternatives. PNV is the difference between the present value of the revenues and present value of the costs. PNV converts costs and revenues over the entire time frame of the project into a single figure for a selected year. A positive PNV means that the project would generate more revenues than expenses. Costs for sale preparation, sale administration and ecosystem restoration (including mandatory weed monitoring and treatment) are included. Some of these costs are incorporated in the predicted high bid. Remaining costs are displayed in Table 36 below.

Table 36-Ecosystem Restoration Expenditures Over a Five-year Period (2006 dollars)

Restoration Activity	Alternative 1	Alternative 2	Alternative 3
REVENUES			
Predicted High Bid ($)	0	$180,424.96	$258,496.00
Indicated Advertised Rate ($)	0	$18,094.08	$21,546.24
RESTORATION ACTIVITIES			
Weeds monitoring and Treatments	0	$25,000.00	$27,500.00
Treatment of Sub merchantable Timber & Fuels (Pile & Burn)	0	$77,055.00	$77,055.00

The expected revenue for each alternative is the corresponding predicted high bid from the transaction evidence appraisal equation multiplied with the estimated volume. The PNV was calculated using Quicksilver, a program for economic analysis of long-term, on-the-ground resource management projects. A four percent discount rate (exclusive of inflation) was used over the five-year project lifespan (2011-2015).

Table 37 summarizes the project feasibility and financial efficiency for each alternative. Because all costs of the project are not related to the timber sale, two PNV's were calculated. The PNV's include the following:

- PNV(1) - Includes the total revenue (predicted high bid times the volume) and all Forest Service costs associated with the timber harvest (e.g. sale preparation and sale administration) and mandatory weed monitoring and treatment.
- PNV(2) - Includes all revenues and costs associated with the timber harvest (PNV1) plus ecosystem restoration activities proposed to be accomplished that are non-timber harvest related by alternative.

The restoration activities proposed may be accomplished with funds generated from the timber sale in accordance with Forest Service Handbook (FSH) 2409.19 Chapter 60 - Stewardship Contracting and/or cooperator contributions.

Table 37-Project Feasibility & Financial Efficiency Summary (2009 dollars)

Category	Measure	Alternative 1	Alternative 2	Alternative 3
Timber Harvest Information	Acres Harvested	0	485	730
	Volume Harvested (ccf)	0	3,968	5,792
	Base Rates ($/ccf)	0	$6.00	$6.00
	Predicted High Bid Rate ($/ccf)	0	$45.47	$44.63
	Predicted High Bid Total Revenue	0	$180,424.96	$258,496.00
Timber Harvest & Required Design Criteria	PNV(1)	0	$108,170.37	$171,959.97
Timber Harvest & Restoration Activities	PNV(2)	0	$31,115.37	$94,904.97

In order to estimate jobs and labor income associated with the timber harvest, we assumed that 98% of saw log material for Alternatives 2 and 3 would be processed by the sawmill and planning sector, and the limited remaining volume would be processed as pulp and paper.

Table 38 displays both direct and total estimates for employment (part and full-time) and labor income that may be attributed to each alternative. Since the expenditures occur over a five-year period, the estimated impacts of jobs and labor income would be spread out over the life of the project. Most of the timber harvest and wood processing jobs would occur over the first two years of the project, and the economic impacts related to the forestry activities would be spread across the five-year life of the project. It is important to note that these are not new jobs or income, but rather jobs and income that can be attributed to this project.

Table 38-Total Employment and Labor Income (2008 dollars)

Analysis Item	Alt 1	Alt 2	Alt 3
Direct Employment	0	18	24
Total Employment	0	27	37
Direct Labor Income ($000)	0	$624	$867
Total Labor Income ($000)	0	$980	$1,378

Both of the action alternatives would show a positive value for the harvest of timber. Market benefits that would occur as a result of the proposed activities include increases in forest productivity and value for the remaining trees by eliminating competitive stress and reducing the risk of growth limiting insect attack. Positive timber revenues may be re-invested to complete restoration projects thus meeting the Purpose and Need for the project and achieving land management goals. Restoration items will be prioritized and accomplished as revenue is made available from the timber sale. Additional funds for ecosystem restoration projects may also be obtained from cooperators, and agency funds.

With Alternative 1, the No Action Alternative, no timber harvest, natural fuels reduction, or road improvement would occur. The public would incur no costs, nor realize any benefits of timber harvest in this area.

Results of the economic analysis completed for the project indicate that economic feasibility of the project is not a key issue and can be dismissed. See the Economics discussion/analysis in the specialists report located in the Project File.

Compliance with Laws, Regulations, and Forest Plan Direction

Economic and social analyses are described in **Forest Service Manual (FSM) 1970.** This guidance considers costs, benefits, and effects of proposed actions on the public. It also considers economic efficiency, along with other factor, in making decisions and in implementing and reviewing projects, programs and budgets.

Forest Service Handbook (FSH) 1909.17 - Economic and Social Analysis, Chapter 10, measures costs and outputs to consider for economic efficiency, ranking for alternatives.

Forest Service Manual (FSM) 2420 - Commercial Timber Sales, provides direction for preparing a financial and if necessary, economic analyses to verify the feasibility of a timber sale.

Forest Service Handbook (FSH) 2409.18 - Timber Sale Preparation Handbook, directs a financial efficiency to be included in the timber sale preparation process.

Forest Service Handbook (FSH) 2409.19 Chapter 60 - Stewardship Contracting, provides direction for applying revenues generated from timber sales to achieve restoration and land management activities.

The Gallatin Forest Plan (page II-1) directs the Forest to "Provide a sustained yield of timber products and improve the productivity of timber growing lands."

u. Heritage Resources

Affected Environment

The Forest Service Heritage Resource Program is responsible for managing cultural resources to prevent loss or damage before they can be evaluated for scientific study, interpretive efforts, or other appropriate uses. This requires projects to be implemented in a manner that avoids adverse effects on historic properties. Project design should ensure that the essential form and integrity of historic properties is not impaired. If the potential for adverse effects cannot be avoided, appropriate mitigation treatments are determined in accordance with 36 CFR 800.5. Where a project has the potential to impact a property of Tribal concern, the Forest Service will consult with Tribal representatives to develop appropriate mitigation measures.

Effects Analysis

Methodology and Scale

When a project is proposed on the Gallatin National Forest, heritage program specialists participate in its planning and in the analysis of potential project effects. This participation consists of: 1) reviewing historical materials, archival documents, and overviews relevant to the project area; 2) analyzing the nature of the project and its potential to affect cultural resources; 3) reviewing public concerns regarding the project and its potential effect; and 4) consulting with interested Tribes, heritage interest groups, and the Montana State Historic Preservation Office. In the process, the heritage specialist determines the project's "area of potential effect" (APE) based on the geographic area in which a project may alter the character or use of any existing historic properties.

Based on this information, heritage specialists determine whether existing cultural resource data is adequate to complete the environmental analysis and disclose potential effects on cultural resources. If the information is insufficient, additional research and/or inventory will be undertaken. Where additional inventory is needed, heritage personnel design a survey strategy to locate all prehistoric/historic properties within the APE. This strategy is designed in accordance with the criteria defined in the "Site Identification Strategy" (SIS), for the Gallatin, Helena, Custer, and Lewis and Clark National Forests. If a survey discovers previously unknown cultural resources, those resources are recorded and their National Register eligibility status determined in consultation with the Montana State Historic Preservation Office (MTSHPO). Both background research and fieldwork are documented in a report submitted to the MTSHPO. The heritage program manager consults with MTSHPO to determine the nature of the project's effects on significant properties. If needed, the heritage program manager and MTSHPO work together to determine appropriate project redesign, restrictions, designation of sensitive areas, or mitigation measures. The heritage program manager coordinates recommendations, actions, and monitoring with the project leader, MTSHPO, and interested Tribal preservation officials.

A project is determined to affect a prehistoric/historic property when project activities alter the characteristics that qualify the property for inclusion in the National Register of Historic Places (NRHP). In determining the effect, alteration to features of the property's location, setting, or use may be relevant, depending on the property's significant characteristics. An "adverse effect" results when the project may diminish the integrity of a prehistoric/historic property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects include (but are not limited to): physical destruction, damage, or alteration of all or part of the property; isolation of the property from its setting; alteration of the setting's character when that character contributes to the property's National Register eligibility; introduction of visual, audible, or atmospheric elements out of character with the property or its setting; and neglect of a property resulting in its deterioration or destruction (National Register Bulletin #15; How to Apply the National Register Criteria for Evaluation, US Dept. of Interior, National Park Service, rev. ed., 1995).

Within the East Boulder Fuels Reduction Project boundary, all areas that are considered "moderate-to-high probability for cultural resource occurrence" were surveyed by a qualified archaeologist on the 8th and 20th of July 2009. The area was previously surveyed in 1981 and 1982. Five cultural sites were known to exist within the treatment area boundaries and no new sites were found. All five of the sites have been evaluated, and are considered eligible for listing on the National Register of Historic Places.

Direct/Indirect/Cumulative Effects

Areas where sites occur in Unit 1 section 29, Unit 3 section 32, and Unit 18 section 11 would be treated utilizing tractor harvesting methods. An archaeologist and the sale administrator would properly flag off the known site before work would begin in the site vicinity such that the site would be avoided by any ground disturbing activities. The fuel reduction actions can easily be completed and still avoid the site as long as the operators and sale administrator know where the site is located. Mitigation to protect heritage resources would also include identification of landing areas and skid trails specifically outside of the heritage site(s) locations. If any additional heritage sites are encountered during the treatment activities, then disturbing actions would be halted immediately and an archaeologist contacted.

Unit 2 section 32, where another site is located, would consist of hand treatment that would only salvage, pile, and burn downed materials to get rid of debris, without using any heavy equipment. Unit 11A section 3 would also have hand treatments and no heavy equipment would be used. In these areas, the sites would be flagged off, and hand piles to be burned would be located away from the sites.

The proposed actions associated with Alternatives 2 & 3 could be completed without any direct, indirect, or cumulative effects to heritage resources if mitigation outlined on pp. 2-36 is implemented. Following these mitigations would protect existing sites and would allow for modification of the project, should any new sites be found, thus allowing for dismissal of the heritage resource issue. See heritage discussion/analysis in the specialists report located in the Project File.

Compliance with Laws, Regulations, and Forest Direction

The primary legislation governing modern heritage resource management is the **National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and**

1992). All other heritage resource management laws and regulations support, clarify, or expand on the **National Historic Preservation Act. Federal Regulations 36 CFR 800 (Protection of Historic Properties), 36CFR 63 (Determination of Eligibility to the National Register of Historic Places), 36 CFR 296 (Protection of Archaeological Resources) and Forest Service Manual 2360 (FSM2360)** provide the basis of specific Forest Service heritage resource management practices. These laws and regulations guide the Forest Service in identifying, evaluating, and protecting heritage resources on national forest system lands. The Forest Service is required to consider the effects of agency actions on heritage resources that are determined eligible for the National Register of Historic Places (NRHP) or on heritage resources not yet evaluated for eligibility. Eligible Heritage Guidelines for Archaeology and Historic Preservation are also an important element of federal agencies' management of cultural resources on public lands.

Several other laws address various aspects of heritage resource management on national forests, including the **National Environmental Policy Act of 1969 (NEPA**), the **National Forest Management Act of 1976 (NFMA), the Antiquities Act of 1906, the Historic Sites Act of 1935, and the Archaeological Resource Protection Act of 1979, as amended in 1988 (ARPA)**. ARPA and two other regulatory acts describe the role of Tribes in the federal decision-making process, including heritage management. ARPA requires Tribal notification and consultation regarding permitted removal of artifacts from federal lands. The **Native American Graves Protection and Repatriation Act of 1990 (NAGPRA**) recognizes Tribal control of human remains and certain cultural objects on public lands and requires consultation prior to their removal. The American **Indian Religious Freedom Act of 1978 (AIRFA**) requires federal agencies to consider the impact of their actions on traditional Tribal cultural sites. The **National Historic Preservation Act (NHPA)** also specifically calls for Tribal participation in the NHPA Section 106 consultation process.

The Crow Tribal Nation located on the Crow Reservation, regards the Gallatin National Forest as an area of concern, and is consulted on all projects occurring on the Forest. Heritage and Tribal interests are regulated by federal laws that direct and guide the Forest Service in identifying, evaluating, and protecting heritage resources.

All of the alternatives in this analysis would comply with federal laws. The Gallatin Forest Plan tiers to these laws, therefore all of the alternatives would meet Forest Plan standards.

Chapter 4. Consultation and Coordination

The Public Involvement and Scoping Process

Public Notices and Outreach

The scoping letter for the East Boulder Fuels Reduction Project was sent to interested parties on April 10, 2009 (Mailing List, Project File). More than 90 scoping letters were mailed to private individuals, organizations, groups, businesses, media and elected officials that the Forest Service felt would potentially be interested in the project. The scoping letter provided a map and description of the project area and potential treatment units, the purpose and need for the project, and the types of treatments that were likely to occur. Specific methods of treatment for the units were not identified at that time. Ten groups or individuals responded to the scoping letter. A summary of scoping comments was created and all of these comments, as well as internal comments, were considered in determining potential issues and developing the actual treatment units that are associated with each of the action alternatives.

The Legal Notice for the East Boulder Fuel Reduction Project appeared in the Bozeman Chronicle (the paper of record) on January 29, 2010. An ad was also placed in the Big Timber Pioneer on January 29, 2010 inviting public comments on the project.

The original EA was released to the public on March 16, 2010 for a 30-day comment period, with three comment letters being received. A decision regarding the project, a finding of no significant impacts (FONSI), and responses to the EA comment letters were released on June 4, 2010 for a 45 day appeal period. Two appeals to the decision were filed in late July 2010. Appeal transmittal letters were prepared and the project was reviewed by the Regional appeal panel. On August 27, 2010 the decision was withdrawn by the responsible official, Yellowstone District Ranger Archuleta. His reasons for withdrawing the decision are as follows "In light of recent court decisions relative to Management Indicator Species, the relisting of the Gray Wolf, and intricacies of meeting big game hiding cover standards, I want to evaluate the wildlife analysis for the project". After the evaluation was complete Ranger Archuleta made the decision that additional analysis was necessary and that the Forest Service should prepare a Revised Environmental Assessment (EA). This Revised EA is being released to those who showed interest in the original EA, live in the project area, or have asked to be included on the mailing list. There will be another 30-day public comment period, with these additional comments being thoroughly considered before a new decision regarding the project will be made.

The East Boulder Fuels Reduction Project was identified on the Gallatin National Forest NEPA Quarterly Project Listings from spring 2008 through spring 2011 and is available to the general public on the Gallatin National Forest website.

Chronology of Public Participation Activities

Collaboration with Sweet Grass County officials, Big Timber city officials, local fire departments, East Boulder Mine officials, BLM, local businesses, adjacent private landowners, recreationists, and other interested public has been and will continue to be important in the development of the East Boulder Fuels Treatment Project. The proposal

was developed with input from adjacent private homeowners, as well as state, county, and local officials. Public meetings and field trips have been held with the Forest Service providing information and updates regarding the proposed project on National Forest System lands.

A listening session was held at the Big Timber office of the Yellowstone Ranger District on February 11, 2009. Local business representatives, city officials, county officials, fire department members, and local environmental group representatives that had previously expressed interest in helping to develop the East Boulder Fuel Reduction Project proposal were invited. In attendance were representatives from the Stillwater Mining Company (East Boulder Mine), Big Timber Volunteer Fire Department, Boulder Watershed Association, RY Timber, and local environmental groups. The Forest Service also presented the same information later that day to members of the Cottonwood Resource Council (a local environmental group) at their monthly meeting asking for their ideas and input reading the project.

An open house regarding the project was held at the Big Timber office of the Yellowstone Ranger District on March 18, 2009 to discuss the initial hazardous fuel reduction proposal. Notice of this meeting was posted as a Legal Notice in the Bozeman Daily Chronicle on Wednesday, February 25, 2009 and in the Big Timber Pioneer on Thursday February 26, 2009. The meeting, facilitated by the District Ranger and IDT members, was attended by a representative from the Big Timber Pioneer, Sweet Grass County Commissioners, and some of the adjacent private landowners. The initial proposal was presented and discussed with the attendees. Ideas from this meeting were utilized in drafting the project proposal that went out for public scoping.

Public field trips have been and still are available to anyone wanting to review the various activities associated with the alternatives for this project. The intention is to provide the interested public with an on the ground opportunity to comment on various aspects of the proposed project.

Agencies, Organizations, and Individuals Contacted

Listed below are those agencies, tribes, elected officials, media, and organizations who either received the 4/10/2009 scoping letter, provided consultation, were involved via other outreach processes, or who provided scoping comments. In addition to those listed below, there were numerous individuals, and small businesses that received the scoping document. Locations are in Montana unless indicated otherwise.

Federal Agencies

Bureau of Land Management; Billings
NRCS; Big Timber
Rural Areas Development Commission; Bozeman
US Environmental Protection Agency; Helena
US Fish and Wildlife Service, Helena

State Agencies

Farm Bureau; Big Timber
MT Department of Natural Resources and Conservation; Billings, Bozeman, Columbus
MT Fish, Wildlife and Parks; Big Timber

City Agencies

Big Timber Fire Department, Big Timber

County Agencies

Park County Department of Environmental Services; Livingston
Park County Rural Fire Department; Livingston
Park County Conservation District; Livingston
Sweet Grass County Department of Emergency Services; Big Timber
Sweet Grass Extension Agent; Big Timber
Sweet Grass County Road Department; Big Timber
Sweet Grass County Department of Environmental Services; Big Timber
Sweet Grass County Volunteer Fire Dept; Big Timber
Sweet Grass County Weed Supervisor; Big Timber

American Indian Tribes

Crow Tribal Council; Crow Agency
Shoshone-Bannock Tribes; Fort Hall, ID

Elected Officials

Max Baucus; MT State Senator; Bozeman
Jon Tester; MT State Senator; Bozeman
Big Timber Mayor; Big Timber
Denny Rehberg; MT State Representative, Billings
Park County Commissioners
Park County Sheriff; Livingston
Sweet Grass County Commissioners; Big Timber
Sweet Grass County Sheriff; Big Timber

Media

Bozeman Daily Chronicle; Bozeman
Big Timber Pioneer; Big Timber

Organizations

Aliance for the Wild Rockies; Helena
American Wildlands; Bozeman
Boulder River Fuels Reduction Co-operative, Big Timber
Boulder River Watershed Association, Big Timber
Cottonwood Resource Council; Big Timber
Crazy Mountain Stockgrowers; Big Timber
Ducks Unlimited; Big Timber
Greater Yellowstone Coalition; Bozeman
Greater Yellowstone Coordinating Committee; Bozeman
MT Wilderness Association, Helena, Butte
Native Ecosystems Council; Willow Creek
Park County Environmental Council, Livingston
Rifle and Pistol Club, Big Timber
Sweetgrass County Wool Growers; Big Timber
Trout Unlimited Madison/Gallatin Chapter; Bozeman

Wilderness Society; Bozeman

Mining, & Wood Products Companies

Montana Wood Product Assn; Helena
RY Timber, Livingston, Townsend
Stillwater Mining Company, Big Timber, Columbus

List of Preparers

The Forest Service Employees listed in Table 39 below comprise the Interdisciplinary Team that conducted the Environmental Analysis and prepared the disclosure document for the project.

Table 39-List of Preparers

Name	Responsibility
Ron Archuleta	District Ranger Responsible Official/Decision Notice
Barb Ping	Interdisciplinary Team Leader Writer/Editor/Sensitive Plant Species
Lauren Oswald	Deputy District Ranger
Greg Juvan	Fuels
Sally Orr Chauntelle Rock	Noxious Weeds
Mark Story	Hydrology/Air Quality
Frank Cifala Lauren Oswald	Recreation/Roadless/Visual Quality/Special Uses
Steve Schacht	Economics
Rachel Feigley Steve Schacht	Sensitive Species/MIS Species/
Bev Dixon Rachel Feigley	T&E Species/Winter Range/Snags/ Migratory Birds
Steve Martell Jonathan Kempff	Transportation System
Mark Novak	Vegetation/Old Growth/Insect & Disease
Justin Moschelle	Cultural Resources
Tom Keck	Soils
Scot Shuler	Fisheries
Nate Motzko	Unit Design/GIS Maps
Steve Swain	GIS Maps
Karen Tuscano	Public Information Officer

Distribution and Review of the EA

Distribution

A legal notice was published in the Bozeman Daily Chronicle (the paper of record), stating that the Revised EA for the East Boulder Fuel Reduction Project was available for public review and comment. Copies of the April 2011 Revised EA were mailed to persons, groups, local governments, and agencies that previously expressed interest in the project. The mailing list was compiled using names and addresses from the following sources:

- Parties who requested to have their names placed on the mailing list for the project
- Parties who have submitted written comments to date in the process
- Agencies and groups consulted during preparation of the EA
- Private property owners in the immediate project area

Review

Copies of this Revised EA can be obtained or viewed at the following locations:

- Bozeman Ranger District Office, Bozeman, MT
- Yellowstone Ranger District, Big Timber Office, Big Timber, MT

Copies of the document are also available from the following address:

USDA-Forest Service
c/o Barbara Ping
IDT Leader/Writer/Editor
Bozeman Ranger District
3710 Fallon St. Suite C
Bozeman, Montana 59718
(406)-522-2558

Appendix A-BMP's

Best Management Practices

Introduction

Best Management Practices are the primary mechanism to enable the achievement of water quality standards (Environmental Protection Agency 1987). This Appendix: 1) describes the Forest Service's BMP process in detail; 2) lists the key Soil and Water Conservation Practices (SWCP) that have been selected to be used in the Gallatin; and 3) describes each SWCP that will be refined for site-specific conditions in order to arrive at the project level BMPs that protect beneficial uses and meet water quality objectives.

BMPs include, but are not limited to, structural and nonstructural controls, operations, and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR 130.2, EPA Water Quality Standards Regulation). Usually BMPs are applied as a system of practices rather than a single practice. BMPs are selected on the basis of site-specific conditions that reflect natural background conditions and political, social, economic, and technical feasibility.

The Gallatin National Forest Plan states that "Soil and water conservation practices as outlined in the Soil and Water Conservation Practices Handbook (FSH 2509.22, May 1988) will be incorporated into all land use and project plans as a principal mechanism for controlling non-point pollution sources; meeting soil and water quality goals; and to protect beneficial uses. Activities found not in compliance with the soil and water conservation practices or State standards will be brought into compliance, modified, or stopped." (FP, p. II-23). Montana State Water Quality Standards require the use of Reasonable Land, Soil, and Water Conservation Practices (analogous to BMPs) as the controlling mechanism for non-point pollution. Use of BMPs is also required in the MOU between the Forest Service and the State of Montana as part of our responsibility as the Designated Water Quality Management Agency on National Forest System (NFS) lands.

The Practices described herein are tiered to the practices in FSH 2509.22 and include the Montana Forestry BMP's which were updated by Montana DNRC in 2004 and used in the Montana Forestry BMP audit process. They were developed as part of the NEPA process, with interdisciplinary involvement, and meet Forest and State water quality objectives.

BMP Implementation Process

In cooperation with the State of Montana, the USDA Forest Service's primary strategy for the control of non-point sources is based on the implementation of preventive practices (BMPs) determined necessary for the protection of the identified beneficial uses.

The Forest Service Non-point Source Management System consists of:

1. BMP selection and design based on site-specific conditions; technical, economic and institutional feasibility; and the designated beneficial uses of the streams.

2. BMP Application.
3. BMP monitoring to ensure that they are being implemented and are effective in protecting designated beneficial uses.
4. Evaluation of BMP monitoring results.
5. Feeding back the results into current/future activities and BMP design.

The District Ranger is responsible for ensuring that this BMP feedback loop is implemented on all projects.

A. **BMP Selection and Design.** Water quality goals are identified in Forest Plans. These goals meet or exceed applicable legal requirements, including State water quality regulations, the Clean Water Act, and the National Forest Management Act. Environmental assessments for projects are tiered to Forest Plans, using the NEPA process. Appropriate BMPs are selected for each project by an interdisciplinary team.

   BMP selection and design are dictated by water quality objectives, soils, topography, geology, vegetation, and climate. Environmental impacts and water quality protection options are evaluated and alternative mixes of practices are considered. A final collection of practices are selected that not only protect water quality but meet other resource needs. These final selected practices constitute the BMPs.

B. **BMP Application.** The BMPs are translated into contract clauses, special use permit requirements, project plan specifications, and so forth. This ensures that the operator or person responsible for applying the BMP actually is required to apply it. The site-specific BMP prescriptions are taken from plan-to-ground by a combination of project layout and resource specialists (hydrology, fisheries, soil, geology, etc.). This is when final adjustments to fit the BMP prescriptions to the site are made before implementing the resource activity.

C. **BMP Monitoring**. During project activities (ex., timber harvest or road construction), timber sale administrators, engineering representatives, resource specialists, and others ensure that the BMPs are implemented according to plan. BMP implementation monitoring is done before, during, and after resource activity implementation. This monitoring answers the question: Did we do what we said we were going to do? Once BMPs have been implemented, further monitoring is done to evaluate if BMPs are effective in meeting management objectives and protecting beneficial uses of water. State water quality standards, including the beneficial uses, will serve as one evaluation of the criteria for the sale.

D. **BMP Monitoring Evaluation**. The technical evaluation/monitoring described above will determine how effectively BMPs protect and/or improve water quality. Water quality standards and conditions of the beneficial uses of water will serve as one-evaluation criteria. If the evaluation indicates that water quality standards are not being met and/or beneficial uses are not being protected, corrective action will consider the following three components:

- The BMP: Is it technically sound, properly designed, and effective? Is it really best, or is there a better practice, which is technically sound and feasible to implement?
- The implementation program or processes: Was the BMP applied entirely as designed? Was it only partially implemented? Was it properly designed? Were personnel, equipment, funds, or experience lacking with a result of inadequate or incomplete implementation?
- The water quality criteria: Do the parameters and criteria used for effects evaluation adequately reflect human induced changes to water quality and beneficial uses?

E. **Feedback.** Feedback of the results of BMP evaluation is both short- and long-term in nature. Where corrective action is needed, immediate response will be undertaken. This action may include: modification of the BMP, modification of the activity, or ceasing the activity. Cumulative effects over the long-term may also lead to the need for possible corrective actions.

I. Definitions

II. "**Hazardous or toxic material**" means substances which by their nature are dangerous to handle or dispose of, or a potential environmental contaminant, and includes petroleum products, pesticides, herbicides, chemicals, and biological wastes.

III. "**Stream,**" as defined in 77-5-302(7), MCA, means a natural watercourse of perceptible extent that has a generally sandy or rocky bottom or definite banks and that confines and conducts continuously or intermittently flowing water.

IV. "**Streamside Management Zone (SMZ)"** or "zone" as defined at 77-5-302(8), MCA means "the stream, lake, or other body of water and an adjacent area of varying width where management practices that might affect wildlife habitat or water quality, fish, or other aquatic resources need to be modified." The streamside management zone encompasses a strip at least 50 feet wide on each side of a stream, lake, or other body of water, measured from the ordinary high water mark, and extends beyond the high water mark to include wetlands and areas that provide additional protection in zones with steep slopes or erosive soils.

V. **"Wetlands**" mean those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include marshes, swamps, bogs, and similar areas.

VI. **"Adjacent wetlands"** are wetlands within or adjoining the SMZ boundary. They are regulated under the SMZ law.

VII. **"Isolated wetlands"** lie within the area of operation, outside of the SMZ boundary, and are not regulated under the SMZ law.

II. Streamside Management

The Streamside Management Law (77-5-301 through 307 MCA) provides minimum regulatory standards for forest practices in streamside management zones (SMZ). The "Montana Guide to the Streamside Management Zone & Rules" is an excellent information source describing management opportunities and limitations within SMZs.

III Roads

A. Planning and Location

1. Minimize the number of roads constructed in a watershed through comprehensive road planning, recognizing intermingled ownership and foreseeable future uses. Use existing roads, unless use of such roads would cause or aggravate an erosion problem.

2. Review available information and consult with professionals as necessary to help identify erodible soils and unstable areas, and to locate appropriate road surface materials.

3. Fit the road to the topography by locating roads on natural benches and following natural contours. Avoid long, steep road grades and narrow canyons.

4. Locate roads on stable geology, including well-drained soils and rock formations that tend to dip into the slope. Avoid slumps and slide-prone areas characterized by steep slopes, highly weathered bedrock, clay beds, concave slopes, hummocky topography, and rock layers that dip parallel to the slope. Avoid wet areas, including moisture-laden or unstable toe slopes, seeps, wetlands, wet meadows, and natural drainage channels.

5. Minimize the number of stream crossings and choose stable stream crossing sites.

6. Locate roads to provide access to suitable (relatively flat and well-drained) log landing areas to reduce soil disturbance.

B. Design

1. Properly design roads and drainage facilities to prevent potential water quality problems from road construction.
2. Design roads to the minimum standard necessary to accommodate anticipated use and equipment. The need for higher engineering standards can be alleviated through proper road-use management.
3. Design roads to balance cuts and fills or use full bench construction (no fill slope) where stable fill construction is not possible.
4. Design roads to minimize disruption of natural drainage patterns. Vary road grades to reduce concentrated flow in road drainage ditches, culverts, and on fill slopes and road surfaces.

C. Road Drainage

Road Drainage: Road Drainage is defined as all applied mechanisms for managing water in a non-stream crossing setting, road surface drainage, and overland flow; ditch relief, cross drains and drain dips) #

1. Provide adequate drainage from the surface of all permanent and temporary roads. Use outsloped, insloped or crowned roads, and install proper drainage features. Space road drainage features so peak flow on road surfaces or in ditches will not exceed capacity.
   a. Outsloped roads provide a means of dispersing water in a low-energy flow from the road surface. Outsloped roads are appropriate when fill slopes are stable, drainage will not flow directly into stream channels, and transportation safety can be met.
   b. In-sloped roads, plan ditch gradients steep enough, generally greater than 2% but less than 8%, to prevent sediment deposition and ditch erosion. The steeper gradients may be suitable for more stable soils; use the lower gradients for less stable soils.
   c. Design and install road surface drainage features at adequate spacing to control erosion; steeper gradients require more frequent drainage features. Properly constructed drain dips can be an economical method of road surface drainage. Construct drain dips deep enough into the subgrade so that traffic will not obliterate them.
2. Design all ephemeral draw culverts with adequate length to allow for road fill width. Minimum culvert size is 15 inch. Install culverts to prevent erosion of fill, seepage and failure as described in V.C.4 and maintain cover for culverts as described in V.C.6.
3. Design all relief culverts with adequate length to allow for road fill width. Protect the inflow end of all relief culverts from plugging and armor if in erodible soil. When necessary construct catch basins with stable side slopes. Unless water flows from two directions, skew ditch relief culverts 20 to 30 degrees toward the inflow from the ditch to help maintain proper function. #
4. Where possible, install culverts at the gradient of the original ground slope; otherwise, armor outlets with rock or anchor downspouts to carry water safely across the fill slope.
5. Provide energy dissipaters (rock piles, slash, log chunks, etc.) where necessary to reduce erosion at outlet of drainage features. Crossdrains, culverts, water bars, dips, and other drainage structures should not discharge onto erodible soils or fill slopes without outfall protection.
6. Prevent downslope movement of sediment by using sediment catch basins, drop inlets, changes in road grade, headwalls, or recessed cut slopes.*
7. Route road drainage through adequate filtration zones or other sediment-settling structures to ensure sediment doesn't reach surface water. Install road drainage features above stream crossings to route discharge into filtration zones before entering a stream.

D. Construction (see also Section IV on stream crossings)

1. Keep slope stabilization, erosion and sediment control work current with road construction. Install drainage features as part of the construction process, ensuring that drainage structures are fully functional. Complete or stabilize road sections within same operating season.*
2. Stabilize erodible, exposed soils by seeding, compacting, riprapping, benching, mulching, or other suitable means.
3. At the toe of potentially erodible fill slopes, particularly near stream channels, pile slash in a row parallel to the road to trap sediment (example, slash filter windrow). When done concurrently with road construction, this is one method that can effectively control sediment movement, and it can also provide an economical way of disposing of roadway slash. Limit the height, width and length of "slash filter windrows" so wildlife movement is not impeded. Sediment fabric fences or other methods may be used if effective.
4. Minimize earthmoving activities when soils appear excessively wet. Do not disturb roadside vegetation more than necessary to maintain slope stability and to serve traffic needs.
5. Construct cut and fill slopes at stable angles to prevent sloughing and other subsequent erosion.
6. Avoid incorporating potentially unstable woody debris in the fill portion of the road prism. Where possible, leave existing rooted trees or shrubs at the toe of the fill slope to stabilize the fill.
7. Consider road surfacing to minimize erosion.
8. Place debris, overburden, and other waste materials associated with construction and maintenance activities in a location to avoid entry into streams. Include these waste areas in soil stabilization planning for the road.
9. Minimize sediment production from borrow pits and gravel sources through proper location, development and reclamation.
10. When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety; avoid disturbing stable road surfaces. Prior to reconstruction of existing roads within the SMZ, refer to the SMZ law. Consider abandoning existing roads when their use would aggravate erosion.

E. Maintenance

1. Grade road surfaces only as often as necessary to maintain a stable running surface and adequate surface drainage.
2. Maintain erosion control features through periodic inspection and maintenance, including cleaning dips and crossdrains, repairing ditches, marking culvert inlets to aid in location, and clearing debris from culverts.
3. Avoid cutting the toe of cut slopes when grading roads, pulling ditches, or plowing snow.
4. When plowing snow, provide breaks in snow berm to allow road drainage.*

5. Haul all excess material removed by maintenance operations to safe disposal sites and stabilize these sites to prevent erosion. Avoid sidecasting in locations where erosion will carry materials into a stream.
6. Avoid using roads during wet periods if such use would likely damage the road drainage features. Consider gates, barricades or signs to limit use of roads during spring break up or other wet periods.
7. Upon completion of seasonal operations, ensure that drainage features are fully functional. The road surface should be crowned, outsloped, insloped, or water-barred. Remove berms from the outside edge where runoff is channeled.
8. Leave abandoned roads in a condition that provides adequate drainage without further maintenance. Close these roads to traffic; reseed and/or scarify; and, if necessary, recontour and provide water bars or drain dips.

IV Timber Harvesting and Site Preparation

A. Harvest Design

1. Plan timber harvest in consideration of your management objectives and the following*:
   a. Soils and erosion hazard identification.
   b. Rainfall.
   c. Topography.
   d. Silvicultural objectives.
   e. Critical components (aspect, water courses, landform, etc.).
   f. Habitat types.
   g. Potential effects on water quality and beneficial water uses.
   h. Watershed condition and cumulative effects of multiple timber management activities on water yield and sediment production.
   i. Wildlife habitat.
2. Use the logging system that best fits the topography, soil type, and season, while minimizing soil disturbance and economically accomplishing silvicultural objectives.
3. Use the economically feasible yarding system that will minimize road densities.
4. Design and locate skid trails and skidding operations to minimize soil disturbance. Using designated skid trails is one means of limiting site disturbance and soil compaction. Consider the potential for erosion and possible alternative yarding systems prior to planning tractor skidding on steep or unstable slopes.
5. Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturated, highly erosive, or easily compacted soils to a maximum of

35%. Use mitigating measures, such as water bars and grass seeding, to reduce erosion on skid trails.

6. Minimize the size and number of landings to accommodate safe, economical operation. Avoid locating landings that require skidding across drainage bottoms.
7. Implement the Revised Gallatin National Forest Soil Protection Guidelines for all ground-based activities. These are as follows:

Gallatin National Forest Revised Best Management Practices (BMP's) for Protecting Soil Resources (Keck 2009)

OBJECTIVE: Protect soil productivity and soil quality by limiting the extent of detrimental soil disturbance associated with ground based harvest systems on the Gallatin National Forest

EFFECTIVENESS: Moderate to High

JUSTIFICATION: The predominant sources of long term detrimental soil disturbance associated with timber harvests are temporary road construction, the construction and use of landings, and instances where poorly laid out timber sales result in excessive soil erosion. These disturbances pose the greatest threats to long term soil and site productivity. Revised Gallatin National Forest Best Management Practices (BMP's) are designed to minimize the most critical soil disturbances through proper timber sale design and by renovating critically impacted areas along temporary roads and at landings in a manner that fits the silvicultural prescription.

Tractor-based methods of timber harvest have the potential to cause significant soil disturbance. Past studies on the Gallatin National Forest have shown that the largest contributor of detrimental soil disturbance was dispersed ground-based harvesting using motorized, tracked or wheeled equipment (Shovic and Widner, 1991; Shovic and Birkland, 1992). Inconsistencies in the soil bulk density data reported in the 1992 report and the ad hoc criteria used to identify detrimental soil disturbance in both studies make exact interpretations of results from these studies difficult.

In addition, sites examined in the above studies were clearcut, burned, and scarified. Partial cutting proposed for fuels treatments will not create near the same level of soil disturbance. It does seem reasonable, however, that unfettered used of ground-based harvesting equipment and site scarification using a dozer blade can result in unnecessary levels of soil disturbance. Such practices are no longer used on the Gallatin National Forest.

Dispersed skidding practices using equipment with low ground pressure have been successfully used to harvest timber while limiting detrimental soil disturbance on Forests having deep layers of organic material and slash (broken branches). The protective layer in these instances ranges from 6 to 20 inches thick and is comprised of existing organic surface horizons plus slash from the harvest operation. This organic layer protects the soil surface from displacement and prevents compaction. Use of such thick organic mats to minimize disturbance during dispersed mechanical harvesting is considered a standard Best Management Practice (BMP) on many of the highly productive; west-side Forests in Region One (Shovic 2008)

Harvest activities on the Gallatin National Forest, in contrast, leave much less slash behind because trees are generally smaller and they are often more widely spaced than on more productive, west-side Forests. What soils on the Gallatin National Forest have is abundant rock fragments. Rock fragments in the soil, especially in surface horizons and on the surface, will provide a significant armoring effect that can limit detrimental soil disturbance even more effectively than thick organic matter layers.

Actual results depend on site specific conditions. The Soil Survey for the Gallatin National Forest reports 65 percent of the map units as having skeletal surface textures (>35% rock fragments in surface horizons) and 72% of the total acreage within the soil survey boundary as having skeletal surface textures (USDA 1996, Tables 2 and 5) for the Forest as a whole. Soil classifications (USDA 1996, Table 13) identify 71 percent of the soils on the Forest as being skeletal in the particle-size control section (that portion of the soil used to determine the family particle-size classification. As noted previously in this document and in the soil specialist report, nearly all soils in the East Boulder Fuels project area have abundant rock fragments.

Recent field observations of past timber sales in the Swan, Moose, and Portal Creek drainages (units 33E, 77A, 22, 108, and 22P) and Lewis Gulch in the East Bolder drainage indicate that disturbances on and off skid trails were healing relatively quickly on stable landscape positions. Exceptions occurred when skid trails were located on highly erodible landscape positions, or on unsuitable soils, or when major disturbances from dispersed skidding occurred in the same type of locations.

Despite armoring by rock fragments in many areas, Gallatin National Forest BMP's require a systematic skid trail pattern to be used during logging. Mechanical, ground-based skidding and harvesting equipment may be used off skid trails only to the degree necessary to harvest the available timber based on the soil administrator's judgment and only during favorable soil moisture conditions (see details below). An average skid trail spacing of 75 feet is required for all commercially harvested partial cuts, and 100 feet for clear cuts.

The level of compaction, detrimental or not, associated with the use of mechanical harvesting equipment depends in large part on soil moisture conditions and soil texture. Han et.al. 2006 studied the effects of multiple passes by harvesting equipment over loess derived, silt loam soils at three different water levels: low, medium, and high. Although three levels of water were applied, the resulting water content in the top 30 centimeters (12 inches) of soil was the same for the medium and high water treatments. Soil water contents in both the medium and high treatments were just below 30 percent moisture in the top 0-4 inches which is approximately the soil moisture level at field capacity for a silt loam. Soil moisture levels in the 4-8 inch and 8-12 inch depths were at approximately 25 percent for both the medium and high treatments which is somewhat below field capacity. Soil moisture in the low water treatment ranged from 10 to 15 percent or approximately ? to ½ field capacity.

Results from Han, et. al. (2006) show a limited increase in penetration resistance for the highly compactable, silt loam soil in the low moisture treatment from multiple equipment passes. Substantial increases in penetration resistance were recorded for the medium water treatment below the 2.5 cm (1 inch) depth. Revised soil best management practices for the Gallatin National Forest factor in both soil moisture and soil texture of the top 6 inches of soil through use of a simple field soil moisture estimation technique

(USDA-NRCS 2005) to determine when conditions are suitable for equipment use off skid trails, if needed to harvest the available timber. For fine textured soils, loams, clay loams, silt loams, silty clay loams, silty clays, and clays, the recommend soil moisture level is 50% of field capacity or less. For less compactable sandy loams, the recommended soil moisture level is 75% of field capacity or less. There are no soil moisture criteria for sands or loamy sands although some moisture in the soil may help minimize excessive soil disturbance in coarse soils.

Renovation of temporary roads and landings, the abundance of rock fragments in most soils, proper layout and spacing of temporary roads and skid trails, and the use of combined soil moisture and soil texture criteria for controlling the use of harvesting equipment off skid trails will ensure that detrimental soil disturbance is maintained below the 15 percent allowable on Region One Forests. The Soil Scientist on the Gallatin National Forest will be actively involved during timber harvesting and renovation activities to that end. Post harvest monitoring of soil disturbance is scheduled for the second and fifth year after harvesting to verify the desired results were obtained and that no long term reduction in overall site productivity results from timber harvesting.

IMPLEMENTATION:

Trail Placement and Slope Limitations

1. Require a systematic skid trail pattern during logging. Mechanical ground-based skidding and harvesting equipment may be used off of skid trails only to the degree necessary to harvest the available timber and only when soil moisture conditions are favorable. (See below for details.)
2. Use ground-based harvest systems only on slopes having sustained grades less than 35 percent.
3. Maintain an average of at least 75 feet between skid trails in all tractor harvested partial cuts and an average of 100 feet in all tractor harvest clearcuts. Skid trails may be closer than this spacing where converging so long as the overall spacing averages 75 feet and 100 feet, respectively.
4. Lay out skid trails in a manner that minimizes or eliminates extended sections of trail running directly down slope at grades steeper than 15%. This recommendation is expanded to include grades steeper than 8% on the most erosion prone soils, i.e.: coarse textured soils over shallow bedrock.
5. Avoid placing skid trails or temporary roads over convex knobs or along narrow, rocky ridges (areas least able to recover from disturbance) to the extent possible.

Limited Use of Skidding and Harvesting Equipment Off Skid Trails-(Non-winter)

1. Ground based skidding equipment may travel off of the established skid trails but only to the extent reasonably necessary to harvest timber based on the sale administrator's judgment and only when the top 6 inches of soil will not form a ribbon between the thumb and forefinger** (Criteria integrates the combined influence of soil texture and soil moisture - see USDA Technical Guide for Estimating Soil Moisture). Repeat passes over the same ground should be minimized.

2. Feller/buncher/mechanical harvesters may be used off established skid trails to the extent reasonably necessary to harvest timber but only when the top six inches of soil will either not form a ball when squeezed in the palm of a hand or will only form a weak ball and at most will form a weak ribbon between the thumb and forefinger** (Criteria integrates soil texture and soil moisture effects and is slightly more restrictive than the criteria for skidding equipment - see USDA Estimating Soil Moisture Tech. Guide). Repeat passes over the same ground should be minimized.
3. In some limited instances, soils may be too dry to allow ground-based, mechanical skidding or harvesting equipment to operate off of established skid trails in sensitive areas, such as on sandy or shallow soils on south aspects, along ridges, or other convex slopes.** These are often the lowest productivity sites within a stand in any event.
4. **Soil scientist for the GNF will be actively involved in the implementation of these provisions.

Winter Harvesting Restrictions

1. Tractor harvesting over snow or frozen ground in the winter should be limited to periods when there is a minimum of 8 inches of settled snow covering the ground or, in the absence of sufficient snow, when the top four inches of mineral soil is frozen. Harvesting should not proceed if ponding occurs at the mineral soil surface due to partial thawing of a surface 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 harvesting providing the settled snow depth or frozen ground criteria are met.

Landings, Temporary Roads, and Skid Trails

1. Landings - Cut and fill slopes, if present, around the margins of landings may be re-contoured if soils are non-skeletal (have less than 35% rock fragments in the subsoil). The landing base should be ripped to a depth of at least 6 inches subject to the following: 1) Scarification (ripping) of landings with burn piles only needs to be completed on exposed portions of the landing surrounding the burn pile, 2) The scarification (ripping) requirement may be waived on soils having abundant rock fragments in the top 6 inches of soil; defined as 20 percent or more 3 inch or larger rock fragments or more than 50 percent rock fragments overall, or partial ripping may be used depending on site specific conditions*.
2. Temporary Roads - Cut and fill slopes, where present, may require re-contouring if soils are non-skeletal (have less than 35% rock fragments in the subsoil). In all other areas, the road prism should be scarified (ripped) to a minimum depth of 6 inches into the mineral soil. This requirement may be waived on soils having abundant large rock fragments in the top 6 inches of soil; defined as 20 percent or more 3 inch or larger rock fragments or more than 50 percent rock fragments overall, or partial ripping may be used depending on site specific conditions*. (See write-up on temporary road decommissioning standards for alternative ripping options on roads with abundant rock fragments or other special concerns).
3. Skid Trails - Scarification (ripping) will not be required on skid trails except in areas where the soil is detrimentally compacted and mineral soil is exposed at the

surface or where wheel ruts have formed at least 2 inches deep on continuous grades steeper than 15%. Other mitigation actions such as water bars, grass seeding, and extra slashing (see below) will be added to skid trails on grades steeper than 15%. Detrimental soil compaction, as defined by the Detrimental Soil Disturbance Standards for the Gallatin National Forest, has a combined thickness of 2 inches of significant compaction in the top 4 inches of soil, 3 inches in the top 8 inches of soil, or 4 inches in the top 12 inches of soil.

Logging Slash and Other Woody Debris

1. Leave at least 15 tons per acre of coarse woody debris (3" inch or larger clearing or logging slash) behind in clearcut units and 8-12 tons per acre in partial cutting units (less than 60% canopy cover removed), when available, to protect the soil surface, slow surface runoff, and return soil nutrients to the soil. The coarse woody debris requirement in specific instances of forest stands growing on dry, south facing slopes or on high organic matter soils may be reduced proportionately to 12 tons/acre in clearcuts and 6-10 tons/acre for partial cuts.
2. Slash at an approximate rate of 15 tons per acre should be placed across skid trails in areas of steeper (>15%) slopes at the completion of logging. Lopping off at least some of the branches to get better contact with the ground surface increases the soil remediation effectiveness of this treatment.
3. Leave some unmerchantable material standing adjacent to temporary roads and landings , to the extent reasonable, during harvesting so this material can be used for slashing these areas by Forest Service personnel at the end of the project.
4. Finally, leave the logs and brush to be burned by the Forest Service at landings in more of a mounded than a steep sided pile. This will allow Forest Service personnel to remove a portion of the material from the edge of the pile prior to burning. Brush removed will be used for slashing the area of the burn pile by Forest Service personnel at the completion of burning.

B. Other Harvesting Activities

1. Avoid operation of wheeled or tracked equipment within isolated wetlands, except when the ground is frozen (see Section VI on winter logging).
2. Use directional felling or alternative skidding systems for harvest operations in isolated wetlands.
3. For each landing, provide and maintain a drainage system to control the dispersal of water and to prevent sediment from entering streams.
4. Insure adequate drainage on skid trails to prevent erosion. On gentle slopes with slight disturbance, a light ground cover of slash, mulch or seed may be sufficient. Appropriate spacing between water bars is dependent on the soil type and slope of the skid trails. Timely implementation is important.
5. When existing vegetation is inadequate to prevent accelerated erosion, apply seed or construct water bars before the next growing season on skid trails, landings and fire trails. A light ground cover of slash or mulch will retard erosion.

C. Slash Treatment and Site Preparation

1. Rapid reestablishment of vegetation of harvested areas is encouraged to reestablish protective vegetation.
2. When treating slash, care should be taken to preserve the surface soil horizon by using appropriate techniques and equipment. Avoid use of dozers with angle blades.
3. Remove all logging machinery debris to proper disposal site.
4. Limit water quality impacts of prescribed fire by constructing water bars in firelines; not placing slash in drainage features and avoiding intense fires unless needed to meet silvicultural goals. Avoid slash piles in the SMZ when using existing roads for landings.

V STREAM CROSSINGS

A. Legal Requirements

1. Under the Natural Streambed and Land Preservation Act of 1975 (the "310 law"), any activity that would result in physical alteration or modification of a perennial stream, its bed or immediate banks must be approved in advance by the supervisors of the local conservation district. Permanent or temporary stream crossing structures, fords, rip-rapping or other bank stabilization measures, and culvert installations on perennial streams are some of the forestry-related projects subject to 310 permits.

   Before beginning such a project, the operator must submit a permit application to the conservation district indicating the location, description, and project plans. The evaluation generally includes on-site review, and the permitting process may take up to 60 days.
2. Stream-crossing projects initiated by federal, state or local agencies are subject to approval under the "124 permit" process (administered by the Department of Fish, Wildlife and Parks), rather than the 310 permit.
3. Sho rt-term exemption (3a authorization) from water quality standards is necessary unless waived by the Department of Fish, Wildlife and Parks as a condition of a 310 or 124 permit. Contact the Department of Environmental Quality in Helena at 444-2406 for additional information.

B. Design Considerations (Note: 310 permit required for perennial streams)

1. Cross streams at right angles to the main channel if practical. Adjust the road grade to avoid the concentration of road drainage to stream crossings. Direct drainage flows away from the stream crossing site or into an adequate filter.
2. Avoid unimproved stream crossings. When a culvert or bridge is not feasible, locate drive-throughs on a stable, rocky portion of the stream channel.

C. Installation of Stream Crossings (Note: 310 permit required for perennial streams)

1. Minimize stream channel disturbances and related sediment problems during construction of road and installation of stream crossing structures. Do not place

erodible material into stream channels. Remove stockpiled material from high water zones. Locate temporary construction bypass roads in locations where the stream course will have minimal disturbance. Time construction activities to protect fisheries and water quality.

2. When using culverts to cross small streams, install those culverts to conform to the natural stream bed and slope on all perennial streams and on intermittent streams that support fish or that provides seasonal fish passage. Ensure fish movement is not impeded. Place culverts slightly below normal stream grade to avoid culvert outfall barriers. Do not alter stream channels upstream from culverts, unless necessary to protect fill or to prevent culvert blockage.
3. Design stream-crossings for adequate passage of fish (if present), minimum impact on water quality, and at a minimum, the 25-year frequency runoff. Consider oversized pipe when debris loading may pose problems. Ensure sizing provides adequate length to allow for depth of road fill. #
4. Install stream-crossing culverts to prevent erosion of fill. Compact the fill material to prevent seepage and failure. Armor the inlet and/or outlet with rock or other suitable material where feasible.
5. Consider dewatering stream crossing sites during culvert installation.*
6. Maintain a 1-foot minimum cover for stream-crossing culverts 15 to 36 inches in diameter, and a cover of one-third diameter for larger culverts, to prevent crushing by traffic.
7. Use culverts with a minimum diameter of 15 inches for permanent stream crossings.

D. Existing Stream Crossing

1. Existing stream crossing culverts shall have adequate length to allow for road fill width and have adequate capacity to allow for the passage of the 25-year frequency runoff. To prevent erosion of fill, provide or maintain armoring at inlet and/or outlet with rock or other suitable material where feasible. Maintain fill over culvert as described in V.C. 6.

VI Winter Logging

A. General

1. Consider snow-road construction and winter harvesting in isolated wetlands and other areas with high water tables or soil erosion and compaction hazards.
2. Conduct winter logging operations when the ground is frozen or snow cover is adequate (generally more than one foot) to prevent rutting or displacement of soil. Be prepared to suspend operations if conditions change rapidly, and when the erosion hazard becomes high.*
3. Consult with operators experienced in winter logging techniques.

B .Road Construction and Harvesting Considerations

1. For road systems across areas of poor bearing capacity, consider hauling only during frozen periods. During cold weather, plow any snow cover off of the roadway to facilitate deep freezing of the road grade prior to hauling.
2. Before logging, mark existing culvert locations. During and after logging, makesure that all culverts and ditches are open and functional.
3. Use compacted snow for road beds in unroaded, wet or sensitive sites. Construct snow roads for single-entry harvests or for temporary roads.
4. In wet, unfrozen soil areas, use tractors or skidders to compact the snow for skid road locations only when adequate snow depth exists. Avoid steeper areas where frozen skid trails may be subject to erosion the next spring.
5. Return the following summer and build erosion barriers on any trails that are steep enough to erode.

VII. Hazardous Substances

A. General

1. Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances. Follow all label instructions.
2. Develop a contingency plan for hazardous substance spills, including cleanup procedures and notification of the State Department of Environmental Quality.

B. Pesticides and Herbicides

1. Use an integrated approach to weed and pest control, including manual, biological, mechanical, preventive and chemical means.

2. To enhance effectiveness and prevent transport into streams, apply chemicals during appropriate weather conditions (generally calm and dry) and during the optimum time for control of the target pest or weed.

Glossary/Acronyms

Active Floodplain - ” Applies to floodplains that are ininundated during a normal 2 to 5 year recurrence interval. These are typically lateral bars within the active channel where conifers and other vegetation has established.

Activity – A measure, course of action, or treatment that is undertaken to directly or indirectly produce, enhance, or maintain forest and range land outputs or achieve administrative or environmental quality objectives.

Affected Environment- The natural, physical, and human-related environment that is sensitive to changes due to proposed activities

Airshed - Units in which Basic geographic air quality is managed.

Allotment - See Grazing Allotment

Alternative - A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis as expressed in goals and objectives. One of the several policies, plans or projects, proposed for decision-making. An alternative need not substitute for another in all respects.

Analysis Area – The geographic area defining the scope of analysis for a particular resource. This area may be larger than the project area when effects extend beyond the boundaries of the proposed action.

Aquatic – Biological and physical attributes and their interaction to water**.**

At-Risk Community – An area containing homes, businesses, structures and/or infrastructure that lies adjacent to or within National Forest System lands.

Bark Beetle Hazard – The degree of vulnerability of a stand to a particular bark beetle.

Benefit-Cost Ratio - Measure of economic efficiency, computed by dividing total discounted primary benefits by total discounted economic costs.

Benefit (Value) - Inclusive terms to quantify the results of a proposed activity, project or program expressed in monetary or non-monetary terms.

Best Management Practices (BMPs) - The set of practices in the Forest Plan which, when applied during implementation of a project, ensures that water related beneficial uses are protected and that State water quality standards are met. BMP's can take several forms. State regulation or memoranda of understanding between the Forest Service and the States define some. Others are defined by the Forest interdisciplinary planning team for application Forest-wide. Both of these kinds of BMP's are included in the Forest Plan as Forest-wide Standards. A third kind is identified by the interdisciplinary team for application to specific management areas; these are included as Management Area Standards in the appropriate management areas. A fourth kind, project level BMP's, are based on site specific evaluation and represent the most effective and practicable means of accomplishing the water quality and other goals of the specific area involved in the

project. These project level BMP's can either supplement or replace the Forest Plan standards for specific projects.

Big Game - Those species of large mammals normally managed as a sport hunting resource.

Big Game Winter Range - The area available to and used by big game through the winter season.

Biodiversity - "The variety and variability among living organisms and the ecological complexes in which they occur (OTA 1987)". "The variety of biotic communities, species and genes, and their interactions with ecological processes and functions, within ecosystems and across landscapes" (Hann 1990).

Biological Assessment (BA) - "A 'biological evaluation' conducted for major Federal construction projects requiring an environmental impact statement, in accordance with legal requirements under section 7 of the Endangered Species Act (16 USC 1536(c)). The purpose of the assessment and resulting document is to determine whether the proposed action is likely to affect an endangered, threatened, or proposed species" (FSM 2670.5.2).

Biological Evaluation (BE) - "A documented Forest Service review of Forest Service programs or activities in sufficient detail to determine how an action or proposed action may affect any threatened, endangered, proposed, or sensitive species" (FSM 2670.5.3).

Biomass – The sum total of living plants and animals above and below the ground.

Burn Intensity – The effect of fire on the vegetative component relating to the proportion of vegetation blackened or consumed.

Burn Severity – **The effect of fire on the ecosystem primarily concerned with the soils and usually only loosely correlated to burn intensity.**

Canopy - The more or less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

Capability - The potential of an area of land and/or water to produce resources, supply goods and services, and allow resource uses under a specified set of management practices and at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils and geology, as well as the application of management practices, such as silviculture or protection from fires, insects, and disease.

Cavity - A hollow in a tree that is used by birds or mammals for roosting and reproduction.

Cavity Nesters – Wildlife species that utilize cavities for nesting purposes.

Closed Road – A national forest road or segment, which is restricted from certain types of use during certain seasons of the year.

Closure - The administrative order that does not allow specified uses in designated areas or on Forest development roads or trails.

Coarse Woody Debris – Sound and rotting dead woody plant material standing, or fallen, usually greater than 3" in diameter.

Commercial Forest Land - Land that is producing, or is capable of producing, crops of industrial wood and (1) has not been withdrawn by Congress, the Secretary of Agriculture or the Chief of the Forest Service (suitable timber lands); (2) where existing technology and knowledge is available to ensure timber production without irreversible damage to soils productivity or watershed conditions; and (3) where existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that adequate restocking can be obtained within years after final harvesting.

Community – A group of one or more populations of plants, animals, or humans in a common spatial arrangement, an ecological term used to include groups of various sizes and degrees of integration.

Community Wildfire Protection Plan (CWPP) – A county plan designed to help local, state, and federal officials in the identification of private and public lands at risk of severe wildfires and to explore strategies for the prevention and suppression of such fires.

Compaction – A physical change in soil properties from compression, vibration, or shearing that increases bulk soil density and decreases porosity, I infiltration, and permeability.

Compartments – A geographic area delineated by watershed drainage for management planning purposes.

Conifer – Any group of needle and cone-bearing evergreen trees.

Contain (Fires) – Keeping the fire within the established boundaries under prevailing conditions and reasonable constraints.

Corridors - Travel ways, often forested, which are required by some species for movement and transfer of genetic material.

Cost - The negative or adverse effects or expenditures resulting from an action. Costs may be monetary, social, physical or environmental in nature.

Cost Efficiency - The usefulness of specified inputs (costs) to produce specified outputs (benefits). In measuring cost efficiency, some outputs, including environmental, economic, or social impacts, are not assigned monetary values but are achieved at specific levels in the least cost manner. Cost efficiency is usually measured using present net value, although use of benefit-cost ratios and rates of return may be appropriate.

Council on Environmental Quality (CEQ) - An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover - Vegetation used by wildlife for protection from predators, breeding, and rearing of young (hiding cover) or to ameliorate conditions of weather (thermal cover).

Crown - The upper part of a tree or other woody plant, carrying the main branch and foliage, and surmounting at the crown base a more or less clean stem.

Crown Fire – A fire burning into the crowns of the vegetation, generally associated with an intense understory fire.

Cumulative Effects – The effects that "result from spatial (geographic) and temporal (time) crowding of environmental perturbations" (Council of Environmental Quality, 1997). It is recognized that effects of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the effect of the first perturbation. Cumulative effects can be either positive or negative. Cumulative effects are analyzed, therefore, by studying the incremental impact of an action when added to other past, present, and reasonable foresee-able future actions regardless of what agency (Federal or Non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taken place over a period of time (40 DFR 1508.7).

Deciding Officer – The Forest Service employee who has the authority to select and/or carry out a specific planning action.

Deferred Maintenance – Maintenance activities, which can be delayed without critical loss of facility serviceability until such time as the work can be economically or efficiently performed.

Degradation – This occurs when a stream has excess energy and more sediment leaves a reach than enters it. This is associated with channel scouring.

Designated Roads and Trails – Specific roads and trails identified by the agencies where some type of motorized vehicle use is appropriate and allowed either yearlong or seasonally.

Detrimental Soil Condition – The condition where established soil quality standards are not met and the result is a significant change in soil quality.

Direct Effects – Effects on the environment, which occur at the same time and place as the initial cause or action.

Displacement - Lack of security causes wildlife to be displaced (or move out of) their normal use areas. The removal and movement of soil from one place to another, usually by mechanical forces, such as dozer blades, repeated vehicle traffic, or yarding of logs is considered to be soil displacement.

Disturbance – Any event, which affects the structure, function, (e.g. fire, insect attack, windthrow, timber harvest) composition, and/or development of a plant community

Diversity - The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

Economic Efficiency – The usefulness of inputs (costs) to produce outputs (benefits) and effects when all costs and benefits that can be identified and valued are included in the computations. Economic efficiency is usually measured using present net value, though the use of benefit-cost ratios and rates of return may be appropriate.

Ecosystem - A complete, interacting system of organisms considered together with their environment (for example; a marsh, a watershed, or a lake).

Effects - Physical, biological, social and economic results (expected or experienced) resulting from implementation of an action. Effects can be direct, indirect and cumulative.

Elk Security - "The protection inherent in any situation that allows elk to remain in a defined area despite an increase in stress or disturbance associated with the hunting season or other human activities" (Lyon and Christensen 1990).

Endangered Species - Any species, plant or animal, which is in danger of extinction throughout all or a significant portion of its' range. Endangered species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act. [ESA Section 3(6)]

Environmental Analysis - An analysis of alternative actions and their predictable short and long-term environmental effects which include physical, biological, economic, social, and environmental design factors and their interactions.

Environmental Assessment - A concise public document for which a Federal agency is responsible that serves to:

Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact.

Aid an agency's compliance with the National Environmental Policy Act when no environmental impact statement is necessary.

Facilitate preparation of an environmental impact statement when one is necessary.

Epidemic – The populations of plants, animals, and diseases that build up, often rapidly to highly abnormal and generally injurious levels

Erosion - The group of processes whereby earthy or rocky material is worn away by natural sources such as wind, water or ice and removed from any part of the earth's surface.

ESA – The Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Fine Fuels – Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than ¼ inch in diameter and have a lag time of one hour or less. When dry, these fuels readily ignite and are rapidly consumed by fire.

Fines - Sediments less than .25 inches in diameter.

Fire Behavior – The manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Hazard – The rapid ignition of fuels dependent on arrangement, volume, and conditions to sustain fire.

Fish Habitat – The place where a population of fish species lives and its surroundings; providing life requirements such as food and cover.

Fishery – The total population of fish in a stream or body of water and the physical, chemical, and biological factors affecting that population.

Forage - All browse and nonwoody plants available to livestock or wildlife for feed.

Forest Plan (FP) - Gallatin National Forest Land and Resource Management Plan, September 1987

Forest Land - Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential, or administrative areas, improved constructed roads of any width, and adjoining road clearing and powerline clearing of any width.

Forest System Road- Also called Forest Development Road. A road wholly or partly within or adjacent to and serving the National Forest System and which is necessary for the protection, administration and utilization of the National Forest System and the use and development of its resources.

Forest Transportation Plan – An inventory, description, display, and other associated information that are important to the management and use of National Forest System lands or to the development and use of resources upon which communities within or adjacent to National Forest System lands.

Forest-Wide Management Guidelines - An indication or outline of policy or conduct dealing with the basic management of the Forest. Forest-wide management guidelines apply to all areas of the Forest regardless of the other management prescriptions applied.

Fragmentation – The process of removing links between areas of habitat suitable for a species, or the reduction of continuous blocks of vegetation with similar structure and form into isolated parts.

Fuel Break - A zone in which fuel quantity has been reduced or altered to provide a position for suppression forces to make a stand against wildfire. Fuel breaks are designated or constructed before the outbreak of a fire. Fuel breaks may consist of one or a combination of the following: Natural barriers, constructed fuel breaks, man-made barriers.

Fuels - Include both living plants; dead, woody vegetative materials; and other vegetative materials which are capable of burning.

Fuels Management - Manipulation or reduction of fuels to meet Forest protection and management objectives while preserving and enhancing environmental quality.

Fuels Reduction – Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lesson the potential damage and resistance to control.

Fuels Treatment - The rearrangement or disposal of natural or activity fuels.

Game Species - Any species of wildlife or fish for which seasons and bag limits have been prescribed, and which are normally harvested by hunters, trappers, and fishermen under State or Federal laws, codes, and regulations.

Goshawk - A Management Indicator Species in the Gallatin National Forest Plan. The goshawk was chosen as an indicator old growth dependent species, dry Douglas fir sites (FP pg. II-19).

Grazing Allotment - A designated area of land available for livestock grazing upon which a specified number and kind of livestock may be grazed under a range allotment management plan. It is the basic land unit used to facilitate management of the range resource on National Forest System and associated lands administered by the Forest Service.

Grizzly Bear Recovery Zone - The area comprised of Management Situations 1 and 2 for grizzly bear as decided by an interagency team. The Bear Creek drainage is within the Recovery Zone.

Habitat – The sum total of environmental conditions of a specific place occupied by a wildlife species or population of such species.

Habitat Effectiveness - The percentage of available habitat that is usable by elk during the non-hunting season (Lyon and Christensen 1990)

Habitat Effectiveness Index (HEI) - A calculation of how habitat is influenced by the presence of roads and cover. The HEI ranges between zero and one; with one representing 100% HEI (or 100% habitat availability); 0.7 mile of road per square mile is equal to 70 percent HEI.

Habitat Type - An aggregation of all land areas potentially capable of producing similar plant communities at climax.

Healthy Forest Restoration Act (HFRA) of 2003 – Public law providing improved statutory processes for hazardous fuel reduction projects on certain types of National Forest System (NFS) lands and also provides other authorities and direction to help reduce hazardous fuels and restore forests and rangeland.

Heritage Resources - The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events, as a sacred area of native peoples, etc.) of an area of prehistoric or historic occupation.

Hiding Cover - "Vegetation capable of hiding 90 percent of an adult elk from the view of a human at a distance equal to or less than 200 feet" (Lyon and Christensen 1990). A component of security.

Indirect Effects - Secondary effects which occur in locations other than the initial action or significantly later in time.

Interdisciplinary (ID) Team - A group of individuals with different training assembled to solve a problem or perform a task. The team is assembled out of recognition that no

one scientific discipline is sufficiently broad to adequately solve the problem. Through interaction, participants bring different points of view to bear on the problem.

Inventoried Roadless Area - An area identified and classified as roadless. These areas were identified during the Roadless Area Review and Evaluation (RARE II). See *Roadless Area*.

Issue - A point of discussion, debate, or dispute about environmental effects. An issue is the focus of analysis related to the environmental effects of a proposed action.

Issue Indicators – Units of measure developed to facilitate comparison of major issues.

Large Woody Debris (LWD) –Branches and/or tree trunks located within a stream channel of sufficient size to remain partially submerged during all but major flood events. These materials are important to stream systems serving in a variety of functions related to channel hydraulics and morphology. Large woody debris is delivered to stream channels by means of decay or windfall of trees in close proximity.

Lethal Fires – A descriptor of fire response of high-severity or severe that burns through the overstory and understory, which consumes large woody surface fuels and may consume the entire duff layer.

Lynx Analysis Unit (LAU) – The LAU is a project analysis unit upon which direct, indirect, and cumulative effects analyses are performed. It is an area of at least the size used by an individual lynx, about 25-50 square miles.

Management Area – Geographic areas, not necessarily contiguous, which have common management direction, consistent with Forest Plan Direction.

Management Indicator Species - Species identified in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish including those that are socially or economically important.

Mature Timber - Individual trees or stands of trees that in general are at their maximum rate in terms of the physiological processes expressed as height, diameter, and volume growth.

Mitigate - To lessen the severity.

Mitigation – Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

Mixed Severity – Units that have a combination of high, moderate, and low degree of severity, and may depend on fuel loading and placement.

Modification (VQO) - See Visual Quality Objective (VQO).

Monitoring And Evaluation - The periodic evaluation on a sample basis of Forest Plan management practices to determine how well objectives have been met and how closely management standards have been applied.

Moose Winter Range - The area where moose generally winter.

National Environmental Policy Act (NEPA) - An act which encourages productive and enjoyable harmony between man and his environment; promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; enriches the understanding of the ecological systems and natural resources important to the Nation; and establishes a Council on Environmental Quality.

National Forest Management Act (NFMA) - A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of Regional and Forest plans and the preparation of regulations to guide that development.

National Forest System - All national forest lands reserved or withdrawn from the public domain of the United States, all national forest lands acquired through purchase, exchange, donation, or other means, the national grasslands and land utilization projects administered under Title III.

Native Species – Those plant and animal species indigenous to the planning or assessment area.

New Road Construction- Activity that results in the addition of Forest Service classified or temporary road miles

No Action Alternative - The management direction, activities, outputs, and effects most likely to exist in the future if the current plan would continue unchanged.

No Effect – The appropriate conclusion when a proposed action will not affect a listed species or designated critical habitat.

Nongame Species – All wild animals not subject to sport hunting, trapping, or fishing regulations.

Noxious Weed – A plant species designated by Federal or State law as generally possessing one or more of the following characteristics: aggressive and difficult to manage; parasitic; a carrier or host of serious insects or disease; or nonnative, new or not common to the United States.

Objective - A concise time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning, to define the precise steps to be taken and the resources to be used in achieving identified goals.

Off-Road Vehicle (ORV) - Any vehicle capable of being operated off an established road or trail, e.g., motorbikes, four-wheel drives, and snowmobiles.

Old Growth - A multistoried stand that is past full maturity and showing a high degree of decadence--the last stage in forest succession.

- Old growth is defined as having several characteristics:
- Size of overstory trees should be 9 inches DBH for lodgepole pine, 14 inches DBH for Douglas fir, and 14 inches DBH for spruce/alpine fir. There should be at least 10 large trees per acre.
- Crown closure--there should generally be 10-40 percent crown closure of the overstory.

- Dead and down--this component should be at least 15 tons per acre of 3-inch diameter or larger material.
- Snags--on the average, one or more snags per acre, at least 9 inches DBH for lodge pole and 14 inches DBH for Douglas fir or spruce/alpine fir.
- Understory--a minimum of 200 trees per acre greater than 5 feet tall less than 5 inches DBH, with understory and overstory crown closure combined exceeding 70 percent
- Distribution--areas selected for management, as old growth should be elevationally and spatially distributed. This definition represents an optimum condition. However, all these characteristics do not necessarily have to be present for a stand of timber to provide adequate old growth habitat. This definition should serve as a guideline for identifying old growth stands on the project level.

Open Road Density - "A measure of access that addresses all types of roads and trails used by motorized vehicles and equates these to a common standard. Frequently used in the computation of Habitat Effectiveness" (Lyon and Christensen 1990). In this document, miles of road per square mile.

Overstory - The portion of the trees that form the uppermost canopy layer in a forest of more than one story.

Partial Retention (VQO) - See Visual Quality Objective (VQO).

Perennial Streams - Streams that flow continuously throughout most years.

Pine Marten - A Management Indicator Species in the Gallatin National Forest Plan. The pine marten was chosen as an indicator old growth dependent species, moist spruce sites (FP pg. II-19).

Pole Timber - Live trees of a commercial species at least five inches in diameter at breast height but smaller than saw timber size, and of good form and vigor.

Prescribed Burning - The intentional application of fire to wildland fuels in either their natural or modified state under such conditions as allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, etc.).

Prescribed Fire - A fire burning under specified conditions which will accomplish planned objectives in strict compliance with an approved plan and the conditions under which the burning takes place and the expected results are specific, predictable, and measurable.

Present Net Value (PNV) - The difference between the total discounted value of all outputs to which monetary values or established market prices are assigned and the total discounted costs for management.

Present Net Worth - The discounted value of price times quantity less cost.

Project Area – The geographic area defining the scope of this document and the alternatives proposed for it.

Project File – An assemblage of documents that contains all the information developed or used during an Environmental Analysis. The Project File becomes part of the administrative record for judicial review in case of legal action.

Proposed Action - In terms of the National Environmental Policy Act, the project, activity, or action that a Federal agency intends to implement or undertake and which is the subject of an environmental analysis.

Proposed Species – Any species of fish, wildlife, or plant that is proposed in the Federal Register to be listed under Section 4 of the ESA.

Public Involvement - A Forest Service process designed to broaden the information base upon which agency decisions are made by (1) informing the public about Forest Service activities, plans, and decisions, and (2) encouraging public understanding about and participation in the planning processes which lead to final decision making.

Rapid Bio-assessment Procedure - A macroinvertebrate community structure analysis, with specific emphasis on metrics designed to detect sediment related affects.

Ranger District - Administrative subdivision of the Forest supervised by a District Ranger.

Reach – A segment of a stream that contains similar physical characteristics (e.g. gradient, width, stream bottom materials0 In general most reaches are between 1 and 3 miles in length**.**

Recontour – A form of road obliteration where the road prism is eliminated by pulling back fill material to re-establish the natural sideslope.

Recreation Opportunities - The combination of recreation settings, activities, and experience provided by the Forest.

Recreation Opportunity Spectrum (ROS) - Provides a framework for stratifying and defining classes of outdoor recreation environments, activities, and experience opportunities. The settings, activities, and opportunities for obtaining experiences have been arranged along a continuum or spectrum divided into six classes:

Reforestation - The renewal of forest cover by seeding, planting, and natural means.

Regeneration - The process where trees reproduce themselves by either artificial (hand planting of small seedlings) or natural (where trees reproduce themselves by seed) means. Often the term means the young trees themselves. A successfully regenerated stand occurs when seedlings have survived two growing seasons if artificial regeneration has occurred or three growing seasons if natural regeneration occurred on 90 percent of the reforestable land at prescribed stocking levels determined by the District silviculturist.

Rehabilitation – The act of closing and restoring temporary roads to a more natural state by ripping, seeding, slashing, removing culverts, etc.

Responsible Line Officer - The Forest Service employee who has the authority to select and/or carry out a specific planning action.

Restoration – The process of restoring site conditions as they were before the land disturbance (NRCS Resource Conservation Glossary). It is recognized that these treatments may need to occur over a period of years and may need to be maintained Restorations could include but is not limited to tillage, ripping, seeding, mulching, recontouring if temporary roads, and water barring.

Restriction – A restriction precludes use of the route or area during a specified time period (seasonal or yearlong) by either type of vehicle (such as log trucks) or type of traffic (such as motorized or public).

Retention (VQO) - See Visual Quality Objectives (VQO).

Riparian Areas - Areas with distinctive resource values and characteristics that are comprised of an aquatic ecosystem and adjacent upland areas that have direct relationships with the aquatic system. This is considered the horizontal distance of approximately 100 feet from the normal high water line of a stream channel, or from the shoreline of a standing body of water.

Ripping (Roads) – A form of obliteration; a method of aerating the surface and sub-surface material of a road, landing, and/or skid trail to allow infiltration by tilling the soil with a piece of machinery equipped with ripper bars.

Road Closure – A route or area is closed to all types of traffic, including foot traffic. This option is seldom used except in emergencies or special situations such as protection of an eagle nesting site (ATM guide – R1 – 1997). Page 5 in the ATM guide explains road closure signage and pages 14-16 discuss how closure is used in the CFRS.

Road Density – Number of miles of open road per square mile.

Road Maintenance – The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective.

Road Management Objective – Defines the intended purpose of an individual road based on management area direction and access management objectives. Road management objectives contain design criteria, operation criteria, and maintenance criteria. (FSM 7721.31 and FSH 7709.55—33)

Roadless Area - A National Forest area which (1) is larger than 5000 acres, or if smaller than 5000 acres, is contiguous to a designated wilderness or primitive area; (2) contains no roads; and (3) has been inventoried by the Forest Service for possible inclusion in the wilderness preservation system.

Rosgen Channel Classification – A system of measure that utilizes various channel features to rate a stream or river into reproducible classes.

Salmonids – Members of the family of elongate soft-finned fishes Salmonidae- the trout and salmon family.

Salvage Harvest - The cutting of trees that are dead, dying, or deteriorating (e.g., because they are overmature or materially damaged by fire, wind, insects, fungi, or other injurious agencies) before they lose their commercial value.

Sanitation Harvest – The removal of dead, damaged, or susceptible trees, essentially to prevent the spread of pests or pathogens and to promote forest health.

Sawlog – A log that meets minimum regional standards of diameter, length, and defect intended for sawing.

Sawtimber - Trees containing at least one 8-foot piece with a 5.6 inch diameter inside bark at the small end and meeting the Regional specifications for freedom from defect. Softwood trees must be at least eight inches in diameter at breast height for all species except Lodgepole Pine, which will be seven inches at breast height.

Scoping - An early and open process designed to identify the environmental issues and significant factors to be addressed in the analysis process. During this process the Forest Service collects public input, which is used to determine the extent of analysis necessary, the range of alternatives needed, impacts to be addressed, and the significant issues related to the proposed action.

Security Area (Lyon and Christensen 1990) - "Any area because of its geography, topography, vegetation, or a combination, that will hold elk during periods of stress".

Sediment - Solid material, both mineral and organic, that is in suspension, being transported, or has been moved from its site of origin by air, water, gravity, or ice.

Seedling/Sapling - A size category for forest stands in which trees less than five inches in diameter are the predominant vegetation.

Sensitive Species – Those species identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trends in population densities or habitat capability.

Setting - Opportunity spectrum that characterizes a predominately natural or natural appearing environment of a moderate to large size. Concentration of users is low, but there is often evidence of other area users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle.

Seral - That group of species that occupy a site during early to mid successional stages of vegetative development. These species are often sun loving and require bare mineral soil for successful germination.

Shading (Planting) - Providing natural or artificial shade for seedlings. Shading is used to prevent sun damage to seedlings. Natural shade may be logs, branches or stumps. Artificial shade devices are biodegradable cards or screens, which provide shade generally from 1-3 years.

Significant – As used in NEPA, requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts. (40 CFR 1508.27).

Silvicultural Examination - The process used to gather the detailed in-place field data needed to determine management opportunities and direction for the timber resource within a small subdivision of a forest area such as a stand.

Slash - The residue left on the ground after felling and other silvicultural operations and/or accumulating there as a result of storm, fire, girdling, or poisoning trees.

Snag - A standing dead tree usually greater than five feet in height and six inches in diameter at breast height.

Soil Productivity - The capacity of a soil to produce a specific crop such as fiber and forage, under defined levels of management. It is generally dependent on available soil moisture and nutrients and length of growing season.

Soil Quality – The capacity of a specific soil function within its surroundings, to support plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation.

Spot Fire – A fire ignited outside the perimeter of the main fire by flying sparks.

Stand - A community of trees or other vegetative growth occupying a specific area and sufficiently uniform in composition (species), age, spatial arrangement, and conditions as to be distinguishable from the other growth on adjoining lands, so forming a silvicultural or management entity.

Standard And Guideline - An indication or outline of policy or conduct.

Stand Structure – The horizontal and vertical arrangement of the vegetation in a stand. The components of stand structure include tree diameter, heights, crown layers, number of stems, shrubs, herbaceous understory, snags, and down logs.

Stream Channel Stability – A classification system that utilizes ocular estimates of various channel, bank and riparian areas.

Stream Order – A means of classifying streams within a drainage basin by systematically defining the network of branches. Each non-branching segment is designated a first-order stream (smallest). A stream which receives only first-order segments is termed a second-order stream, and so on. The order of a particular drainage basin is determined by the order of the principal or largest segment.

Streamside Management Zone (or SMZ) – is a buffer strip that serves as a natural filter, which helps to keep sediment out of the stream. A zone of variable width along each side of the stream, lake, or other body of water.

Streamside Management Zone Law (SMZL) – Montana Legislature passed the law in 1993 and developed administrative rules for management activities for protecting and maintaining the functions of a SMZ. The SMZ law and rules apply only to drainage's that meet the definition of a stream, lake, or other body of water. This law prohibits the following timber harvest activities within at least 50 feet of any stream, lake, or other body of water. The Department of Natural Resources and Conservation must approve any exceptions to these prohibited practices. 1) Broadcast burning; 2) Operating wheeled or tracked vehicles except on established roads; 3)Clear-cutting; 4) Constructing roads in the Streamside Management Zone except when necessary to cross a stream or wetland; 5) Handling, storing, applying, or disposing of hazardous or toxic material in a manner that pollutes streams, lakes, or wetlands or that may cause damage or injury to humans, land,

animals, or plants; 6) Casting road material into a stream, wetland, or watercourse; 7) Depositing slash in streams or other water bodies.

Structural Diversity – The variation in sizes and shapes of landscape elements, as well as diversity of pattern.

Succession - A series of dynamic changes in vegetation and in animal life over time as a result of one community replacing another, leading to a climax change.

Suitable Forest Land - Forest land (as defined in 36 CFR 219.4) for which technology is available that will ensure timber production without irreversible resource damage to soils, productivity, or watershed conditions; for which there is reasonable assurance that such lands can be adequately restocked (as provided in CFR 219.14); and for which there is management direction that indicates that timber production is an appropriate use of that area.

Sustained Yield - The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the National Forest System without impairment of the productivity of the land.

Surface Fuels - Loose litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark. Cones, and small branches that have not yet decayed enough to loose their identity; also grasses, forbs, shrubs, seedlings, downed logs, and stumps interspersed with or partially replacing the litte

Target Stand – A description of individual forest stands that reflects the desired future conditions and attributes that have the potential to meet management objectives.

Temporary Road - Those roads needed only for the purchaser or permittee's use. The Forest Service and the purchaser or permittee must agree to the location and clearing widths. Temporary roads are used for a single, short-term use, e.g., to haul timber from landings to Forest Development Roads, access to build water developments, etc. Temporary roads must be obliterated as part of a timber sale contract.

Thermal Cover - "For elk a stand of coniferous trees 40 feet or more tall with average crown closure of 70% or more. In some cases, topography or vegetation less than specific may meet animal needs for thermal regulation" (Lyon and Christensen 1990).

Threatened Species - Any species, plant or animal, which is likely to become an endangered species within the foreseeable future throughout all, or a significant portion, of its range. The Secretary of the Interior in accordance with the 1973 Endangered Species Act identifies threatened species.

Tiering - Refers to the elimination of repetitive discussions of the same issue by incorporating by reference the general discussion in an environmental impact statement of broader scope. For example, a project environmental assessment could be tiered to the Forest Plan EIS.

Timber - A general term for the major woody growth of vegetation in a forest area.

Timber Base - The lands within the forest that are suitable for timber production.

Timber Production - The purposeful growing, tending, harvesting, and regeneration of rotational crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of Forest planning, timber production does not include production of fuelwood or harvest from unsuitable lands.

Timber Stand Improvement (TSI) - All noncommercial intermediate cuttings and other treatments to improvement composition, condition, and volume growth of a timber stand.

Timber Types – A descriptive classification of forestland based on present occupancy of an area by a tree species (i.e. lodgepole, mixed conifer, etc.)

Total Maximum Daily Load (TMDL) - The maximum allowable load of a pollutant to a water body that will result in a stream's water quality meeting standards.

Trailhead - The parking, signing, and other facilities available at the terminus of a trail.

Transitory Range - Land that is suitable for grazing use for a period of time. For example, on particular disturbed lands, grass may cover the area for a period of time before being replaced by trees or shrubs not suitable for forage.

Understory - The trees and other woody species which grow under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.

Ungulate - A mammal with hooves.

Unit – A treatment area that may undergo activity such as harvest, salvage, burning, or other purposes that is specified within boundaries.

Unmerchantable - Timber that does not meet minimum height and diameter specifications, which would make it suitable for commercial sawtimber.

Unsuitable Forest Land - Lands not selected for timber production in the suitability analysis during the development of the Forest Plan due to (1) the multiple-use objectives for the alternative preclude timber production, (2) other management objectives for the alternative requirements set forth in 36 CFR 219.27 cannot be met, and (3) the lands are not cost-efficient over the planning horizon in meeting forest objectives that include timber production. Land not appropriate for timber production shall be designated as unsuitable in the Forest Plan.

Values at Risks - Natural resources, improvements, or other values that may be jeopardized if a fire occurs.

Vertical Diversity - The diversity in an area that results from the complexity of the above ground structure of the vegetation; the more tiers of vegetation or diversity of species makeup, the higher the degree of vertical diversity.

Viable Population – A fish, wildlife or plant population of sufficient size to maintain its existence over time in spite of normal fluctuations in population levels.

Visual Quality Objective (VQO) - A desired level of scenic quality and diversity of natural features based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape.

- ***Preservation*:** Only ecological changes are allowed to alter the natural landscape.
- ***Retention*:** Human activities are not evident to the casual Forest visitor.
- ***Partial Retention***: Human activities may be evident, but must remain subordinate to the characteristic landscape.
- ***Modification***: Human activity may dominate the characteristic landscape, but should appear as natural when viewed as background.
- ***Enhancement*:** A short-term management alternative, which is done with the express purpose of increasing positive visual variety where little variety now exists.

Visual Resource - The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for visitors.

Vulnerability - "A measure of elk susceptibility to being killed during the hunting season. Note that this is the antonym of Security during the hunting season" (Lyon and Christensen 1990). In this document, vulnerability is also used as it relates to hunting or trapping of species other than elk.

Water Quality Limited Segment (WQLS) - Stream segments, which are not expected to meet water quality standards or are not sufficient to meet beneficial uses even after the application of technology-based controls.

Watershed Treatment – Planned land management action designed to maintain or improve a desired watershed condition. (adapted from Black, Watershed Hydrology, 1996 Glossary for watershed management).

Watershed Risk Assessment – A landscape level, coarse assessment of the risk to various natural resources from different levels of predicted changes caused by wildfire, weather, insect and disease outbreaks, or other disturbances.

Water Yield - The measured output of the Forest's streams.

Wetlands - Those areas that are inundated by surface or ground water with a frequency sufficient, under normal conditions, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

WholeTree Yarding – During timber harvest, entire trees are yarded to the landing. Tops, limbs, and other merchantable materials are piled for later treatment or utilization at the landing site.

Wildfire (Wildland Fire) – Any non-structure fire (not a prescribed fire) in the wildlands. May be ignited naturally or by arson.

Wildland-Urban Interface - Includes those areas of resident human populations at imminent risk from wildfire, and human developments having special significance. These areas include not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved. The HFRA defines WUI as the area adjacent to an at-risk community that is identified in a community wildfire protection plan. If there is no plan the WUI is the area .5 mile from

the community boundary, or if terrain is steep, there is a near-by road, or ridgetop that could be used for a fuel break, or the land is in condition class 3, or the area contains an emergency exit route needed for safe evacuations.

Windthrow - The action of uprooting trees by the force of the wind.

Winter Range - The area available to and used by big game during the winter season. Must contain forage or browse to feed big game. Winter range areas tend to have a relatively low amount of snow cover which enables the animals to reach the forage.

Woody Debris Recruitment - The process of trees naturally falling over and landing in stream channels.

Yarding - A method of bringing logs to a roadside or landing, for truck transport. Methods include forms of skyline cabling, ground-based skidding, and helicopter.

ABBREVIATIONS AND ACRONYMS

ACHP Advisory Council on Historic Preservation

AIRFA American Indian Religious Freedom Act

ARM Administrative Rules of Montana

ATV All Terrain Vehicle

BA *Biological Assessment*

BCR *Benefit Cost Ratio*

BE Biological Evaluation

BEHAVE Interactive Computer program for fire behavior prediction and modeling

BLM Bureau of Land Management

BMA Bear Management Analysis Area

BMP Best Management Practice

BMU Bear Management Unit

BFRC Boulder River Fuels Reduction Cooperative

CE Categorical Exclusion

CCF Cubic Feet

CEQ Council of Environmental Quality

CFR Code of Federal Regulations

CFS Cubic Feet per Second

COR Contracting Officer Representative

CWD Coarse Woody Debris

DBH Diameter Breast Height

DC Design Criteria

DEQ Department of Environmental Quality
DN Decision Notice
DNRC Department of Natural Resource and Conservation
EA Environmental Assessment
EEC Elk Effective Cover
EPA Environmental Protection Agency
ESA Endangered Species Act
FEIS Final Environmental Impact Statement
FOFEM First Order Fire Effects Model
FONSI Finding of No Significant Impact
FP Gallatin National Forest Land and Resource Management Plan
FS Forest Service
FSH Forest Service Handbook
FSM Forest Service Manual
FVS-FFE Forest Vegetation Simulation-Fire/Fuel Effects extention
FWP Fish, Wildlife, & Parks
GBCS Grizzly Bear Conservation Strategy
GIS Geographic Information System
GLT Gallatin Leadership Team
GNF Gallatin National Forest
GNFP Gallatin National Forest Plan
GYA Greater Yellowstone Area
HAU Habitat Analysis Unit
HE Habitat Effectiveness
HEI Habitat Effectiveness Index
IDT Interdisciplinary Team
IGBC Interagency Grizzly Bear Committee
IRA Inventoried Roadless Area
LAU Lynx Analysis Unit
LCS Canada Lynx Conservation Assessment and Strategy
LRMP Land and Resource Management Plan
LWD Large Woody Debris
MA Management Area
MBF Thousand Board Feet

MBTA Migratory Bird Treaty Act
MCA Montana Conservation Act
MDFWP Montana Department of Fish Wildlife and Parks
MIS Management Indicator Species
MMBF Million Board Feet
MNHP Montana Native Heritage Program
MOU Memorandum of Understanding
MOUCA Memorandum of Understanding and Conservation Agreement
MSDL Montana State Department of Lands
MTSHPO Montana Historic Preservation Office
MUTCD Manual on Uniform Traffic Control Devices
MFWP Montana Fish, Wildlife and Parks
NAAQS National Aviation Air Quality Standards
NEPA National Environmental Policy Act
NEXUS- an Excell spreadsheet that links surface and crown fire prediction models
NF National Forest
NFMA National Forest Management Act
NFP National Fire Plan
NFS National Forest System (lands**)**
NHPA National Historic Preservation Act
NRHP National Register of Historic Places
NTU Natural Turbidity Unit
PA Proposed Action
PCA Primary Conservation Area
PGV Predicted Gross Value
PM Particulate Matter
PNV Present Net Value
R Rural
R1 Region One
R1R4 Region 1/ Region 4
RO Regional Office
ROS Recreation Opportunity Spectrum
SAF Subalpine Fir
SMZ Streamside Management Zone

SPM Semi Primitive Motorized

SWCP Soil and Water Conservation Practices

T&E Threatened and Endangered Species

TE Transactions Evidence

TES Threatened, Endangered, and Sensitive Species

TMDL Total Maximum Daily Load

TPA Trees per Acre

TSA Timber Sale Administrator

TSC Timber Sale Contract

TSMRS Timber Stand Management Record System (data base**)**

TU Trout Unlimited

UMWCT Upper Missouri Short Term Strategy for Conserving Westslope Cutthroat Trout

USDA United States Department of Agriculture

USDI United States Department of the Interior

USFS USDA-Forest Service

USFWS United States Fish and Wildlife Service

USGS United States Geological Survey

VQO Visual Quality Objectives

VMS Visual Management System

WATSED Water and Sediment Yield (model**)**

WBBB Western Balsam Bark Beetle

WCT Westslope Cutthroat Trout

WQLS Water Quality Limited Segment

WRA Weed risk Assessment

WRAP Western Regional Air Partnership

WUI Wildland Urban Interface

YCT Yellowstone Cutthroat Trout

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